Calendar of AMS Meetings

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

**ABSTRACTS OF PAPERS** presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the *Notices* which contains the program of the meeting. Abstracts should be submitted on special forms which are available in many departments of mathematics and from the office of the Society. Abstracts must be accompanied by the $15 processing charge. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below. For additional information consult the meeting announcements and the list of organizers of special sessions.

### MEETING # DATE PLACE ABSTRACT DEADLINE ISSUE

<table>
<thead>
<tr>
<th>MEETING #</th>
<th>DATE</th>
<th>PLACE</th>
<th>ABSTRACT DEADLINE</th>
<th>ISSUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>817</td>
<td>March 22-23, 1985</td>
<td>Chicago, Illinois</td>
<td>EXPIRED</td>
<td>March</td>
</tr>
<tr>
<td>818</td>
<td>April 12-13, 1985</td>
<td>Tucson, Arizona</td>
<td>EXPIRED</td>
<td>March</td>
</tr>
<tr>
<td>819</td>
<td>April 20-21, 1985</td>
<td>Worcester, Massachusetts</td>
<td>EXPIRED</td>
<td>March</td>
</tr>
<tr>
<td>820</td>
<td>May 3-4, 1985</td>
<td>Mobile, Alabama</td>
<td>EXPIRED</td>
<td>March</td>
</tr>
<tr>
<td>821</td>
<td>August 12-15, 1985</td>
<td>Laramie, Wyoming</td>
<td>May 28</td>
<td>August</td>
</tr>
</tbody>
</table>

### DEADLINES:

- **News/Special Meetings** (June 1985 Issue) April 8, 1985 (August 1985 Issue) May 23, 1985

### Other Events Sponsored by the Society

- May 27, 1985, Symposium on Some Mathematical Questions in Biology, Plant Biology, Los Angeles, California.
- June 23—August 31, 1985, Joint Summer Research Conferences in the Mathematical Sciences, Humboldt State University, Arcata, California.
- July 8—26, 1985, AMS Summer Research Institute on Algebraic Geometry, Bowdoin College, Brunswick, Maine.
- August 10—11, 1985, AMS Short Course; Actuarial Mathematics, Laramie, Wyoming.

Subscribers' changes of address should be reported well in advance to avoid disruption of service: address labels are prepared four to six weeks in advance of the date of mailing. Requests for a change of address should always include the member or subscriber code and preferably a copy of the entire mailing label. Members are reminded that U. S. Postal Service change-of-address forms are not adequate for this purpose, since they make no provision for several important items of information which are essential for the AMS records. Suitable forms are published from time to time in the *Notices of the American Mathematical Society* (e.g. October 1984, page 726). Send change of address notices to the Society at Post Office Box 6248, Providence, RI 02940.

[Notices of the American Mathematical Society] is published seven times a year (January, March, June, August, October, November, December) by the American Mathematical Society at 201 Charles Street, Providence, RI 02904. Second class postage paid at Providence, RI and additional mailing offices. POSTMASTER: Send address change notices to Membership and Sales Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940.

Publication here of the Society's street address, and the other information in brackets above, is a technical requirement of the U. S. Postal Service. All correspondence should be mailed to the Post Office Box. NOT the street address.

Members are strongly urged to notify the Society themselves of address changes, since reliance on the postal service change-of-address forms is liable to cause delays in processing such requests in the AMS office.
Position Open

Associate Executive Director

American Mathematical Society

Providence, Rhode Island

With the resignation of Dr. Jill P. Mesirow as of September 1985, the position of Associate Executive Director of the American Mathematical Society will become open.

Qualifications: the ideal candidate would
• have received a Ph.D. in one of the mathematical sciences within the past 20 years, and be familiar with the language and trends of contemporary American research mathematics,
• have a good command of the English language and be capable of writing well and easily,
• have both an interest and previous experience (at least at the departmental committee level) in administration,
• have an equable temperament and be able to work harmoniously with mathematicians and nonmathematicians alike,
• be able to commence work in Providence in early summer.

Some previous experience with computers (as text or data processors), publishing, government relations, or business management would be welcome but is of secondary importance.

Responsibility: About 125 people work in the Society’s Providence office, and about half of them are concerned with publishing (editorial processing, translation, computer composition, printing/binding, marketing). In addition there are departments concerned with meetings, member services, order fulfillment, fiscal records, and computer programming and operations. The editorial offices for Mathematical Reviews, in Ann Arbor, employ another 70 persons. The two offices share some facilities, including the use of two DEC-2060 mainframes, but management is largely separate.

The person filling the open position will work with the Executive Director and the continuing Associate Executive Director, Dr. James W. Maxwell, in administering the work of this staff, and in executing the decisions of the Board of Trustees and of the Council. Sensitivity for the concerns of the mathematical research community is essential, since an important part of the job is to facilitate communication between members of the staff and the Trustees, the Council, editorial and other AMS committees, government agencies, and American and foreign mathematicians. Some travel will be involved, including attendance at the two national meetings.

Term of Appointment: Preferably this will be a three-year initial appointment, with a good possibility of reappointment on a term or continuing basis. Alternatively, the Society may consider the temporary appointment for one or two years of a mathematician on leave from a college or university.

Applications and nominations should be sent to
Dr. W. J. LeVeque, Executive Director
American Mathematical Society
P. O. Box 6248
Providence, R.I. 02940

Completed applications received by 1 April 1985 will be assured of consideration. Appropriate letters of reference should also be received by that date.

The Society is an equal opportunity employer, and has a generous fringe-benefit program, including TIAA/CREF. Salary for this position will be commensurate with the background of the appointee.
Gauss and the Arithmetic-Geometric Mean
by David A. Cox

In 1828, after seeing the first works of Abel and Jacobi on elliptic functions, Gauss wrote: “I shall most likely not soon prepare my investigations on transcendental functions which I have had for many years... Herr Abel has now, I see, anticipated me and relieved me of the burden in regard to one third of these matters...” [3, X. 1, page 248]. This is a tantalizing quote—one wonders what Gauss knew that Abel and Jacobi did not. What do the other two thirds “of these matters” refer to? Part of the answer is well known, for Gauss’s collected works show that he anticipated much of the later work on modular functions done by Riemann, Klein, and others. But a considerable portion of Gauss’s unpublished work in this area dealt with the arithmetic-geometric mean. The agM (this is Gauss’s abbreviation) is not widely known today, but for Gauss it lay at the very center of his study of elliptic and modular functions. This article will sketch the theory behind the agM and indicate briefly some of its history and applications.

1. To define the agM we begin with the familiar inequality \( \frac{a+b}{2} \geq (ab)^{1/2} \) between arithmetic and geometric means. Notice that from one pair of positive numbers, \( a \) and \( b \), we obtain a second pair, \( \frac{a+b}{2} \) and \( (ab)^{1/2} \). If we iterate this process, we obtain sequences \( \{a_n\}_{n=0}^\infty \) and \( \{b_n\}_{n=0}^\infty \) defined by

\[
\begin{align*}
a_0 &= a, \\
b_0 &= b, \\
a_{n+1} &= \frac{(a_n+b_n)}{2}, \\
b_{n+1} &= (a_n b_n)^{1/2}.
\end{align*}
\]

(1)

The above inequality enables one to show easily that these sequences converge to a common limit \( M(a,b) \), which we define to be the agM of \( a \) and \( b \).

One of the most striking features of the agM algorithm is how rapidly it converges. For example, the computation of \( M(\sqrt{2},1) \) begins as shown in the table below:

<table>
<thead>
<tr>
<th>( n )</th>
<th>( a_n )</th>
<th>( b_n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.414213562373095048802</td>
<td>1.000000000000000000000</td>
</tr>
<tr>
<td>1</td>
<td>1.20710678118654724101</td>
<td>1.189207115002721066717</td>
</tr>
<tr>
<td>2</td>
<td>1.19815694809463429559</td>
<td>1.198123521493120122607</td>
</tr>
<tr>
<td>3</td>
<td>1.198140234735592207441</td>
<td>1.198140234735592207439</td>
</tr>
<tr>
<td>4</td>
<td>1.198140234735592207441</td>
<td>1.198140234735592207439</td>
</tr>
</tbody>
</table>

The entries are rounded off to twenty-one decimal places. Since \( M(a,b) \) always lies between \( a_n \) and \( b_n \), we see that to nineteen decimal places

\[
M(\sqrt{2},1) = 1.198140234735592207441.
\]

Such accuracy is easily obtained these days, though not without some effort, since we went beyond the usual sixteen digits of double precision. More surprising is the fact that Gauss did these calculations (correctly!) over 180 years ago (see [3, III, page 364]).

The theory of the agM begins with its relation to elliptic integrals. The key result is the formula

\[
I(a,b) = \frac{\pi}{2} \int_0^{\pi/2} (a^2 \cos^2 \phi + b^2 \sin^2 \phi)^{-1/2} d\phi = \frac{\pi}{2}.
\]

(2)

To prove this let \( \mu = M(a,b) \), and let \( I(a,b) \) denote the above integral. Following Gauss [3, III, page 352], we introduce a new variable \( \phi' \) defined by

\[
\sin \phi = \frac{2a \sin \phi'}{a+b+(a-b) \sin^2 \phi'}.
\]

(3)

It can be shown that

\[
(a^2 \cos^2 \phi + b^2 \sin^2 \phi)^{-1/2} d\phi = (a_1^2 \cos^2 \phi' + b_1^2 \sin^2 \phi')^{-1/2} d\phi',
\]

and

\[
I(a,b) = I(a_1,b_1) = \cdots = I(\mu,\mu) = \pi/2 \mu \text{ since the } a_n's \text{ and } b_n's \text{ converge to } \mu.
\]

We thus have a very efficient method for computing elliptic integrals, and this is the most common application of the agM. A nice example is a recent paper of Buhler, Gross, and Zagier [1] concerned with numerical evidence for the conjectures of Birch and Swinnerton-Dyer for a particular elliptic curve of rank 3 over \( \mathbb{Q} \). Very delicate computations have to be made regarding the behavior of a certain \( L \)-series at \( s = 1 \), and one of the factors of the \( L \)-series is the real period
\( \Omega \) of the elliptic curve (see [9]). Since the curve in question can be written \( y^2 = (x-e_1)(x-e_2)(x-e_3) \) with \( e_1 < e_2 < e_3 \), from (2) one can show that
\[
\Omega = 4 \int_{e_3}^{\infty} \frac{dx}{y} = \frac{2\pi}{M(\sqrt{e_3-e_1}, \sqrt{e_2-e_1})}.
\]
The agM thus gives a wonderfully quick method for finding \( \Omega \).

Historically, this computational method was known before the agM was. This seems impossible, but Lagrange, in his 1785 paper on calculating elliptic integrals [5], defined the sequences (1) and showed how to use them to compute integrals. While he noted that the sequences had a common limit, he did nothing with this observation. Only six years later, Gauss, then fourteen, independently discovered the sequences (1) and defined the agM for the first time (although he did not see the connection with elliptic integrals until 1799). In this context it is amusing to note that the authors of [1] only recently realized that the agM was the best way to compute the elliptic integrals in question.

A more unusual computational application of the agM was discovered by Salamin in 1973. Consider Legendre’s relation between complete elliptic integrals of the first and second kinds:
\[
K E' + K' E - KK' = \pi/2,
\]
where
\[
K = K(k) = \int_{0}^{\pi/2} (1 - k^2 \sin^2 \phi)^{-1/2} d\phi,
\]
\[
E = E(k) = \int_{0}^{\pi/2} (1 - k^2 \sin^2 \phi)^{1/2} d\phi
\]
and \( K' = K(k') \), \( E' = E(k') \) for \( k' = (1 - k^2)^{1/2} \). From (2) one easily sees that
\[
K = \pi/2 M(1, k').
\]

Also, using the substitution (3), one can show that
\[
E = \left( 1 - \sum_{n=0}^{\infty} \frac{2^{n-1} c_n^2}{2^n} \right) K,
\]
where \( c_n = (a_n^2 - b_n^2)^{1/2} \), and \( a_n \) and \( b_n \) are as in (1) with \( a = 1 \) and \( b = k' \). (This formula was known to Gauss—see [3, III, page 353].) Setting \( k = k' = 1/\sqrt{2} \), the above equations give us a formula for \( \pi \):
\[
\pi = \frac{2M(\sqrt{2}, 1)^2}{1 - \sum_{n=0}^{\infty} 2^{n+1} c_n^2}.
\]
This might seem a strange way to compute \( \pi \), but Salamin shows that it is very efficient (see [8]). Recently, some computer scientists in Japan have used this method to compute \( \pi \) to 10,013,395 decimal places, a world record (see [11]).

Purely theoretical applications of (2) are also known. For example, Reyssat recently proved in [7] that \( M(a, b) \) is transcendental whenever \( a \) and \( b \) are distinct, positive, algebraic numbers. He has also proved that \( M(\sqrt{2}, 1) \) and \( \pi \) are algebraically independent. (More generally, \( M(1, \sqrt{1-\lambda}) \) and \( \pi \) are algebraically independent whenever \( -1 \leq \lambda < 1 \) is an algebraic number such that the elliptic curve \( y^2 = \pi(x-1)(x-\lambda) \) has complex multiplication.)

The final application we give concerns the arc length of the lemniscate \( r^2 = \cos 2\theta \). As is well known, the arc length is given by
\[
4 \int_{0}^{1} (1 - z^4)^{-1/2} dz = 4 \int_{\pi/2}^{\pi/2} (2\cos^2 \phi + \sin^2 \phi)^{-1/2} d\phi.
\]
Using (2) we see that the arc length equals \( 2\pi/M(\sqrt{2}, 1) \). Gauss, in his development of lemniscatic functions, used the notation \( \hat{\omega} = 2 \int_{0}^{1} (1 - z^4)^{-1/2} dz \). Then the formula for arc length can be stated as
\[
M(\sqrt{2}, 1) = \pi/\hat{\omega}.
\]
To see the importance of this equation we turn to the 98th entry in Gauss’s mathematical diary. It is dated May 30, 1799 and reads as follows: “We have established that the arithmetic-geometric mean between 1 and \( \sqrt{2} \) is \( \pi/\hat{\omega} \) to the eleventh decimal place; the demonstration of this fact will surely open an entirely new field of analysis” [3, X, 1, page 542]. Thus the first evidence Gauss had for (2) was this coincidence of two numbers! The applications just given support the truth of Gauss’s claim of a “new field of analysis”.

2. The surprising fact is that we have barely scratched the surface of the agM. Most people who have heard about it know more or less what has been discussed so far—i.e., the theory of the agM over \( \mathbb{R} \). There is also a complete theory over \( \mathbb{C} \)! This makes sense because the agM is so closely related to elliptic integrals, and, as happens with the latter, the real power of the subject becomes apparent only when we use complex numbers.

We will assume \( a, b \in \mathbb{C}^* \) and \( a \neq \pm b \). The problem with algorithm (1) is that there seems to be no way to distinguish between the two choices for \( b_{n+1} \). We thus get an uncountable number of sequences, and it is not clear that any of them converge. Fortunately, a distinguished choice of \( b_{n+1} \) can be made: since we want the sequences of (1) to have a common limit, it makes sense to let \( b_{n+1} \) be the square root of \( a_n b_n \) closest to \( a_{n+1} \). More precisely, we call \( b_{n+1} \) the right choice if \( |a_n - b_n| < |a_n + b_n| \), and if equality occurs, we require \( \text{Im}(b_{n+1}/a_{n+1}) > 0 \). Given our restrictions on \( a \) and \( b \), there is always a unique right choice for \( b_{n+1} \).

We could thus always require \( b_{n+1} \) to be the right choice in (1). But Gauss saw that more is
possible. The following example is taken from his notebooks \[3, \text{III, page 379}]:

<table>
<thead>
<tr>
<th>n</th>
<th>a_n</th>
<th>b_n</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0,000000</td>
<td>1,000000</td>
</tr>
<tr>
<td>1</td>
<td>2,000000</td>
<td>-1,732058</td>
</tr>
<tr>
<td>2</td>
<td>.139746</td>
<td>.8612098</td>
</tr>
<tr>
<td>3</td>
<td>.0669873 + .9306949i</td>
<td>.3539696 + .3539696i</td>
</tr>
<tr>
<td>4</td>
<td>.2100421 + .6418695i</td>
<td>.2836903 + .6208239i</td>
</tr>
<tr>
<td>5</td>
<td>.2468676 + .6313374i</td>
<td>.2470649 + .6324002i</td>
</tr>
<tr>
<td>6</td>
<td>.2469696 + .6318686i</td>
<td>.2469696 + .6318686i</td>
</tr>
</tbody>
</table>

Note that \( b_1 \) is the wrong choice and that the succeeding \( b_n \)'s are the right choice. The agM algorithm seems to converge nicely.

Surprisingly, it turns out that any pair of sequences \( \{a_n\}_{n=0}^{\infty} \) and \( \{b_n\}_{n=0}^{\infty} \) as in (1) converge to a common limit. But the common limit is nonzero if and only if \( b_{n+1} \) is the right choice for all but finitely many \( n \) (see \[2, Proposition 2.1\] for a proof). Thus there are only countably many nonzero limits. This leads to the following definition:

**Definition.** Given \( a, b \in \mathbb{C}^* \), \( a \neq \pm b \), a number \( \mu \in \mathbb{C}^* \) is a value of \( M(a,b) \) if it is the common limit of sequences \( \{a_n\}_{n=0}^{\infty} \) and \( \{b_n\}_{n=0}^{\infty} \) satisfying (1). \( \mu \) is the simplest value if \( b_{n+1} \) is the right choice for all \( n \geq 0 \).

The next question is how to relate the different values of \( M(a,b) \). The answer is as follows:

**Theorem.** Given \( a, b \in \mathbb{C}^* \) with \( a \neq \pm b \) and \( |a| \geq |b| \), let \( \mu \) and \( \lambda \) be the simplest values of \( M(a,b) \) and \( M(a+b, a-b) \), respectively. Then all values \( \mu' \) of \( M(a,b) \) are given by the formula

\[
\frac{1}{\mu'} = d/\mu + ic/\lambda,
\]

where \( d \) and \( c \) are arbitrary, relatively prime integers satisfying \( d \equiv 1 \mod 4 \) and \( c \equiv 0 \mod 4 \).

This theorem is basically due to Gauss. He never stated it in this form, but the bits and pieces of proof he left behind show that he knew what was going on. The first complete proofs appeared in 1928 after the last volume of Gauss's collected works was published (see \[4\] and \[10\]). We will only sketch some of the ideas involved in the proof (see \[2\] for the details).

Though the statement of the theorem is elementary, the proof uses some sophisticated mathematics: specifically, theta functions and modular forms (a basic reference is \[6\]). We will use Gauss's notation for the Jacobi theta functions. For \( \tau \in \mathbb{H} = \{ z \in \mathbb{C} : \text{Im}(z) > 0 \} \), set \( q = e^{\pi i \tau} \) and define

\[
p(\tau) = 1 + 2 \sum_{n=1}^{\infty} q^n = \vartheta_0(\tau, 0),
\]

\[
q(\tau) = 1 + 2 \sum_{n=1}^{\infty} (-1)^n q^n = \vartheta_1(\tau, 0).
\]

The natural question is what do theta functions have to do with the agM? The answer lies in the observation that if

\[
(4) \quad a = \mu p(\tau)^2, \quad b = \mu q(\tau)^2,
\]

for \( \mu \in \mathbb{C}^* \) and \( \tau \in \mathbb{H} \), then \( \mu \) is a value of \( M(a,b) \). To see why this is true, consider the theta identities

\[
p(\tau)^2 + q(\tau)^2 = 2p(2\tau)^2, \quad p(\tau)q(\tau) = q(2\tau)^2.
\]

It follows that \( p(2\tau)^2 \) and \( q(2\tau)^2 \) are the respective arithmetic and geometric means of \( p(\tau)^2 \) and \( q(\tau)^2 \). Setting \( a_n = \mu p(2^n\tau)^2 \) and \( b_n = \mu q(2^n\tau)^2 \), we get sequences satisfying (1), and the formulas for \( p(\tau) \) and \( q(\tau) \) show that \( \{a_n\}_{n=0}^{\infty} \) and \( \{b_n\}_{n=0}^{\infty} \) converge to \( \mu \).

To exploit this, set \( k'(\tau) = q(\tau)^2/p(\tau)^2 \), and note that solutions of (4) are equivalent to solutions of \( k'(\tau) = b/a \) with \( \mu = a/p(\tau)^2 \). Thus the set

\[
R = \{ p(\tau)^2/a : k'(\tau) = b/a \}
\]

consists of reciprocals of values of \( M(a,b) \).

The function \( k'(\tau) \) has some remarkable properties. Recall the action of \( \text{SL}(2, \mathbb{Z}) \) on \( \mathbb{H} \) via linear fractional transformations, and set

\[
\Gamma_2(4) = \{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in \text{SL}(2, \mathbb{Z}) : \begin{pmatrix} a & b \\ c & d \end{pmatrix} \equiv \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \mod 4 \}, b \equiv 0 \mod 2 \}.
\]

Then \( k'(\tau) \) is a modular function for \( \Gamma_2(4) \). Thus it is invariant under \( \Gamma_2(4) \) and, in fact, induces a biholomorphism \( \mathbb{H}/\Gamma_2(4) \to \mathbb{C} - \{0, \pm 1\} \). Our restrictions on \( a \) and \( b \) ensure that \( b/a \in \mathbb{C} - \{0, \pm 1\} \), so that if we fix one \( \tau \in \mathbb{H} \) with \( k'(\tau) = b/a \), it follows that

\[
R = \{ p(\gamma\tau)^2/a : \gamma \in \Gamma_2(4) \}.
\]

The next crucial fact is that \( p(\tau)^2 \) is a modular form of weight one for \( \Gamma_2(4) \). Hence,

\[
p(\gamma\tau)^2 = (c\tau + d)p(\tau)^2, \quad \gamma = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in \Gamma_2(4).
\]

If we set \( \mu = a/p(\tau)^2 \), then a typical element of \( R \) can be written

\[
p(\gamma\tau)^2/a = (c\tau + d)p(\tau)^2/a = d/\mu + ic/\lambda,
\]

where \( \lambda = i\mu/\tau \). It is easy to show that \( d \) and \( c \) can be any relatively prime integers with \( d \equiv 1 \mod 4 \) and \( c \equiv 0 \mod 4 \). Though \( \lambda \) may seem mysterious, it is possible to show (using theta identities) that

\[
a + b = \lambda p(-1/2\tau)^2, \quad a - b = \lambda q(-1/2\tau)^2.
\]

From (4) we see that \( \lambda \) is a value of \( M(a+b, a-b) \).

These last few paragraphs illustrate nicely the interaction between the agM and theta functions, modular functions, and modular forms. The formula for the values of \( M(a,b) \) given by the
Another surprise found in Gauss’s notes is his values. This follows from a lemma (due to Gauss) which states that \(\lambda = i\mu/\tau\) has some nice consequences. By abuse of notation set \(\mu = M(a, b)\) and \(\lambda = M(a + b, a - b)\). If we let \(c = (a^2 - b^2)^{1/2}\), then \(M(a + b, a - b) = M(a, c)\) since \(a\) and \(c\) are the arithmetic and geometric means of \(a + b\) and \(a - b\). Thus \(\lambda = i\mu/\tau\) implies that

\[
\tau = M(a, b)/M(a, c).
\]

This shows that \(\tau\) can be explicitly computed in terms of \(a\) and \(b\). An especially nice case is when \(a = \sqrt{2}\) and \(b = 1\). Then \(c = 1\), giving us \(\tau = i!\).

3. Gauss’s notes on the agM span thirty years and contain some amazing facts about modular function theory. In particular, he basically knew everything mentioned in the above sketch. (With regard to \(p(\tau)^2\) being a modular form, he even computed the \(q\)-expansions at the cusps—see [3, X. 1, page 224].) Another example of what he knew is his famous drawing of a fundamental domain:

\[
\begin{array}{c}
+1 \\
0 \\
-1
\end{array}
\]

Raan für \(t\) und \(1/t\).

Note that Gauss worked in the right half-plane instead of the upper half-plane. His theta functions were thus power series in \(e^{-\pi t}\), where \(\text{Re}(t) > 0\). In the third volume (1876) of his collected works, the above picture is reproduced inaccurately; the editor did not know its real meaning (see [3, III, page 478]). Only in the eighth volume (1900), edited by Fricke and Stäckel, do we find a correct drawing (see [3, VIII, page 105]). Another surprise found in Gauss’s notes is his use of the reduction theory of positive-definite quadratic forms to analyze \(p(\tau)^2\) (see [3, X. 1, page 224]). What he does is closely related to finding fundamental domains for subgroups of \(SL(2, \mathbb{Z})\).

While these fragments are quite compelling, we must be careful not to read too much into them. Gauss did not have a general theory of modular functions, and in some respects he is closer to Euler than to us. But is clear that he knew a tremendous amount about certain basic modular functions and forms.

The final topic we explore is the chronology of Gauss’s discoveries about the agM. We’ve seen that everything began on May 30, 1799 when he noticed that \(M(\sqrt{2}, 1) = \pi/\omega\). How long did Gauss take to get from this observation to the agM of complex numbers? We find part of the answer in his mathematics diary. The 101st and 102nd entries show that Gauss had proofs of both \(M(\sqrt{2}, 1) = \pi/\omega\) and the more general formula (2) by December 1799 (see [3, X. 1, page 544]). But the 109th entry, dated June 3, 1800, reads as follows:

“Between two given numbers \(a\) and \(b\) there are infinitely many means both arithmetic-geometric and harmonic-geometric, the observation of whose mutual connection has been a source of happiness for us” [3, X. 1, page 550]. (The harmonic-geometric mean of \(a\) and \(b\) is \(M(a^{-1/b}, b^{-1})\).)

This quote is amazing: The infinitely many means and their mutual connection must refer to the theorem discussed above. Yet only six months have passed! Is it possible to discover so much mathematics in so short a period of time?

Unfortunately, such a question is beyond the scope of this article. Our goal will be more modest: We will show that Gauss, in June 1800, was aware of the theta functions and knew the formula (5) giving \(\tau\) in terms of the agM. Our evidence comes from the 108th entry of the mathematical diary. It is also dated June 1800 and announces a complete theory of elliptic functions (“sinus lemniscatici universalissime accepti”—see [3, X. 1, page 548]). To see how this relates to the agM, we need to review Gauss’s work on lemniscatic functions.

In January 1797 Gauss defined \(sl\phi\) and \(cl\phi\), the lemniscatic sine and cosine, as follows:

\[
sl\phi = x \leftrightarrow \int_0^z (1 - z^4)^{-1/2} dz = \phi,
\]

\[
cl\phi = sl(\omega/2 - \phi).
\]

Notice the strong analogy with \(\sin\phi\) and \(\cos\phi\). The addition law came quickly, and by March 1797 he had defined \(sl\phi\) and \(cl\phi\) for complex \(\phi\), and he knew the double periods \(2\omega\) and \(2i\omega\). In October 1798 Gauss saw how to express \(sl(\phi)\) as a quotient of theta functions \(P(\phi)/Q(\phi)\), where

\[
(6) \quad Q(\psi \omega) = 2^{-1/4}(\frac{\pi}{\psi})^{1/2}(1 + 2e^{-\pi\psi} 2\psi\pi + 2e^{-\pi\psi}\cos \psi\pi + 2e^{-\pi\psi}\cos \psi\pi\pi + \cdots),
\]

and \(P(\psi \omega)\) is given by a similar formula. Thus six months before the observation of May 30, 1799, Gauss was well aware of one side of the equation \(M(\sqrt{2}, 1) = \pi/\omega\). Notice also that the general form of the theta function is easily discerned from the above formula.

We can now see the real significance of the diary entry of May 30, 1799, for when Gauss noticed that \(M(\sqrt{2}, 1) = \pi/\omega\), he must have realized instantly that there was a deep connection between the
agM and the lemniscatic functions. This is the "entirely new field of analysis" that his diary refers to.

It remains to see how Gauss got from the lemniscatic functions to general elliptic functions. The goal is to construct a function \( S(\phi) \) which inverts the elliptic integral

\[
\int \left( (1 - z^2)(1 + \mu^2 z^2) \right)^{-1/2} dz.
\]

Note that \( \mu = 1 \) corresponds to the lemniscatic case. Gauss's idea is to generalize formula (6), using the agM. Specifically, he first sets

\[
\tilde{\tau} = \frac{\tilde{\omega}}{\tilde{\omega}'} = \frac{M(\sqrt{1 + \mu^2}, 1)}{M(\sqrt{1 + \mu^2}, \mu)},
\]

and \( Q(\phi) \) is defined analogously to (6); i.e.,

\[
Q(\psi \tilde{\omega}) = (1 + \mu^2)^{-1/4} (\psi / \tilde{\omega})^{1/2} \cdot (1 + 2e^{i\pi \tau} \cos 2\psi \pi + 2e^{2i\pi \tau} \cos 4\psi \pi + \cdots).
\]

A similar formula gives \( P(\phi) \), and then Gauss sets \( S(\phi) = P(\phi)/Q(\phi) \). The function \( S(\phi) \) inverts the above integral, satisfies the appropriate differential equation, and has periods \( 2\tilde{\omega} \) and \( 2i\tilde{\omega}' \). This is the theory that Gauss announced in June 1800.

The formulas for \( P \) and \( Q \) are a classical method for producing elliptic functions. A standard difficulty is showing that such functions invert all elliptic integrals —this is called the uniformization problem. The wonderful thing about Gauss's theory is that it solves this problem explicitly: The uniformizing variable \( \tau \) is computed by using the agM! The formula for \( \tau \) also substantiates two of our earlier claims. First, we see that Gauss did know formula (5) for \( \tau \) in June 1800, and second, we see clearly that the agM was essential to Gauss's study of elliptic functions.

The full story of Gauss's work on the agM is quite complicated. No short survey article can convey the real richness of Gauss's mathematical thought. We have only sampled some of the highlights. For more of the details the reader should consult [2] or [3, X.2].

There is one final point to consider. In §1 we saw numerous applications of the agM over \( \mathbb{R} \). Far fewer are known over \( \mathbb{C} \), partly because most people simply aren't aware that the agM of complex numbers can be defined. It is our hope that once this theory becomes better known, the applications will follow. Some of them could be very exciting.

**References**


On Topology and Other Things

by Raoul Bott

On a beautiful fall day in 1949 my wife and I drove our brand-new Buick convertible, vintage 1934, into the little valley over which "Fuld Hall", the main building of Princeton Institute for Advanced Study, presides so majestically—in spite of its marked Howard Johnson overtones. For us this moment seemed like the entrance to Paradise. Partly, I suppose, it was a matter of contrasts: from Pittsburgh to Princeton, from near despair three months earlier due to illness and joblessness to health and the beginning of a wonderful adventure.

I start my account here because this was also soon to be the place where I first heard the word topology, which was to become my dominant professional love; and I thought that rather than try to sum up in the manner of wise—i.e. old—men the subject and its development on this occasion, I would prefer to tell you a bit about Princeton in 1949 and my first skirmish there with that subject and really with all of pure mathematics. The true title of this talk should therefore lie somewhere between From Network Theory to Topology or An Engineer at the Court of Robert Oppenheimer or Reminiscences of a Brash Ignoramus at the Institute Circa 1949—1951.

To return to that afternoon in 1949, I am proud to say that our euphoria did not even diminish when we were shown to our apartment in the Compound—as we referred to the derelict army barracks which housed all the "Temporary Members." Of course the drawbacks of a coal stove with a penchant for going out in the middle of a cold winter night were not apparent yet in September.

An indeed that whole first year seemed—to us at least—enchanted; we had to pinch ourselves at times to be certain that it was all real. But so you would have done also. Imagine a place where the suspicious-looking vagrant whom the police try to arrest turns out be Jean Leray; where around eleven each morning it is quite easy to chat with Einstein about weighty subjects such as the weather or the tardiness of the mail delivery. Where the friendly but very silent neighbor in the midst of a raucous group of young lunchers turns out to be P.A.M. Dirac, and so on and so on. What I am describing here then is the excitement of the young in the midst of their idols, an excitement and an inspiration which only increases as one becomes aware of their foibles. It is a phenomenon which I am sure goes on today also, and one of the great virtues of having an institute such as Princeton in our midst is precisely the excitement which is generated there and which bonds the young to the old and so to their subject. However I cannot resist the canonical "old man's" delusion, that in his day things were somehow grander; and so I can not help feeling that those were the truly Olympian days of the Institute: Veblen, Alexander, Morse, H. Weyl, von Neumann, and C. L. Siegel were the full professors in Mathematics; Selberg, D. Montgomery and Gödel the permanent members, while Lefschetz, Artin, and Bochner were still active at the University. Oppenheimer had been recently appointed director and his energy was apparent everywhere, especially when, after tea, he would literally herd the young physicists to their seminar.

Just as today, the mathematicians were a less homogeneous group that the physicists, each with their own rhythm of work and play, and the group of my contemporaries there firmly believed in the therapeutic effects of alcohol on a tired mathematical mind. One anecdote from such a very successful therapy session conducted at Dean Montgomery’s house is the following. Some aspects of the cocktail party are blurry in my memory now—doubtless due to the long time span that has elapsed—but I remember distinctly that eventually a small number of us remained playing marbles on Dean’s carpet. Von Neumann was one of the party, and somehow in the course of the game I came to ask him what it felt like to be a "great mathematician." In his characteristic quiet, thoughtful way, it behooved him to take my question seriously—although a moment earlier he had given us a sampling of his seemingly unlimited store of raunchy stories. Essentially what he said was that, in all honesty, he had known only one "great mathematician"—David Hilbert. And that as far as he was concerned, what with being a Wunderkind, he never really felt that he had lived up to what had been expected of him. So you see it is not difficult to be found wanting—one just needs an appropriate measuring rod.

But it is now really time to say a word about the "serious" subject of this talk: "Topology"
or "Analysis Situs" as it was still then called by people like Veblen, Morse, C. L. Siegel and Hermann Weyl. Analysis Situs of old is now known under the ungainly title of "Algebraic Topology," and its purpose and aim is to construct and understand the more or less computable invariants which distinguish different geometric shapes—or more generally, topological spaces.

The most intuitively obvious such invariant is, of course, the number of pieces into which a space falls, and in some sense the whole vast edifice of this subject falls into two branches depending on how the concept of component is understood. If we use the concept of arc-component i.e. two points \( p \) and \( q \) of a topological space \( X \) are in the same component if and only if there is a map, i.e. continuous function: \( \mu : I \to X \) of the interval \( I \) into the space with

\[
\mu(0) = p \quad \text{and} \quad \mu(1) = q,
\]

then this concept naturally leads us into "homotopy theory." Thus in homotopy theory we have

\[
\pi_0(X) = \text{set of arc-components in } X.
\]

On the other hand, if we take the position that two points \( p \) and \( q \) are in the same component of \( X \) if and only if all locally constant functions, say, real-valued, \( f \) and \( X \) agree at \( p \) and \( q \), then we are starting off in the tradition of cohomology theory: to wit, if we set \( H^0(X) \) equal to the space of locally constant functions then in cohomology theory: \# of components = \( \dim_{\mathbb{R}} H^0(X; \mathbb{R}) \).

In both these theories the higher invariants proceed from their zero counterparts by some sort of inductive step, rather geometric and naive for homotopy, and much more algebraic and subtle for cohomology. On the other hand it turns out that the cohomological extension of component is the more computable one, while the conceptually easier homotopy group \( \pi_k(X) \) is very difficult to compute. Indeed, they can be defined \emph{inductively} as follows. Let \( p \) be a point of \( X \) and denote by \( \Omega^kX \) the space of all maps \( \mu : I \to X \) with \( \mu(0) = \mu(1) = p \). The space of \emph{loops} on \( X \) based at \( p \) one calls \( \Omega X \) in, say, the compact open topology. Then define \( \pi_k(X) \) inductively by:

\[
\pi_k(X) = \pi_{k-1}(\Omega X) = \pi_{k-2}(\Omega^2X) \ldots = \pi_0(\Omega_{k}X).
\]

This definition goes right back to the Hurewicz, and is easily seen to be equivalent to the Czech definition of the thirties.

\[
\Omega^p X =
\]

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure1.png}
\caption{Figure 1}
\end{figure}

To give you an idea of the state of the art for determining these groups in 1949, let me tell you that one day Steenrod entered his class on fiber-bundles at Princeton—which I was attending as my "first topology course"—and proudly announced that Pontrjagin had just written to the effect that \( \pi_4(S^2) = 0 \). A few weeks later came an excited word from Cambridge: George Whitehead had determined \( \pi_4(S^2) = \mathbb{Z}/2\mathbb{Z} \) instead. And soon thereafter Pontrjagin confirmed George's result.

But 1949 was not really a homotopy year at the Institute. Rather it was the year when, in H. Weyl's seminar two different but presumably "really watertight" proofs of the "Hodge Theory" were being presented by DeRham on the one hand, and Kodaira on the other. Apart from Steenrod's course at the University, this seminar was the one which intrigued me the most, for of course, the basic existence theorems of network theory may be thought of as a finite-dimensional analogue of Hodge Theory in dimension 0! To explain this, let me recall first of all how the cohomological extension of the component concept works—at least in the category which appeals to me most, the "category of smooth spaces"—i.e. the \( C^\infty \)-manifolds \( M \). Usually such a manifold is, by definition, glued together smoothly out of copies of \( \mathbb{R}^n \), and so the concepts and constructions of analysis naturally extend from \( \mathbb{R}^n \) to them. In particular, one can start with the \( C^\infty \) functions \( A^0(M) \) in which the locally constant ones are characterized by the differential equation

\[
df = 0 \iff \frac{\partial f}{\partial x^i} = 0
\]

relative to any local coordinate \( x^i \).
In this context we therefore find that \# of components of \( M = \dim \) of the space of solutions of the differential equation \( df = 0 \).

Now the inductive cohomological generalizations of this \( H^\infty \) is the DeRham Complex:

\[
A^0(M) \xrightarrow{d} A^1(M) \xrightarrow{d} A^2(M) \xrightarrow{d} \ldots
\]

in which the \( A^i(M) \) denote the “covariant” alternating tensor fields on \( M \), and “\( d \)” is the only natural extension of the “\( d \)” already encountered, sending a function \( f \) to its differential \( df \). The “DeRham Cohomology” of \( M \) is then simply given by

\[
H^q(M) = \ker d / \text{Image} d \text{ in } \dim q.
\]

Now if in addition \( M \) is given a positive definite metric, then each of the vector spaces \( A^i(M) \) inherit a natural inner product \( \langle \phi, \chi \rangle \) and thus, correspondingly, each differential operator “\( d \)” has a well-defined adjoint “\( d^* \)”, satisfying the usual adjoint equation: \( \langle d\phi, \chi \rangle = \langle \phi, d^*\chi \rangle \). The Hodge Theory, then, deals with the harmonic forms on \( M \).

The operator \( \Box = d d^* + d^* d \) and its space of solutions \( H^\Box(M) \) are precisely the harmonic forms on \( M \).

The operator \( \Box \) clearly preserves \( A^i(M) \), and the Hodge theorem asserts that the harmonic forms precisely give the cohomology on any compact oriented manifold \( M \): that is, we have the equality

\[
H^q(M) \cong H^q(M).
\]

Compare this situation now with the first and simplest question of network theory. Here one is dealing with an assembly of resistors \( R \), which are hooked up according to a graph—as for example indicated in Figure 4.

![Figure 4](image)

If \{\( \alpha \)\} runs over the branches of \( N \)—which we orient in some fixed but arbitrary manner—and if we write \( \alpha + \) and \( \alpha - \) for the head and tail vertex of the branch \( \alpha \), then the “incidence” data

\[
\alpha \mapsto (\alpha^+) \]

completely determine the topology of \( N \). In terms of linear algebra this incidence relation in turn is uniquely specified by the linear operator:

\[
\delta : A^0(N) \rightarrow A^1(N)
\]

from the space \( A^0(N) \) of \( \mathbb{R} \)-valued functions on the vertexes of \( N \) to \( A^1(N) \) the space of such functions on the oriented branches, given by

\[
\delta \phi(\alpha) = \phi(\alpha^+) - \phi(\alpha^-).
\]

Clearly then this \( \delta \) is precisely the finite difference analogue of the earlier \( d \), and the “combinatorial cohomology” of \( N \) is also defined, just as before, by

\[
H^0(N) = \ker \delta, \quad H^1(N) = A^1(N)/\text{image of} \ \delta.
\]

These vector spaces turn out to be topological invariants of the graph considered purely as a topological space. And indeed it is clear that the kernel of \( \delta \) consists of those functions on the vertexes of \( N \), which are constant on each connected piece so that pretty obviously one has the relation:

\[
\dim H^0(N) = \# \text{ of connected pieces of } N.
\]

The electrical behavior of \( N \) is of course only given once the positive resistances \( r_\alpha \) of the branches are specified. Mathematically the correct procedure is to interpret the reciprocals \( g_\alpha = 1/r_\alpha \) as determining a positive definite inner product on \( A^1(N) \) by the formula:

\[
\langle \phi \psi \rangle = \sum g_\alpha \phi(\alpha) \cdot \psi(\alpha)
\]

and at the same time to endow \( A^0(N) \) with the “Kronecker” inner product

\[
\langle f, g \rangle = \sum_P f(p) g(p).
\]

Just as before it is now meaningful to speak of the adjoint to \( \delta \)—denoted by \( \delta^* \)—and of the corresponding Hodge Laplacian \( \Box = \delta^* \delta + \delta \delta^* \), and in terms of these the steady-state potential distribution \( E \) of \( N \) is related to an exterior current flow \( I \) by the equation

\[
\Box_0 E = I, \quad \text{with} \quad \Box_0 = \delta^* \delta,
\]

the Hodge operator in \( \dim 0 \).

The “Hodge Theory” in this context therefore implies that

\[
\dim \ker \Box_0 = \dim H^0(N) = \# \text{ of components of } N
\]

an so immediately proves the first fundamental existence theorem of network theory—which is of course self-evident to any engineer worth his salt—to wit: that \( \Box_0 E = I \) can be solved uniquely for \( E \) once every component of \( N \) is “grounded” at one vertex and provided only that the total current flowing into any component of \( N \) is zero.

By the way, this finite-dimensional Hodge theory is immediate linear algebra. On the other
hand the following, more precise, Ansatz for solving these equations was really my pride and joy in 1949—and is essentially the first theorem that I thought I had proved.

It is the following formula for the product

$$\det \Omega_0 = \prod_{\lambda > 0} \lambda$$

of the nonzero eigenvalues of the operator $\Omega$.

![Figure 5](image)

FIGURE 5

For each (spanning =) maximal tree of $N$, as indicated in Figure 5, let $T_\alpha$ be the product

$$T_\alpha = g_{\alpha_1} \cdots g_{\alpha_T}$$

of the $g$'s corresponding to the branches in $T$. With this understood one has

$$\det \Omega_0^T = \sum_{T} T_\alpha,$$

where $T$ ranges over the maximal trees of $N$.

I called this determinant $\Omega_0^T$, the *impedance potential* $\psi$ of the network $N$, and in terms of it $\Omega_0^T$ can be explicitly inverted on the complement of its null-space. In particular

$$\frac{\partial \log \psi}{\partial g_\alpha} = R_\alpha$$

gives a formula for the "Effective Impedance" of $N$ across the branch $\alpha$ in terms of $\psi$.

Alas—as I learned much later—I had essentially been scooped on these formulas by Kirchhoff himself!! I mention them here only because the infinite-dimensional analogues of this determinant, i.e. the $\det \Omega_0^T$, in the Hodge theory proper, have played such a central role in modern physics to this very day and while preparing this talk I could not help puzzling about whether this impedance potential has some generalization to the infinite dimensional case.

I also wondered what the formula for all the coefficient of $\det (\Omega_0 + \lambda I)$ might be, and I expect they involve only positive "tree" products.

Of course in the infinite dimensional context, each Laplacian $\Omega_{(k)}$ on $A^k(M)$ is a second order differential operator so that it is not at all clear how its determinant should be defined. However on a compact manifold such a $\Omega$ has a discrete set of eigenvalues and in 1949 enough was known concerning the asymptotic distribution of the eigenvalues—another favorite subject of Hermann Weyl's—to be able to define some sort of *regularized notion of determinant* for $\Omega$.

The theorem I am alluding to, and which I heard for the first time in Hermann Weyl's address on *The Eigenvalue Problem Old and New*, is due to Minakshisundaram and Pleijel and asserts that the zeta function

$$\zeta(s) = \sum \lambda^{-s}$$

where $\lambda$ ranges over the eigenvalues of $\Omega$, not only makes good sense for $\text{Res}$ large enough but has a meromorphic extension to the whole complex $s$-plane, the position of whose poles could be described explicitly. In particular $\zeta(0)$ was analytic near $s = 0$. Hence the formal computation

$$\frac{d}{ds} \frac{\partial \log \psi}{\partial g_\alpha} = R_\alpha$$

can be turned around to yield a a regularized determinant $\Omega$:

$$\det \Omega = e^{-\int \frac{d}{ds} \frac{\partial \log \psi}{\partial g_\alpha}}$$

and that is how these determinants enter the mathematical literature—notably in the Ray-Singer paper of the 1950s on the *Reidemeister Torsion*. They also occur increasingly in this form in the contemporary literature of field theory.

The name Reidemeister brings me back to those days in 1949, for Reidemeister and E. Specker were my private tutors at the Institute that year. Reidemeister was a warm, charming, urbane Philosopher-Mathematician, who spoke and lectured fluently in a language of his own—roughly 40% English and 60% German—and his lessons in a small seminar on Cartan’s "Theory of Carapace"—lectures Cartan delivered at Harvard in 1948—remain as one of the most inspiring but also incomprehensible experiences of my life.

Reidemeister also introduced some of us young blades into an old—and by now, I am afraid, defunct—Institute tradition. These were the woodchopping expeditions which took off Wednesday afternoon at 2 p.m. sharp and ranged over the Institute grounds felling old trees or sawing fallen ones into manageable pieces. The participants were people like C. L. Siegel, Pauli, Alexander, Alexandroff, Reidemeister, etc., all people who seemed to me infinitely sage as well as venerable—in short, old—but who upon reflection turn out to have been in their early fifties at the time, and so quite a bit younger than I am now. Alas!

Although I am running out of time I cannot resist relating one anecdote (out of many!) concerning these expeditions. One Wednesday in November it was pouring rain and sleet, and as a matter of course I decided that woodchopping was out of the question. Then I started to wonder what C. L. Siegel would do. This curiosity finally get the better of me. I went to our meeting place a few minutes before 2 p.m. Sure enough, at 2 p.m.

sharp C. L. appeared. I next thought that as there were only two of us there, he would call it quits. Not a bit of it. We picked up a huge saw, carried it into the woods and went to work—for the most part silently and completely drenched. Then during a short breather, C. L. suddenly turned to me and said: “You know, I really admire those people who did not show up today. But how can one decide to go woodchopping on Wednesdays at 2 p.m.—and then stay at home just because the weather is bad!”

Ah where have the days of such high principle gone!

Carl Ludwig seemed to me the Prince among Princes at the Institute. His lectures were dramatic occasions where one felt in touch with every branch of mathematics. Starting with number theory one would encounter analysis, topology, and algebraic geometry, as well as $P$-adic numbers, all in one hour! Although totally opaque to a beginner in pure mathematics, they certainly inspired me more than anything else with the wish to understand this whole beautiful edifice and in particular to understand the role that topology played in the subject. And I suppose it is to this influence that I owe the position which I still hold today, of not seeing topology in isolation so much, as in interaction with analysis, geometry, and really all of mathematics.

Of course this attitude was shared by many of the great men in Princeton at that time; certainly H. Weyl, Morse, Bochner, and Lefschetz all pointed one in that direction, and were in fact somewhat hostile to the “new algebraic topology” as represented by the Eilenberg-Steenrod-MacLane school. Under these contradictory pressures I compromised by attending on the one hand Steenrod’s course—as well as hanging out around him whenever I could—and on the other by learning “Morse Theory”—pretty much on my own, for Morse had little interest in his early theory at that time. He was deeply into his work with Transue on functions of bounded variation and such matters.

Let me recall for you that in the Morse theory the dimensions $b_k = \dim H^k(X)$ of the cohomology groups of a compact manifold are related to the extrema of a smooth function $f$ or $M$. In fact, for the generic situation where these extrema occur at isolated points, let $m_k(f)$ denote the extrema of $f$ with precisely $k$ directions of “steep descent.” Then the Morse series of $f$

$$M_t(f) = \sum m_k t^k$$

turns out to be correlated to the “Poincaré series” of $M$ defined by

$$P_t(M) = \sum \dim H^k(M) t^k$$

by a set of inequalities. Precisely the Morse theory in this context asserts that:

$$M_t(f) - P_t(M) = (1 + t)Q(t)$$

where $Q(t)$ is a polynomial with non-negative coefficients.

From these inequalities it follows immediately that if the $m_k$ are 0 for odd $k$, then

$$\dim H^k(X) = m_k(f);$$

in short, one can then deduce the entire additive cohomology structure from a second order knowledge of the extrema of $f$.

Morse had of course applied this principle in a grander setting, namely to function spaces, notably to the space of loops $\Omega_p M$, so that in 1927 he already had computed the cohomology of this loop-space for the $n$-spheres $S^n$. His result was that:

$$H_k(\Omega_p S^n) = \begin{cases} \mathbb{Z} & \text{when } k = n - 1 \\ 0 & \text{otherwise}, \end{cases}$$

and from it he deduced the beautiful result that there must be an infinite number of geodesics joining any two points $p$ and $q$ on $S^n$ in any Riemannian structure.

From the very start, I was much taken with this evaluation of $H^k(\Omega S^n)$ but I really did not know how to fit it into the scheme of things. I think none of us knew in Princeton, although I expect Serre in Paris had by then understood. On the whole the topologists proper had as little use for Morse theory as Morse had for them. We were of course in 1949 just in the lull before the storm. The French revolution in algebraic topology and especially in homotopy theory had not hit us yet. As a result, there was no strictly topological method known at the time for obtaining Morse’s formula, and therefore for using the inductive definition of $\pi_k$ which I gave you as a computational device. Thus in 1949 all one could really say with confidence about the higher homotopy groups of the spheres was that they were countable!

Nevertheless—in retrospect—the stage was really set by then for the whole subject as we know it today, save for two ideas. We knew from Eilenberg and MacLane (1945) that the correct way of looking at things was the functorial one. What our fathers had called a topological invariant was always associated with a function from the world of spaces and their maps to the algebraic world, say the world of groups. That is, behind any topological invariant there always lurked a way of attaching not only a group $F(X)$ to a space $X$, but also, by a homomorphism $F(h)$ attached to each map $h : X \to Y$, going from $F(X)$ to $F(Y)$ (in the covariant case) such as homotopy, and the other way in the contravariant case, such as cohomology. We also knew that for many of the classical questions of geometry—such as the existence of vector-fields without zeros, etc., on manifolds—the notion of a twisted product of two spaces was indispensable and that the measurement of the twist involved homotopy.
In its most geometrical setting, this realm of ideas came—like so much—from H. Hopf on the one hand and H. Whitney on the other. I recommend to every young topologist that he sometime look at the Michigan Colloquium in topology in the early forties. All the papers there seem to be landmarks and especially Whitney’s, where the whole theory of what we now call fiber-bundles is sketched out.

We also knew from Eilenberg, MacLane, and independently Hopf, that if a space \( Y \) had only one nontrivial homotopy group, say \( \pi_k(Y) = \pi \) (with all \( \pi_r(Y) = 0, r \neq k \)), then the space \( Y \) was determined by \( \pi \) up to some form of homotopy equivalence, depending on the category of spaces one had in mind. Thus for each Abelian group \( \pi \) and integer \( n \) there is a well-defined space \( K(\pi, n) \), the Eilenberg-MacLane space characterized by the equation

\[
\pi_k \{ K(\pi, n) \} = \pi, \quad \text{all other } \pi_k = 0.
\]

On the other hand, it was also known that in general the homotopy type of a space was not determined by its homotopy groups alone, i.e., not every space was the product of the Eilenberg-MacLane spaces corresponding to its individual homotopy groups, but was rather some sort of twisted product of them

\[
X = K(\pi_1, 1) \times T K(\pi_2, 2) \times T \ldots
\]

with the twist at each stage being measured by an element of \( H^q([\text{preceding stage}] ; \pi_{q-1}) \).

But all these deep original insights were far from the practical world of application because we really had no good way of computing the cohomology of a twisted product \( X \times T Y \), or indeed a really good definition of twisted product.

These two gaps were then filled on the one hand by the Leray spectral sequence which set definite limits to the extent to which the cohomology of a twisted product can differ from that of the Cartesian product, and Serre’s insight that Leray’s results, which were inspired by differential geometric considerations, carried over to a very general type of twisted product—his fiber spaces. In particular in his world he saw quite clearly that the loop space \( \Omega X \) and \( X \) can be twisted together to yield a contractible space

\[
\text{point} = X \times T \Omega X;
\]

and that as a consequence in simple cases such as the spheres, the Leray rules applied to this equation sufficed to compute the cohomology of \( \Omega X \) in terms of that \( X \)! Thus Serre had reproved the Morse formula but with a method he could iterate and so he ushered in the era in which one could hope to compute \( \pi_0(X) \) by purely cohomological means as \( H^0(\Omega^n X) \). Although this is still hard to do in any individual case, this point of view changed matters fundamentally.

Today one knows, for instance, that the \( \pi_n(X) \) are computable in the technical sense (a theorem of E. Brown) if \( X \) is a finite simplicial complex, and of course Serre immediately derived the finiteness of the higher homology groups of the spheres \( S^n \) by this method.

I think, however, that if we students in Steenrod’s course had been allowed to gaze into a crystal ball, what would have surprised us most is the amazing development in the truly geometric aspects of topology which were to come. There was of course an active school of low-dimensional, “honest” topology at Princeton: Papakiriakopolous, Moise, Fox, but who would have then expected Thom’s cobordism of five years hence, Milnor’s exotic spheres and Smale’s immersion and handlebody theory in ten years time, or the setting of the Hauptvermutung in higher dimensions let alone the recent results of Kirby and Friedman. Basically there was pessimism in the air about being able to prove honest topological classification theorems, even if progress in the basic questions of homotopy theory was achieved. This pessimism was so prevalent that it even deflected a wonderful geometric topologist like J. H. C. Whitehead from what he could do best, to messing around with various more algebraic aspects of the subject.

J. H. C. Whitehead, “Jesus He’s Confusing Whitehead,” we used to call him affectionately! What a wonderful way he had about him; the pulse rate of all of Princeton immediately doubled when he arrived for a short visit in—was it 1949 or 1950—I am not certain. But I remember distinctly a party at Steenrod’s when Henry recounted to all of us how mind-blown he had been by Norman’s original paper of 1945 where Steenrod had introduced his \( v_i \) products—later known as Steenrod squares—and immediately applied the construction to an obstruction problem. Steenrod would say that he just stumbled on it playing with the cocycle formula, but J. H. C. wanted details. Whitehead was lavish and generous in his praise but could be quite outspoken in his disapproval also. He was an old friend of von Neumann’s but took a dim view of von Neumann’s involvement in government affairs. “How can one forsake the world of the mind for the dull world of kings?” he admonished me once.

The Steenrod squares of course were very much in the developmental stage at that time—and my first paper in topology dealt with them and their relation with symmetric products and the Smith theory. Just like the theory of characteristic classes, they were treated by all of us gingerly and with great respect. After all, in Whitney’s Proceedings announcement on characteristic classes he remarked that what we call the Whitney duality theorem was the hardest theorem he had proved!

So I can not help thinking how wonderful it would have been, if during that bull-session with Henry in Norman’s kitchen, I could have regaled them with some of the things to come in this area,
such as that it is much more expedient to make this theorem the starting axiom of the theory, or how brazenly a young fellow called Hirzebruch would throw them about in six years' time.

And of course I must admit that it would have been even more fun to startle Henry that night with a consequence of the Morse Theory which I would stumble on, after an incubation period of six or seven years. Well, that would have been fun—but of course was not to be. But maybe it is appropriate to end this lecture with a short reminiscence concerning this application and how I came on it.

When I returned to the Institute for Advanced Study in 1955-1956, the scene had changed drastically—Serre, Kodaira, Spencer, Atiyah, Borel, Milnor, Singer, and Hirzebruch became my teachers and friends and homotopy was not at the top of my mind. I had already noted that the Morse Theory applied beautifully to the topology of a Lie group and that one could write down the characteristic classes wizards such as Borel and Hirzebruch. And it is in the latter genre that I profer this personal strand of history. Still, if sufficiently many of us of my vintage would do the same, we might collectively really bring to life a unique and certainly romantic era of American mathematics. Thank you very much.

Bibliography

L. S. Pontrjagin, Homotopy classification of the mappings of an (n+2)-dimensional sphere on an n-dimensional, Dokl. Akad. Nauk. SSR (N.S.) 70 (1950), 957–959. (Russian)
George Lusztig Awarded 1985 Cole Prize

The Frank Nelson Cole Prize in Algebra is awarded every five years for a notable research memoir in algebra which has appeared during the previous five years. This prize, as well as the Frank Nelson Cole Prize in Number Theory, was founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as secretary of the American Mathematical Society after twenty-five years and as editor-in-chief of the Bulletin for twenty-one years. The original fund was donated by Professor Cole from moneys presented to him on his retirement. It has been augmented by contributions from members of the Society, including a gift made in 1929 by Charles A. Cole, Professor Cole's son, which more than doubled the size of the fund. In recent years, the Cole Prizes have been augmented by awards from the Leroy P. Steele Fund and currently amount to $4,000.

The Twenty-First Cole Prize was awarded to GEORGE LUSZTIG, of the Massachusetts Institute of Technology, at the Society's ninety-first Annual Meeting in Anaheim. The prize was awarded by the Council of the American Mathematical Society on the recommendation of a selection committee consisting of Michael Aschbacher (Chairman), Melvin Hochster, and Bhama Srinivasan.

The text below includes the Committee's citation, the recipient's response on presentation of the award, and a brief biographical sketch of the recipient.

Citation

To GEORGE LUSZTIG for his fundamental work on the representation theory of finite groups of Lie type. In particular, it is awarded for his contributions to the classification of the irreducible representations in characteristic zero of the groups of rational points of reductive groups over finite fields, appearing in Characters of Reductive Groups Over Finite Fields, Annals of Mathematics Studies 107, Princeton University Press, 1984.

Response

I feel very honored to receive the Cole Prize. My book which has been cited contains the classification of the complex irreducible representations of a reductive group \( G(F_q) \) with connected centre over a finite field \( F_q \) and explicit formulas for their character at all regular semisimple elements. This completes a work done about ten years ago jointly with Deligne in which we constructed almost all representations of \( G(F_q) \). After the book was written, I have removed the restriction on the centre. What has emerged is that the classification of representations is simpler than that of conjugacy classes; for instance, it is independent of characteristic. The combinatorics which enters in the classification of degenerate representations is closely related to that which enters in the classification of primitive ideals in enveloping algebras and to that in my work with Kazhdan on singularities of Schubert varieties. For the character values at non-semisimple elements one has quite a bit of information and it now seems reasonable to hope that the full character table of \( G(F_q) \) will be determined in the not too distant future.

Biographical Sketch

GEORGE LUSZTIG was born May 20, 1946, in Timisoara, Romania. He received a Master's degree from the University of Bucharest in 1968, and both M.A. and Ph.D. degrees from Princeton University in 1971. From 1969 to 1971, Lusztig was a visiting member at the Institute for Advanced Study, Princeton, New Jersey. He has also been a research fellow, lecturer, and professor at the University of Warwick, in Coventry, England (1971–1978). In 1978 he became professor of mathematics at the Massachusetts Institute of Technology.

Lusztig has given several AMS addresses: at the 1977 Summer Research Institute on Automorphic Forms, Representations and \( L \)-Functions; at the Symposium on the Geometry of the Laplace Operator in Hawaii (March 1979); and at the Special Session on Cohomology and Representations of Algebraic Groups in San Antonio (January 1980, AMS Annual Meeting). He also gave an invited address in Philadelphia in April 1980. He has been an invited speaker at the International Congresses of Mathematicians in 1974 and 1983.

Lusztig received the Junior Berwick Prize in 1977 from the London Mathematical Society. He was a Guggenheim Foundation Fellow in 1982 and was elected a Fellow of the Royal Society in 1983.
Reports to the Members of the Society

Introduction

The Council of the AMS has asked that henceforth an annual report be prepared describing the highlights of the Society's activities during the preceding year. This report will have three components: a report from the Secretary giving an overview of the professional activity of the Society; one from the Treasurer on the financial well-being of the Society, and recounting various actions of the Board of Trustees; and one from the Executive Director describing other activities of the Society and some of the activities and accomplishments of the AMS staff in Providence and Ann Arbor. All three reports will henceforth be published regularly in the March issue of the Notices. The reports of the Treasurer and the Secretary supplement the formal Report of the Treasurer and the reports of Council Meetings and Business Meetings that appear regularly in the Notices.

Report of the Secretary

The purpose of the Society has been unchanged since its inception though the wording has been altered slightly. The purpose of the New York Mathematical Society was stated in its constitution of 29 December 1888.

The object of the Society shall be to incite and maintain an active interest in Mathematics Pure and Applied.

These words persisted when the name was changed in 1894 to the American Mathematical Society. In the published version of 1898 the words are

to encourage and maintain an active interest in mathematical science.

This text was unaltered until the incorporation of the Society in 1923. The constitution vanished then, some of its features being incorporated in the existing bylaws, but the purpose was stated in the Certificate of Incorporation as follows:

The particular business and objects of the Society are the furtherance of the interests of mathematical scholarship and research.

The Society carries out its purpose in three ways: through meetings, publication, and a variety of services. It does this work with the support of many volunteers; there are more than 400 names in the list of members of committees, which does not include many of the volunteers. It does it with the full-time services of about 200 persons in the offices of Providence and Ann Arbor.

One of the charges to the Executive Committee is to review the operations of the Society. It does this over a three-year cycle corresponding to the three categories that were just named. The year 1984 was the year to examine meetings, so that the report of the actions of the Council of January 1985 may well include Council reaction to the report on meetings to be presented to it.

Meetings in 1984 on diversified subject matter followed a standard pattern, with the required Annual Meeting in January, the Summer Meeting in August, both being joint meetings with the Mathematical Association of America, and five sectional meetings. At these meetings there were sets of Colloquium lectures by Barry Mazur and Paul H. Rabinowitz, the Gibbs lecture by Herbert A. Simon, thirty-three invited hour addresses, and 1027 shorter papers, either contributed or assembled by organizers of special sessions. This is a small offering compared with the year 1982, for which the comparable figures are at hand, a year in which there were nine such meetings (Annual, Summer, and seven sectional) with forty hour addresses and 1587 shorter papers.

The Society had grants or contracts to hold a number of conferences on specialized topics. Some details are given in the report of the Executive Director. The list includes a four-day Symposium on Pure Mathematics, a one-day Symposium on Some Mathematical Questions in Biology, ten one-week Summer Research Conferences, a two-week Summer Seminar in Applied Mathematics, and a three-week Summer Institute.

The decrease in the number of contributed papers between 1982 and 1984 was surprising. Accordingly the entire offering of 1964 was examined for comparison. The current offering is remarkably richer both in the content of general meetings and in specialized conferences. In 1964 there were two national meetings and nine sectional ones with one set of Colloquium Lectures (not two), the Gibbs Lecture, eighteen hour addresses (versus thirty-three), and 698 contributed papers (compared with 1027). In that year there was a Summer Institute in pure mathematics and a three-day symposium in applied mathematics but no other conferences.

On a different level, there were two short courses in 1984, but the concept of short courses at AMS meetings had not yet arisen in 1964.

The status of the Summer Meeting is as follows. There will be the usual joint meeting with the MAA in 1985 and 1987. There will be no Summer Meeting in 1986 only because it has deferred to the International Congress of August 1986 in Berkeley. The Centennial of the Society will be held in the Summer of 1988 in place of the usual Summer Meeting. The issue of continuing Summer Meetings indefinitely, which could affect 1989, is under study. The question of their scientific value was raised because they were losing money. At that point the issue was whether they are of sufficient value to be supported. It appears likely that with the increase
in registration fees that you have observed and with a new cost-sharing arrangement with the MAA now being negotiated, the joint meetings will not lose money, so that the nature of the issue has changed.

Publication is a substantial part of the activity of the Society. There are several components to journal publication. First is the publication of research through primary journals, namely Mathematics of Computation, Memoirs, Proceedings, Transactions.

In addition, the research component of the Bulletin consists of announcements of research results. On a different level, the Abstracts is devoted to the announcement of research results. Second is the reviewing component through Current Mathematical Papers and Mathematical Reviews. Finally, there are seven journals in translation from the original Russian.

Another aspect of publication consists of fifteen series of books. It should be noted that the Colloquium Publications and the Mathematical Surveys and Monographs welcome the offering of manuscripts for consideration by the editors. As a comment, it should be noted that the author's royalty in either of these series is unusually favorable.

Publication is a major fraction of the business of the Society, accounting for about seven-tenths of the annual budget. There is a narrow path to be traveled in this business. First, the officers, particularly the Trustees, are determined that the Society publications shall be inexpensive. As evidence of the effectiveness of this policy, one may consult the Notices for November 1983 where journal prices of some fifty-six typeset journals are compared. Even at list price, AMS research journals are in the lowest quartile in price and these journals are, in fact, sold at a discount to members, making their prices even more favorable. On the other hand, publications must produce a modest surplus in order to fit into the total financial picture of the Society and the mathematical community. The use of the surplus will become clear when service obligations of the Society are elucidated.

More detailed information on the publication business is contained in the reports of the Treasurer and the Executive Director.

Services to the profession are of two kinds. A common thread is that they cost money and bring in little income, so that they must be supported from dues or from surplus in other operations of the Society.

One kind of service consists in supplying information or facilitating its flow, for instance through

- Combined Membership List
- Professional Directory
- Annual Survey
- Listing of doctoral degrees
- Listing of backlogs of journals
- Listing of visitors here and abroad
- Reciprocity Agreements
- Listing of fellowships and assistantships
- Listing of postdoctoral fellowships
- Listing of lecture notes (to be resumed in 1985)
- Listing of computer software (under study)
- Employment Information in the Mathematical Sciences
- Employment Register

No single member wants all of these services for personal use but many members want some of them. Almost no one opposes any of them except possibly for their cost.

The other kind of service consists in attempting to influence the climate or the social milieu of research. The most recent activity of this kind is the establishment of the Office of Executive Secretary for National Affairs. (See below.) This is an office concerned with the flow of information between the mathematical community and elective and administrative government officials. It is part of a joint venture with the MAA and SIAM called the Joint Policy Board for Mathematics, to which the Executive Secretary reports.

Other activities in this category include the work of committees on

- Professional Ethics
- Employment and Educational Policy
- Academic Freedom, Tenure and Employment Security
- Science Policy
- Human Rights of Mathematicians
- Opportunities in Mathematics for Disadvantaged Groups
- Service to Mathematicians in Developing Countries
- Public Understanding of Mathematics
- Status of the Profession

In that the activities in the second class have a political or social content, the membership has from time to time been divided over the propriety of some of them as Society activities. This is particularly the case when one reflects on the fact that some of the activities are directed to the political or social scene in the United States while the membership includes several thousand persons from other countries.

The Society is not the only organization uniting and serving mathematicians. The Professional Directory lists thirty-five others in the U.S. and Canada serving various specialized intellectual, geographical, and social areas in the mathematical sciences.

A bit of history on the place of the AMS among these organizations may be pertinent. The American mathematical profession has had its turbulent times. In January of 1915 the Council of the AMS voted that, "It is deemed unwise for the American Mathematical Society to
enter into the activities of the special field now covered by the *American Mathematical Monthly,*" adding that if a new organization were formed, concerned with collegiate mathematics education, the Society would have "feelings of hearty good will and encouragement." In December of 1915, H. E. Slaught resigned his position as Secretary of the Society and became one of the founders of the MAA; one may judge that emotions ran high during the intervening months. And there is no doubt that when SIAM was formed in 1952, it was because many applied mathematicians were concerned that their field was not receiving adequate attention within the Society.

In spite of these differences, many American mathematicians have worked to increase cooperation among the various organizations. The Conference Board of the Mathematical Sciences (CBMS) was formed in 1958, with representatives from the above three organizations as well as the Institute of Mathematical Statistics, the Association for Symbolic Logic, and the National Council of Teachers of Mathematics. There was a move toward amalgamation of the three organizations in 1973, but after considerable discussion, representatives of AMS, MAA and SIAM concluded that it was not feasible at that time. But they successfully recommended that a tripartite Joint Projects Committee for Mathematics (JPCM) be formed to collaborate on problems of common concern, under the aegis of CBMS. Within the past two years the name and structure of JPCM has changed; the new Joint Joint Policy Board for Mathematics (JPB) now operates independent of CBMS. It consists of the presidents and executive directors of the three organizations, and one appointed member from each (the secretary in the cases of AMS and MAA).

K. M. Hoffman is now JPB’s Executive Secretary for National Affairs, and provides one of the principal lines of communication between the three societies and various Federal agencies. (In particular, he has been appointed chairman of the NSF Advisory Panel on Mathematics Education.) JPB will also be seeking funding this fall for a serious study by JPB’s Committee on the Status of the Profession of "the academic mathematical sciences profession: recent trends, present circumstances, and future outlook concerning the characteristics of college and university mathematics faculty, their changing responsibilities and their capacities to meet these responsibilities."

The Society also participates, through the individual memberships of its President and President-Elect or Ex-President, in the Council of Scientific Society Presidents, which is a club with considerable influence in Washington on pertinent aspects of administrative and legislative policy in scientific matters.

Questions considered through these contacts include inter-society issues of cooperation and jurisdiction and the formulation of a united front and concerted action when this represents the interest of all concerned.

There are of course many specific projects in which the Society has cooperated regularly with other mathematical organizations. As examples, the *Combined Membership List,* the Employment Register, and the Congressional Science Fellow are all jointly supported by AMS-MAA-SIAM; several conference series are sponsored jointly by AMS and SIAM and/or the Institute of Mathematical Statistics; and several aspects of publication are joint projects.

E. Pitcher

**Treasurer’s Report**

**I. Introduction**

Over the past ten years, the country has been through several business cycles. Just prior to the years of double-digit inflation, the Society’s finances were very strong and the mood of the Trustees was to hold prices down on member dues, publications, registration fees and other services. This policy, the inflation, and the fact that we must commit ourselves to a selling price long before the service is provided, brought the financial reserves of the Society to a level which caused the Trustees to reconsider pricing policy. During 1982 and 1983, cost-saving procedures were put into effect and prices were adjusted in an effort to bring the budget of the Society into balance. For the 1984 year, it is expected that a modest surplus of about $100,000, or 1% of the budget, will be realized.

The 1985 budget has been set to produce a surplus of about $500,000 or 4.5% of the $11,000,000 budget; experience has shown that the actual surplus will probably be less than that projected, but will still be positive. At the end of 1975, the total budget of the Society was approximately four million and its reserves were two million dollars, or about 50% of a year’s operating budget. At the end of 1983, our reserves were only 24% of a year’s operating budget. A Long Range Planning Committee, which was recently formed by the Executive Committee and Board of Trustees, is currently considering a method to increase our reserves over the next number of years to one full year of expenditures. This will provide the cushion desirable for developing needed programs and services for the profession. In summary, the Society’s finances are in better shape now than they were a year or so ago.

**II. Revenue**

I now turn to a description of the Society’s revenue, followed by explanations of each category. Revenue to support Society activities in 1985 is expected to come from the following sources.
Journals. Although journals provide the largest fraction of revenue, they have been operating at a net loss for the past several years. Costs are under constant scrutiny and cost-saving procedures are implemented where possible, for instance by placing more type on a page, reducing the size of type, using new and cheaper methods of composition, doing in-house printing, and using lighter paper to reduce postage costs. Even with the cost reductions made over the past several years, deficits in the journal accounts persisted, mainly because of fewer subscribers and a reluctance to raise prices too high. Of major concern to the Board of Trustees is the steady erosion of the subscriber base. This is not a problem unique to the AMS, but affects all learned societies. Most subscribers are foreign or domestic institutions, and the library budgets of most of them have been cut. Marketing and promotion efforts are being made to try to halt or reverse this trend, but without much success. Journal prices for 1985 have been raised substantially; fortunately, studies show that AMS journals are still priced near the lower end of the range, in comparison with other mathematical journals.

Books. Included in this category are not only books (monographs or collections of articles) but review volumes and indexes to journals. Books as a group are financially sound, and selling prices of AMS books compare very favorably to other mathematical books. It is interesting to observe that the number of copies printed is usually very small, only 800–1,200. A strong marketing and promotion effort is being made to increase the number of copies sold in an effort to keep prices down, and some success can be reported here.

Review volumes and indexes have been a financial burden to the Society. Prices have to be set very high because the costs of producing these extremely large publications are high. The question of whether to publish such volumes is a difficult one; on the one hand the profession needs such publications as research tools, and on the other the price needed to break even is too high for smaller institutions to pay. In some cases, prices have been set artificially low to address this problem.

Dues. The Society has about 450 institutional members and 20,000 individual members. Of the latter, about 6,000 pay no dues because they are student nominees, emeritus members, or reviewers without convertible currency. Dues from the approximately 14,000 paying members make up 6% of revenue, and the institutional members provide another 3%. Individual member dues are two-tiered to provide some relief to lower paid members. Institutional dues are set, in part, by the number of papers published by members employed by the institution. Increases in dues for individual members are set annually by a cost-of-living index.

Grants and Contracts. The amount of money available from the Federal government has declined substantially over the years. Currently, support is mainly for travel and subsistence for participants in research conferences, institutes and seminars, plus the Society's cost in preparing and running these conferences. The money received from Government agencies is reimbursement only, with no profit to the AMS. The Society does have contracts to perform services for other nonprofit organizations, and this helps to recover some fixed costs.

Meetings. Registration and exhibit fees at the two joint meetings each year have never been sufficient in the past to cover expenses. It will therefore be necessary gradually to increase fees over the next few years to bring revenues and expenses into balance.

III. Expenses

The expenses of the Society are not as easily categorized as revenues. Most expenses are assigned to departments, and these are later allocated to specific publications, meetings, or other accounts. The three major expenses of the Society are personnel ($5,700,000 or 55%), buildings and equipment ($1,326,000 or 13%), and direct publication costs ($1,500,000 or 14%). The remaining 18% or $1,898,000 is made up of pass-through funds from grants, direct meeting costs, and general supplies.

IV. Assets and Liabilities

So far this report has dealt with sources of revenue and applications of expense. Another aspect of the Society's finances is what it owns and owes, or its assets and liabilities. Unlike revenue and expense, which are measured over a specific period (monthly, quarterly, yearly), assets and liabilities are measured on a specific day. It is estimated that on 31 December 1984, assets will be greater than liabilities by approximately $1.3 million. Besides cash of $2.5 million, which is kept in short-term negotiable investments, and inventory (both finished and in process) valued at approximately $1 million, the Society has a significant investment in fixed assets.

The Society owns buildings in both Providence and Ann Arbor. The Providence building was built in 1974, and a major addition for a combination warehouse and printing plant was added in 1981. The total cost of the Providence facility has been slightly more than $2 million. The Ann Arbor building was purchased in 1984 at a cost of approximately $1 million. This amount was financed with a mortgage against the Providence building.

The Society presently has furniture and equipment with a book value of $1.5 million (cost of
$3.4 less depreciation of $1.9 million); most of this value is made up of computers and computer-related equipment. The write-down in value for computer equipment is quite rapid, five years in most cases. Unlike buildings, which could have a substantial residual value, equipment eventually becomes worthless. This is perfectly proper because a building returns income when it is finally disposed of and equipment as it is used in production.

The liabilities of the Society are short term, with the exception of the mortgage on buildings of $1 million. Short-term liabilities as of December 31, 1984 will be approximately $500,000 owed to vendors, $5 million in prepaid 1985 subscriptions and dues, and $700,000 as reserves for employment-related expenses. When these liabilities are subtracted from assets it leaves a positive balance of $1.3 million.

Besides the assets mentioned above, there exists an Investment Fund with a value of approximately $2.6 million. About half of this fund consists of endowments with restricted use of principal, the other half, quasi-endowments created by the trustees from time to time. The income from these two groups helps to support the current operations of the Society, with the exception of a portion that is restricted to prizes. F. P. Peterson

Annual Report of the Executive Director

The present report will probably be longer than those in the future, in order to explain fairly fully just what the Society does and has been doing; later reports can build on this. Probably most members do not realize that the Society has more than 200 employees (about two-thirds of them in the headquarters office, the other third in the Mathematical Reviews editorial office), nor know what a broad spectrum of activities the Society is engaged in.

I. Meetings and Conferences

The Society regularly arranges for the following meetings and conferences:

Annual Meeting (January) and Summer Meeting (August). Normally joint with MAA and sometimes additional organizations.

Sectional Meetings. Normally eight per year, two in each of the four sections of the country.

Summer Research Institute in Pure Mathematics. Three weeks each summer on one topic; usually 200–250 participants. Supported by the NSF.

Summer Seminar in Applied Mathematics. Joint with SIAM; two weeks long; about 100 participants. Supported by various agencies.

Joint Summer Research Conferences. Joint with SIAM and IMS and supported by the NSF;

normally ten conferences, each one week long, all on one campus. About 75–100 participants each.

Symposium on Mathematical Biology. One day, held at the annual AAAS meeting. Usually about 60 participants. Usually supported by the NSF.

In addition, the Society has in the past sponsored two series of two to four day symposia in alternate years, contiguous with spring sectional meetings, one in pure mathematics and one in applied mathematics. Partly because of changes in agency funding practices, these series are now in metamorphosis, with the steady state still to be determined. Probably the symposium in pure mathematics will henceforth usually focus on the work of some outstanding mathematician, as did the recent ones on Hilbert and Poincaré.

AMS Meetings. Summer meetings merit special discussion. For many years the attendance (and therefore income) at the August Joint Mathematics Meetings has been on the decline, whereas costs have continued to rise. Facilities and services previously provided by the host universities at no or low cost are now costing thousands of dollars. As the scientific program has become more complex and more events have been added, more hours must be devoted to preparation and plans. For the past few years, deficits in the $40,000 to $50,000 range have not been uncommon. The Trustees of the Society and the Council have both expressed concern over these deficits, and have devoted a great deal of time and thought to the problem. (See the Secretary's report.) It is hoped that a solution can be found so that the summer meeting can be continued in the future, and representatives of the Society and the MAA are working together toward this end. It has been decided that the usual joint summer meetings will be held in 1985 and 1987; the International Congress of Mathematicians will replace the usual meeting in 1986, and the Society will have a special Centennial meeting in the summer of 1988, so every summer is planned for until 1989, at any rate.

One element of cost pervading all the Society meetings is that of processing the abstracts of talks in order to prepare the program of the meeting. One person works almost full time on this task prior to deadlines for the meetings; this work is quite separate from the preparation of the Abstracts journal (pasting-up, photographing and printing), and is charged to the various meetings. In an effort to bring the meetings accounts into balance and to offset some of the preparation costs of the journal, the Trustees last year reluctantly imposed a fee of $15 for each abstract accepted. In January, the Council recommended to the Trustees that this fee be rescinded.

1986 International Congress of Mathematicians. The National Academy of Sciences, through the United States National Committee
for Mathematics, invited the International Mathematical Union to hold the 1986 International Congress in the United States at the University of California, Berkeley. The Academy, in turn, asked the Society to handle the organizational aspects of the Congress. The Society has chosen to do so through a nonprofit subsidiary corporation called ICM-86; Jill P. Mesirov is its Executive Director. Most of the preplanning and on-site supervision will be done by the Society’s Meetings Department, augmented by some temporary personnel. In order to maintain good liaison with the U.S. mathematical community, the Board of Directors of the corporation has appointed a Steering Committee, chaired by Andrew M. Gleason of Harvard University, with members from all segments of mathematical life. Subcommittees of the Board and Steering Committee will seek to raise funds for support of ICM-86 from the private sector, schedule the various sessions at the Congress (at the direction of the IMU Program Committee), and look after the various publications (program, book of abstracts, proceedings).

Residence hall and hotel rooms have been reserved for Congress participants in Berkeley, Oakland, and San Francisco. Free shuttle service will be provided to and from most of these accommodations and the Berkeley campus, where all sessions of the Congress will be held. The IMU Program Committee is planning approximately sixteen one-hour invited lectures, a large number of invited 45-minute lectures, and sessions for short communications. The scientific program will be supplemented by an extensive social program, including a reception hosted by the Chancellor of the university, a rodeo and western barbecue. A variety of pre- and post-Congress tours will be offered, as well as several day-trips to interesting locations in the northern California area. The Second Announcement of the Congress, containing detailed information and the preregistration and housing form, will be available in late 1985, and can be obtained by writing to ICM-86, Post Office Box 6887, Providence, Rhode Island 02940.

AMS Centennial Celebration. The Centennial of the Society will be celebrated by a special meeting which will take place in Providence, Rhode Island, August 8–12, 1988. Plans are being made for about eighteen-twenty special invited addresses representing a rather comprehensive survey of currently significant fields of mathematics. Sessions for contributed papers will be scheduled, but there will be no special sessions. A proceedings volume will be published at a later date. A paperback reprint of the history of the first fifty years (originally published in 1938) will be on sale at the meeting, and a history of the second fifty years will also be available. An extensive social program, including a reception at the State Capitol building and a real New England clambake, is being developed.

Conferences Held in 1984. The Summer Institute, on Geometric measure theory and the calculus of variations, was held at Humboldt State University in Arcata, California. The Summer Seminar was on Nonlinear systems of PDE in applied mathematics, and was held on the campus of the College of Santa Fe, Santa Fe, New Mexico. The Joint Summer Research Conferences were held on the campus of Bowdoin College, Brunswick, Maine, on the following topics (with organizers’ names following):

- New multivariate methods in statistics, P. Huber
- Random matrices and their applications, J. Cohen
- The mathematics of phase transitions, R. Durrett
- Aspherical complexes, K. Brown and F. T. Farrell
- Group actions on rings, S. Montgomery
- Diophantine problems, including diophantine equations, diophantine approximation, and transendancy, D. J. Lewis and W. M. Schmidt
- The Selberg trace formula and related topics, A. Terras
- Linear algebra and its role in systems theory, B. N. Datta
- Integral geometry, R. L. Bryant
- Complex differential geometry and non-linear differential equations, Y. T. Siu

II. Publications

Mathematical Reviews and Subsidiary Publications. So many changes have taken place in recent years in the way MR is produced that a separate article will be devoted to the Ann Arbor operation in a forthcoming issue of the Notices. Here I will only mention some of the visible results of the labors of the seventy persons who work in that office.

About 10,000 pages were published in MR and CMP and their indexes in 1984, and both publications are completely up to date. CMP now appears triweekly rather than biweekly, to save on distribution and postage costs.

The Cumulative Subject Index for 1940–58 appeared early in 1984. This index was made by pasting together fragments from the various annual subject indexes for those years; the task was complicated by the fact that the classification system was changed repeatedly and sometimes radically during the early years.

A substantial fraction of the work has been done on the preparation of the Cumulative Subject Index for 1959–72, and it will appear in early summer. Since no annual subject indexes were produced during the period 1959–1972 (they would have required substantial increases in staff, or else computers not then available), it was necessary to classify each review now and keyboard the bibliographic headings along with their classifications. It will be important in the future that this work not only provides the paper
copy of the missing index, but permits us to extend the bibliographic entries in MathSci back to 1959.

Another major effort directed in Ann Arbor was the preparation of R. K. Guy's Reviews in Number Theory, 1973–83, which appeared near the end of 1984. This collection of more than 17,000 reviews, taken together with the earlier volumes covering 1940–1972, provides research mathematicians in this field with a unique bibliographic tool. A companion volume edited by B. Magurn, Reviews in K-Theory, is well under way and should appear in mid-1985.

**MathSci.** Perhaps the most exciting developments in the Society's publishing program in 1984 were related not to paper products but to the online service MathSci, which started in 1982, under the name MATHFILE, merely as a computerized version of MR. Beginning in 1985, the following 1984 efforts will become visible:

- The MR file will be extended back to 1959, as mentioned above.
- CMP tapes will be supplied to the database vendors (Dialog, BRS, and FSA) as issues are printed, so that users will find citations (but not reviews) for articles as little as a month after their publication. These citations will be replaced by MR entries when the reviews are published.
- Both CMP and MR entries will be in TEX input code, so that in the not too distant future, citations from vendors can be converted into real mathematics by running them through the TEX program.
- The American Statistical Association and the Institute for Mathematical Statistics have agreed to add their joint publication Current Index to Statistics to MathSci; and the Index to Statistics and Probability, 1902–1968, compiled by J. Tukey, will also be added. It is hoped that funds can be found to eradicate the gap between these two files, now extending from 1969 to 1974, so that the file on statistics will be essentially complete.

With these enhancements, MathSci will unquestionably be the most powerful bibliographic retrieval tool available in the mathematical sciences—and we hope to add still more subfiles in the near future.

**Other AMS Journals.** About 12,000 pages were published in the Society's primary research journals,

- Abstracts of Papers Presented to the AMS
- Mathematics of Computation
- Memoirs of the AMS
- Proceedings of the AMS
- Transactions of the AMS

and in the journals also containing non-research material,

- Bulletin of the AMS

---

**Notices of the AMS**

**Employment Information in the Mathematical Sciences**

The Society maintains a no-backlog policy for its primary journals, thus ensuring authors of prompt publication.

Another 6,500 pages were published in 1984 in the Society's translation journals,

- Mathematics of the USSR - Izvestiya
- Mathematics of the USSR - Sbornik
- Proceedings of the Steklov Institute of Mathematics

**Soviet Mathematics - Doklady**

**Theory of Probability and Mathematical Statistics**

**Transactions of the Moscow Mathematical Society**

**Vestnik of the Leningrad University (Mathematics)**

Unfortunately, it has been necessary to discontinue publication of the Vestnik with the 1984 volume, because of lack of subscription income. Translation journals are extremely expensive to produce, with fees to be paid to translators and royalties to the Soviet copyright agency, and there seemed to be no way that the Vestnik could become self-supporting. (The Allerton Press has now obtained the rights to translate and publish future volumes.)

**Books.** The Society publishes original books in twelve different series,

- CBMS Regional Conference Series
- Colloquium Publications
- Conference Proceedings, Canadian Mathematical Society
- Contemporary Mathematics
- Lectures in Applied Mathematics
- Lectures on Mathematics in the Life Sciences
- Mathematical Surveys and Monographs
- Memoirs of the AMS (also sold by subscription)
- Proceedings of Symposia in Applied Mathematics
- Proceedings of Symposia in Pure Mathematics
- Selected Tables in Mathematical Statistics
- SIAM-AMS Proceedings,

and publishes translations in three series,

- Translations of Mathematical Monographs
- AMS Selected Translations
- Selected Translations in Mathematical Statistics and Probability.

Anyone not familiar with the natures of these series may consult the AMS Catalogue of Publications, available free from 800-556-7774. In 1984, sixty titles were published in these series, amounting to almost 13,500 pages. (The Steklov and Memoirs volumes are also sold by subscription, as journals.) The new series Contemporary Mathematics is flourishing, with volumes appearing at the rate of about 15 books...
per year, including the proceedings of many of the Summer Research Conferences.

Publication Services for other Organizations. Other societies have found that the AMS can provide high-quality editorial, composition and distribution services at very reasonable rates. We now do the keyboarding and computer composition for nine other journals, as well as the editorial preparation of manuscripts for several of them. Some of them we also warehouse and distribute, and we perform the latter service for two foreign journals as well, Astérisque and Journal of Operator Theory. We print a few journals besides our own. In the recent past the Society has prepared the World Directory of Mathematicians on behalf of the IMU, and will do so again for the 1986 edition. We will also produce the proceedings resulting from the 1986 Congress, on behalf of ICM-86.

Taking account also of various non-serial publications such as the Combined Membership List, the Professional Directory, and meeting programs, an average of about four publications prepared by Society staff went to press each week during 1984.

III. Membership Services

Employment Services. The Employment Register, providing for interviews at annual meetings between employers and applicants, is a service that is taken for granted by Society members, but in fact it seems to have no close parallel among other learned and scientific societies. In the background is an optimal matching algorithm published by D. Morrison in 1969 which arranges timed pairings between certain elements of two sets in such a way that there are no time conflicts. This algorithm was built into a program the Society has used since about 1962, first on a Sandia computer, then on the GE network, and more recently on our own computer. The program has been substantially enlarged and improved within the past couple of years, and at the January meeting in Louisville, 6,672 interviews were scheduled between 229 employers and 332 applicants during 48 interview periods stretching over two days. (Other societies which arrange employment interviews seem to manage only a few hundred during a meeting.)

It may be illuminating, as a commentary on the job market, to note the numbers (employers, applicants) since 1973:

<table>
<thead>
<tr>
<th>Year</th>
<th>Employers</th>
<th>Applicants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>60, 535</td>
<td>115, 273</td>
</tr>
<tr>
<td>1974</td>
<td>51, 521</td>
<td>135, 207</td>
</tr>
<tr>
<td>1975</td>
<td>71, 542</td>
<td>175, 284</td>
</tr>
<tr>
<td>1976</td>
<td>63, 364</td>
<td>203, 260</td>
</tr>
<tr>
<td>1977</td>
<td>75, 385</td>
<td>172, 260</td>
</tr>
<tr>
<td>1978</td>
<td>91, 400</td>
<td>229, 332</td>
</tr>
</tbody>
</table>

However much the computer program may be improved, the human part of the job of making the Register work will always be a harried one. At the winter meeting, all the requests for interviews, from both sides, must be input in the late afternoon on a terminal connected by modem to Providence, the program must be run (about four hours on a DEC 2060), and the output records printed out on the terminal, separated, and organized, all in time for a nine o'clock start the next morning. Through changes in procedures, two people can now finish by midnight what used to require four people several more hours.

Employment Information in the Mathematical Sciences. This journal was recently supplemented by a special issue, published each year just prior to the January meeting and containing full resumes of each of the preregistered applicants who will participate in the Employment Register. This has proved to be a great convenience to everyone involved, since employers now have an opportunity to devote more time to the selection of applicants they wish to interview, and congestion at the site of the Employment Register has been reduced.

New Members. Over the years the membership of the Society has grown monotonically, although not very regularly. According to the Combined Membership List, there were 2,392 members in 1940, 4,434 in 1950, 6,725 in 1960, 14,197 in 1970, 19,994 in 1980, and 26,392 in 1984. In 1940 it was almost axiomatic that a new Ph.D. would join the Society; this is unfortunately no longer quite true. For many years we have provided free memberships to the nominees of institutional members of the Society (North American colleges and universities). Some of those student nominees never complete their Ph.D.'s, and others either discontinue their research efforts or concentrate in an area which they feel is better served by another organization than the AMS, but most of the remainder continue their memberships.

This past year, in an effort to be sure that every graduate student who would benefit from AMS membership knew about its value, we began asking mathematics departments for their lists of graduate students, so that we could contact them directly. This program will be continued. Also, a new brochure has been prepared to give clearer information to new members about just what the Society does and what it offers its members.

Other Member Services. A number of changes have been introduced to provide better service to current members. These include installing a toll-free telephone number for members' orders and questions, using UPS for faster book deliveries in the U.S., and accepting VISA and MasterCard for book orders and for registration and housing charges at annual and summer meetings.

W. J. LeVeque
Publishing a Book

As you surely know, the American Mathematical Society has long been recognized for its book and journal publishing program. You may not be aware, however, that the Society has recently taken a number of steps to increase the size and broaden the scope of its book publishing program, and to be more vigorous in acquiring the best manuscripts available.

Consider these developments...

• A new paperback book series, Contemporary Mathematics, was initiated in 1980 with Ross Kindermann and J. Laurie Snell's masterful Markov Random Fields and their Applications. The series consists partly of lecture notes and expository monographs such as this one, and partly of proceedings of conferences. In particular, the proceedings of most of the NSF Joint Summer Research Conferences are published in this series. All books in this series are printed from typescript prepared by the authors, and they are correspondingly inexpensive. About 35 volumes had appeared by the end of 1984.

• The scope of the series Mathematical Surveys was extended and the series was renamed as Mathematical Surveys and Monographs. The books in this series, which are cloth bound and typeset, extend back to Shohat and Tamarkin's 1943 classic, The Problem of Moments. Some of them have been graduate-level textbooks, and we expect to publish more texts of this sort in the future.

• Carl Pearcy, of the University of Michigan, has recently agreed to serve as an acquisition editor for the Society. He will actively seek out well-known mathematicians who are writing—or planning to write—monographs or textbooks that would be suitable for the two series mentioned above. With his help, and possibly that of additional acquisition editors, we expect the number of books published annually by the Society to increase noticeably.

• A marketing specialist has recently been added to the Society staff. This additional staff support will increase efforts already ongoing to promote AMS publications to librarians and researchers in the mathematical sciences.

Why should you publish with the Society? There are a number of good reasons, which together may seem compelling to you.

• The AMS keeps books in print indefinitely; you needn't worry about spending several years writing a book only to see it disappear from the market within a short period of time. (You can still buy the Shohat and Tamarkin book, published in 1943, mentioned above.)

• All AMS books are printed on acid-free paper, so that you can be sure they will still be on the library shelves years from now.

• Most mathematics libraries in the United States, and many abroad, have standing orders for all Society publications. Your book will have automatic sales from the day it is printed.

• The Society pays very generous author royalties on monographs and textbooks published in the Mathematical Surveys and Monographs, substantially in excess of the industry standard. Currently, for a book sold at the special price available to individual members, this royalty amounts to 25% of the sales price.
• The Society sells nearly half of its books abroad, so titles have a very broad distribution.
• Heavily discounted prices to AMS members make even relatively expensive titles affordable for individuals.
• The Society has an extensive computer file of the special interests of mathematicians all over the world. This file is used regularly to direct advertising to the collection of people most likely to be interested in each new title.
• Distributors and agents in foreign countries regularly produce catalogues and flyers, in their respective native languages, promoting AMS titles.
• In addition, every new book is featured in the Notices, which goes to 23,000 mathematicians six times a year, advertised repeatedly to individuals and libraries, and announced again each time it is reprinted.
• One final point. The Society supports many vital functions on behalf of the mathematical community which produce no income, or less income than they cost. It does this principally by using the revenue earned from its publications, which in another company might go to the stockholders. By publishing with the AMS, you will be helping to continue many other useful activities.

So if you have a manuscript or are thinking of writing one, you would be wise to give serious thought to publishing with the AMS. If you have a manuscript ready for publication, mail it to the AMS office for transmittal to the appropriate editorial committee. The address follows.

Director of Publication
American Mathematical Society
P. O. Box 6248
Providence, Rhode Island, USA 02940

If you are thinking of publishing a book, but are unsure of where to publish, contact Professor Carl M. Pearcy, AMS Acquisition Editor. At the time of this issue, Professor Pearcy is out of the country, but mail sent to his permanent address, listed below, will be forwarded.

Professor Carl M. Pearcy
Department of Mathematics
University of Michigan
Ann Arbor, Michigan, USA 48104
Retirement of Lincoln K. Durst

After nearly fifteen years as Deputy Executive Director of the Society, Dr. Lincoln K. Durst retired on 31 December 1984. Speaking for all of the officers of the Society, the Board of Trustees “record[ed] its thanks to Lincoln K. Durst for his years of skilled, perceptive, and devoted service.” The quotation is from the resolution of the Trustees, which subsequently appeared on the certificate presented to Dr. Durst at a dinner in his honor attended by staff and friends. He will be greatly missed by both the staff and members of the Society.

Lincoln K. Durst was born August 5, 1924, in Santa Monica, California. He received his B.A. from the University of California, Los Angeles, in 1945. He also received a B.S. (1946) and a Ph.D. (1952) from the California Institute of Technology.

Dr. Durst served as deputy executive director of the American Mathematical Society from 1970 until his retirement in December 1984. His activities during this period included terms as managing editor of Notices and Abstracts, and membership on the Data Subcommittee of the Society’s Committee on Employment and Educational Policy.

Before coming to Providence, he was a member of the mathematics departments at Rice University (instructor, assistant professor, associate professor, 1951 to 1967) and Claremont McKenna College (professor of mathematics, 1967 to 1970). During the 1950s he was associated with School Mathematics Study Group projects and during the 1960s he worked with the Mathematical Association of America’s Committee on the Undergraduate Program in Mathematics, serving as executive director of CUPM in 1966-1967.

Durst’s mathematical efforts have been centered in the theory of numbers and related areas. He is a member of Phi Beta Kappa, AMS, MAA, SIAM, and the Canadian Mathematical Society.
American Science and Mathematics
by J. B. Mooney, Jr.

American science and mathematics are the strongest in the world. Yet there are problems.
There are problems because we do not have enough young people going into careers in science and particularly going into careers in mathematics and the mathematical sciences.

There are problems because American science has been operating with obsolete equipment and instrumentation.

There are problems because American science is not adapting quickly enough to the revolutions in biotechnology, computerized experimentation and simulation and the increased role of mathematical abstraction.

There are problems because our American system of public education has not adequately prepared our students for scientific careers or even for living in this society which in many ways is defined by the high technology surrounding us.

I will discuss some of these issues with you and offer what the Office of Naval Research will do over the next several years to help remedy these significant problems. In particular, I will describe some recent actions and some planned actions which will impact directly on the mathematical sciences.

In relating ONR policy and the action to the mathematical sciences, I will emphasize an apparent paradox. The world, our world, is becoming more cerebral, more abstract and more mathematical. Nations such as the United States are shifting the intensive concentration of our working population from the manufacturing industries just as we shifted our working population from agriculture a century ago, many would argue that intellectually-based service industries will, in fact, become the dominant form of employment. I remark parenthetically that this is nowhere more evident than in Washington, D.C. The fact is that an abstract, mathematical understanding of our world continues to gain ascendency over an empirical, trial and error approach. Our society is changing from a "hands-on" to a symbol oriented "minds-on" society. The paradox is that even while this is so, the federal support available to the mathematical research community has declined in constant dollars and, as the recent David Committee report showed, has come to be markedly out of balance with support with related fields of science.

One may well argue, what does it matter? The intellectual state of American science is good. During the last 35 years Americans have won more Nobel Prizes in science than any other nation. Indeed, the steady stream of Fields Medals and the large proportion of mathematicians winning the Waterman Award affirm the excellence of American mathematics. Why then should we be concerned?

The general public sees warning signs. Those warning signs are most evident in the weakened competitive position of the United States in international technology. You know the answer in more pointed terms—it lies precisely in the problems I enumerated at the outset. If we are challenged in science and technology now, we, as a nation, must be concerned for the future. We must recognize that while we are winning Fields Medals and Nobel Prizes now, we must also be concerned about winning them in 20 years. We must care for the infrastructure of our scientific community now in order to insure its integrity in the future.

If there is concern for the general state of science and mathematics, why, you may ask, is the Department of Defense and the U.S. Navy in particular so interested in these problems? Is this not the business of the National Science Foundation? If support for science and mathematics falters, is it not the business of the National Science Foundation to correct the deficiencies?

Part of the responsibility does fall to the National Science Foundation. The reason is simple. The U.S. Navy is technologically intensive and technology is driven by scientific progress. The health of the scientific enterprise now and twenty years from now guarantees the health of our technological innovation ten and thirty years from now. In turn, this guarantees the health of our naval services for the remaining decades of the 20th century, and those early decades of the 21st century.

Let me make it clear. Investment by the U.S. Navy in the basic sciences not only makes good economic sense, it is an absolute necessity. The demographics are simple. The post World War II baby boom generation is now in its late 20s and 30s. They are, on the whole, past
the age for entering the military service. The Navy has a choice of a low technology, manpower intensive force or a high-technology, manpower efficient force. The demographics, the national policy on conscription and, in fact, common sense all lead us to the choice of a high-technology force. The alternative is in reality not an alternative. The U.S. Navy is committed to fulfilling its mission via an efficient force whose superiority is guaranteed by strong technological innovation. The Office of Naval Research is therefore unequivocally committed to the health of American science, including mathematics.

This linkage of American science to the Navy is neither accidental nor is it new. The first systematic federal support of basic scientific research was provided by the Office of Naval Research in 1946. The Office of Naval Research was founded by an act of Congress in 1946 as a successor to the very successful office of research and inventions formed during World War II.

From 1946 until the founding of the National Science Foundation in 1951, the Office of Naval Research was the only federal agency supporting basic research in science and mathematics. Within the mathematical sciences, the Office of Naval Research sponsored an extremely broad range of pure and applied mathematics. Early ONR programs included support for abstract algebra, topology, real and complex analysis, geometry, applied mathematics and statistics. The early establishment of the Princeton topology group can be traced to funding by the Office of Naval Research. Similarly, much of the early funding for the Courant Institute at New York University originated with the Office of Naval Research. As a matter of fact, the Office of Naval Research still provides substantial funding to the Courant Institute. In the field of mathematical statistics, the early work in statistical quality control was supported by the Office of Naval Research. The military requirements in logistics lead to sponsorship of work on mathematical optimization including development of the simplex algorithm. Such topics as game theory trace their origin to the Office of Naval Research. The early development of the fast Fourier transform in the 1960s, originate with ONR. More recently, such innovations as systolic computing architecture and robust statistical methods have their roots in research sponsored by the Office of Naval Research.

Stated simply, the Office of Naval Research has a long-standing tradition of funding basic research in support of science and mathematics. It is a tradition of which we in the Navy are justly proud. With the increasing importance of the National Science Foundation, however, the focus of ONR activity shifted somewhat. Around 1970, emphasis was placed by Congress and the executive branch on mission relevance for the Department of Defense Agencies. For the mathematical sciences, emphasis at ONR was placed on supporting basic research in applied mathematics, statistics, operations research, computer science and fluid mechanics. I am, however, personally committed to the long-term support of a broad range of basic research. I believe that a fundamental, long-term commitment to basic academic science is the appropriate policy for ONR. I will describe in a few minutes some of the policies I have put in place. Before I do that, however, I would like to describe ONR a bit more.

The Office of Naval Research serves several basic functions for the Navy. As Chief of Naval Research, I have responsibility for all basic research activities in the Navy. This includes responsibility for basic research in the naval systems commands such as the naval sea system command, the naval air system command and the naval electronic system command, for basic research in the naval research laboratory and, of course, for basic research in the extramural contract research program. Thus my office has responsibility for allocating monies to all basic research claimants within the Navy community. I should, perhaps also mention that I have collateral duty as the Chief of Naval Development. In this role, I have responsibility for allocating the so-called exploratory development or category 6.2 monies. Exploratory development involves that stage of applied research and early engineering development arising from concepts developed from the basic research program. Basic research together with exploratory development, forms the so-called Navy technology base and together account for some $900 million per year. By tradition, exploratory development is carried out largely within the Naval laboratory system whereas the majority of basic research is contracted to academic institutions. In addition to the scientific research function the Office of Naval Research is a focal point for all patent and copyright activity for the Navy. Now you may suppose that leading a command full of esoteric scientists is exasperating enough for a navy commander, but imagine throwing in an equal number of lawyers, particularly those with concomitant degrees in engineering or science!

The Contract Research Program is our primary point of contact with the academic community. The program is headed by Dr. Fred Saalfeld and is administratively divided into four directorates: the life sciences, the engineering sciences, the environmental sciences and most importantly, at least for our purposes here today, the mathematical and physical sciences. This latter directorate, headed by Dr. Ted Berlincourt, contains four divisions; physics, chemistry, electronics and, the mathematical sciences. The latter is headed by Dr. Edward Wegman. Also of interest to some in the audience may be the computer sciences division found in the engineering sciences directorate. This division is headed by Dr. Paul Schneck.

172
The total Contract Research Program involves some $218 million with approximately $14 million allocated to the mathematical sciences extramural program. Most of these monies are made available to academic researchers through the competition program. An unsolicited proposal originates with the proposed principal investigator and represents an initiative on the part of the proposer in defining an area of research. Unsolicited proposals are evaluated by the ONR, on the basis of scientific merit, technical feasibility, potential relevance to the navy and overall availability of funds. An unsolicited proposal may be sent to ONR at anytime throughout the year. The federal fiscal year begins on the 1st of October and funding obligations must be made by the scientific officers by about mid-June of the subsequent year.

In the unsolicited proposal competition, there are many others. Notable among these is the Selected Research Opportunities Program at ONR and the Defense University Research Instrumentation Program. The Selected Research Opportunities Program is a competitive program held on a biennial cycle beginning in odd fiscal years. In this program, the Office of Naval Research selects between four to six high priority naval research topics and invites proposals. The selected research opportunities program is intended to be interdisciplinary in nature and to stimulate interactions between academic scientists and researchers in the naval laboratory system. A successful selected research opportunities proposal is funded over a three year period at a level of from $200,000 to $500,000 per year. Thus the Selected Research Opportunities Program represents an opportunity for significant money to begin building an important research center. By its nature, it encourages the development of young investigators. Recent mathematically oriented Selected Research Opportunities Programs have included topics in non-Gaussian stochastic processes and mathematical inverse methods.

The Instrumentation Program is a response by the Department of Defense to the problem of obsolete research equipment in American universities. Some $30 million annually is being invested in reequipping the universities; $10 million each by the Army Research Office, the Air Force Office of Scientific Research and the Office of Naval Research. A joint announcement is made and proposals are received. The competition for FY 85 is already completed. The next competition will be held again in fiscal year 1986. Announcements for this cycle will appear in the late spring of 1985. Within the mathematical sciences division, the competition is held in much the same manner as the NSF, scientific computing and research equipment for the mathematical sciences program except that the average award size in the DOD program is somewhat larger.

One last Program I would like to single out to this audience is the Navy Summer Faculty Research Program. In this program, academics are invited to work in one of the naval laboratories for the summer. This exposure to naval problems often offers an extremely valuable boost to a naval scientist and by providing further access to the Office of Naval Research.

The programs I have just been describing are part of our normal research programs. Yet, as indicated by the recent national academy of sciences report, *Reviewing U.S. Mathematics*, the David Report, the situation in the mathematical sciences is not normal. I would like to spend a few minutes with you highlighting what I have done and will do as a response to the David Report. Indeed, I am pleased to say that ONR recognized many of the problems before they were codified by the David Report. Having anticipated what was announced on June 6th, we have already begun a revitalization program within ONR.

First and foremost, we must recognize that the scientific staff within ONR is a vital resource for making the case on behalf of the mathematical sciences. Half of the scientific officers within the mathematical sciences division have been there less than seven months. We have hired a vigorous, aggressive new management team for mathematics. We are, in fact, still recruiting to fill a position in probability theory. We believe that this new staff will continue to press the case for the mathematical sciences in ONR's internal competitive process long after the special considerations spawned by the David Report are history.

The David Report mentions four areas as particularly ripe for development: discrete mathematics, nonlinear mathematical methods, computational mathematics and probabilistic methods. I am pleased to say we have been working to establish or strengthen programs in all four areas. We have established a new core program in discrete mathematics in this fiscal year, 1985. I encourage any of you who are conducting research in this area to consider sending a proposal to Dr. Allen Schwenk of ONR's mathematics division. All aspects of discrete mathematics will be considered for funding. In addition, we are planning a special focus program in the area of discrete mathematics related to communication over networks to begin in fiscal year 1986. These areas would include random and topological graph theory, queueing theory on networks, theory for protocols and combinatorial design for coding.

In the area of nonlinear methods, ONR established a small core program in the autumn of 1983. It is planned to supplement this program with a special program on nonlinear dynamics again beginning in fiscal year 1986. This program will address all aspects of nonlinear dynamics, chaos, bifurcation and related topics. Again, I invite those of you working in these areas to consider.
sending ONR a proposal to Dr. Mike Schlesinger of ONR's physics division.

We have had a program in numerical analysis and computational methods for some years now. Indeed, ONR began a program in large scale scientific computing in 1982. We believe that this area has been a successful one and are planning to expand its scope with an additional program in computational mathematics scheduled to begin in fiscal year 1987. We have also presently scheduled a special research program in parallel algorithms to begin in fiscal year 1986. Dr. Richard Lau of the Mathematical Sciences Division is the scientific officer for all to these program areas.

Finally, in the arena of probability theory, we are currently recruiting a scientific officer. Our plan is to begin a new core program in probability theory in fiscal year 1986. This program will cover all aspects of probability theory including stochastic process theory. Again, I invite your participation. You may send proposals in this area directly to Dr. Edward Wegman who is present here today and who heads our Mathematical Sciences Division.

Finally, I want to mention our selected research opportunities program on topological and graph theoretic methods in chemistry. This is a new selected research opportunities topic for fiscal year 1985 and is a very exciting one for us. We had an extraordinarily strong response to the announcement of this program. I am pleased to report that for the first time in nearly two decades, ONR is again supporting research in algebraic topology which we think is something of a landmark.

I have mentioned a large number of new programs. I do not want to leave you with the impression that our response to the David Report is simply the creation of new programs. We are also planning to add resources to existing programs. Plans call for an additional $500,000 to $700,000 in fiscal year 1985 and an additional $1,000,000 in fiscal year 1986 to be added to our Contract Research Program in mathematics. If ONR's growth in FY 85 is as large as presently programmed by the Navy, significant research will be added in FY 87. These monies will enhance existing programs in analysis and mathematical statistics. In addition, we are adding substantial resources to our mathematics programs in our naval systems commands and at the naval research laboratory. We do this because the health of mathematics within the naval research establishment is directly related to the health of mathematics in academia.

The fate of young people in the mathematical sciences was a major theme of the David Report. Emphasis on attracting them and encouraging their research careers is well placed. In fiscal year 1985, the current fiscal year, ONR has established mathematics as one of the priority topics in the ONR graduate fellowship program. These fellowships are very desirable since the stipend begins at $13,000 for the first year, going to $15,000 in the third year. The fellowship covers full tuition and fees and provides an additional $2,000 annually to the fellow's department. Fellowships are awarded for three years with satisfactory progress.

Earlier, I mentioned the ONR summer faculty programs as a means for encouraging investigators to get involved with our naval laboratories. This program is particularly well suited to helping young investigators become established. I have established the mathematical sciences as a priority area for this program. I am especially enthusiastic about this since the naval laboratories tend to be weaker in mathematics than in most other discipline areas. This will not only create opportunities for young people, but hopefully give the labs a much needed infusion of technical skills in mathematics.

A final new program I want to mention is still on the drawing boards, but will be in place soon. That is our Naval Young Investigators Program. The operational details have not yet been completed, but the program will be aimed at identifying outstanding young investigators early in their careers and giving them a boost. Again, this will be a program that has the mathematical sciences as a priority area.

I will conclude my remarks on ONR's response to the David Report by mentioning two administrative actions I have taken. Within the Navy, our accounting categories (really disciplines), called subelements, have over the years aggregated mathematics and computer science. This was reasonable when computer science was a fledging discipline. However, while the composite growth within the mathematics and computer science subelement has been healthy, the aggregation of these two disciplines has obscured the fact that growth in computer science has been accompanied by stagnation in mathematics. Thus, I have taken steps to disaggregate these funding categories so that we may track progress and growth in mathematics more clearly.

Finally, I recognize that ONR alone will not solve the problems within the mathematics sciences, nor will we do it this year. Recognizing that we are committed to an on-going process, I have established a special advisory panel on mathematics which will report to Dr. Marvin Moss, ONR's technical director, and to me. This distinguished panel of mathematicians will give expert advice at the policy level.

The actions I have just outlined represent a turning point, a new beginning. I am hopeful. I am looking forward to better things in our immediate future, not only for the mathematical sciences but for all of the scientific activities within the Office of Naval Research. We recognize the difficulties the mathematics community faces and the serious implications for national security.
that these difficulties imply. ONR is determined
to do its part in correcting these problems and
personally, I pledge to work hard and long for this
revitalization.

In return I ask for your assistance, for you as
citizen-scholars play a vital role.

First, the mathematics and university com-
munities can play a vital role in increasing con-
gressional understanding of the ONR role. ONR
funds basic academic research. This fact is not
always understood in the halls of Congress. The
simple fact is that budget cuts for ONR hurt
academic research.

Second, the mathematics community must play
a key role in describing the significance of results
and trends in mathematics. Without public
awareness of and enthusiasm for the vital role of
mathematics in modern technology, it is difficult
to muster financial support for the discipline.

Third, the mathematics community can help in
packaging initiatives responsive to general naval
interest. I have said that ONR supports basic
research, but it should never be forgotten that
ONR’s client is the navy.

And finally, the mathematics community can
offer advice. ONR prides itself on listening. We
want your input for it is ultimately the vitality of
the American scientific research community which
must create and strengthen itself.

In one of my frequent discussions with my
technical director, Dr. Marvin Moss, he expressed
his concern over budget cuts in basic research
and stated that the surest way for this country
to mortgage its future is to not adequately fund
academic research today. Realizing that I was to
be here with you today, he also seriously added
that the surest way for us to mortgage innovative
technological programs in the future was for us
to fail to adequately fund mathematics now. He
really meant that. And I’m also convinced that
he is right.

---

**Astérisque**

**Société Mathématique de France**

The journal “ASTERISQUE” of the Société Mathématique
de France publishes twelve issues a year, one of which
contains the notes of the Bourbaki Seminar. Apart from
this one, each issue of ASTERISQUE is devoted to one
theme and these cover in principle the entire spectrum of
mathematics, including occasionally subjects of less im-
mediate use for the mathematician such as the history of
mathematics. The vocation of ASTERISQUE is to publish
fairly long texts (100 to 500 pages) of high quality. Most
issues consist of monographs, proceedings or seminar notes. In all cases, the text must be original
in content although the editorial committee is also happy to accept expository texts of excep-
tional interest. Each article of each issue is refereed.

The AMS is the exclusive distributor of Astérisque in the U.S., Canada, and Mexico. It is sold
in the current year either as separate issues or as a journal subscription. Prompt delivery in
North America is assured because the AMS maintains an inventory of Astérisque (except for a
small number which are out-of-print). A complete list of titles can be found in the February 1984
issue of the Notices (pages 209–210), or in the AMS September 1984 catalogue (pages 26–28),
or may be requested by calling (800) 556-7774.
New Directions in Two-Year College Mathematics

The Curriculum and the New Technologies

Mathematics courses in two-year colleges should be of immediate use to students and not be seen merely as preparation for distant goals. The material should be connected to real life. Those parts of the subject of broadest usefulness in problem solving should be emphasized.

Computers and other elements of information technology are changing in fundamental ways both the mathematics that it is important to learn (such as discrete mathematics, statistics, and technical mathematics) and the ways that mathematics, traditional and otherwise, can be learned. This will have profound and continuing implications for students, faculty, and the curriculum.

Successful integration of information technology into the curriculum requires immediate access to computers; thus all mathematics faculty members must be provided by their institutions with appropriate computer equipment and support and with training opportunities in information technology and related mathematical subjects.

- Statistical literacy should be a fundamental goal of schooling. Basic mathematics courses should contain elementary statistical ideas and must prepare students for statistics as well as for calculus. Mathematics faculty members should be trained in statistics.
- Geometric concepts, including the use of computer graphics, should be integrated into entry-level courses wherever appropriate.

EDITOR'S NOTE: With financial support from the Alfred P. Sloan Foundation, the first national conference on the state of mathematics in two-year colleges was held at Menlo College in Atherton, California, in July 1984. At the conference twenty-two papers were presented and discussed. The main topics addressed by participants included the following: A case for curriculum change, technical mathematics, the influence of new technologies on the learning of mathematics, faculty renewal, and collaboration with secondary schools, colleges, and universities.

It is worth noting that fifty percent of all college freshmen in the United States are enrolled in two-year colleges, and that more than one-third of all undergraduate enrollments are in such institutions.

This report presents the recommendations from the conference; the proceedings of the meeting, New directions in two-year college mathematics, will be published by Springer-Verlag. LKD

- Entry-level courses for students who lack arithmetic skills should be organized around mathematical content new to these students (for example, vocational mathematics) and should utilize approaches different from what they may have experienced in school mathematics (for example, an approach emphasizing problem solving with calculators).
- Liberal arts mathematics (mathematics appreciation) is an important course and should integrate basic mathematical competencies including new technologies. These courses should be organized around the great ideas of mathematics and should offer a variety of topics for choice by instructors. Included in this choice should be topics from statistics, computing, and discrete mathematics.
- New mathematics curricula and approaches based on information technology (for example, spreadsheets, databases, and computer graphics) should be developed to serve the special vocational/technical and functional needs of the diverse two-year college student population.
- Planning should begin immediately to deal with the impact of symbolic manipulation software, graphics-based software, and the algorithmic point of view on the content of all mathematics courses.
- Two-year colleges must be prepared to meet the needs of entering students having a wide range of prior experience with computers.

Two-year colleges enroll nearly one-half of all college freshmen and share common concerns about mathematics students with secondary schools, colleges, and universities. The success of our students will be enhanced by collaboration including the following general activities: development of policies and methods for cooperation by the principal mathematics organizations concerned with teaching at these levels (American Mathematical Association of Two-Year Colleges, Mathematical Association of America, National Council of Teachers of Mathematics); joint efforts by state and local mathematics organizations and institutions; personal initiatives on a professional and social basis by individual faculty at all levels to promote a coherent and appropriate mathematics curriculum.

- It is imperative to reduce the need for remediation in the colleges. Two-year colleges along with other post-secondary institutions must work together with high schools to this end.
Two-year college faculty members in mathematics and in vocational/technical areas should meet within their own institutions and at regional levels to form better working relationships and to improve the quality of mathematics courses for vocational/technical students.

Training programs should be instituted for mathematics faculty members in order to increase skills in teaching technical mathematics. These programs will require collaboration and support by the private sector, two-year colleges, foundations, and professional organizations.

High schools, four-year colleges and universities, and two-year colleges should establish faculty exchange programs for mutual benefit.

Faculty Development and Renewal

Faculty development and renewal are essential in maintaining the vigor of instruction and the quality of the curriculum. Faculty members must commit themselves to continued and on-going professional growth and development. Thus, the educational community, industry, government, and foundations should provide adequate funding to ensure continued and frequent opportunities for faculty development. Professional organizations should provide a variety of activities and assistance for faculty growth. College administrators should encourage, support, acknowledge, and reward renewal efforts by faculty members.

Faculty members must foster their own continued growth. Two-year colleges should view these efforts of faculty members as essential and support them financially. Such growth activities include regularly teaching a variety of courses, reading, writing papers, participating in seminars and in professional organizations, and learning new material through workshops and courses.

Two-year colleges and their supporting bodies should view employment compensation and status more flexibly in order to encourage and reward professional excellence.

The private sector and two-year colleges should facilitate faculty participation in industry, including short-term work experiences, as a valuable form of development.

Universities should provide graduate programs appropriate for two-year college mathematics faculty members.

Conference Participants

DONALD J. ALBERS (CHAIRMAN OF THE CONFERENCE)
Menlo College, Atherton, California

BETTYE ANNE CASE
Tallahassee Community College
and Florida State University, Florida

ARTHUR M. COHEN
ERIC Clearinghouse for
Junior Colleges, UCLA

LARRY A. CURNUTT
Bellevue Community College, Washington

RONALD M. DAVIS
Northern Virginia Community College, Alexandria

WADE ELLIS
West Valley College, Saratoga, California

BEN FUSARO
Salisbury State College, Maryland

SHELDON GORDON
Suffolk County Community College, New York

JAMES KAPUT
Southeastern Massachusetts University, North Dartmouth

JOAN R. LEITZEL
The Ohio State University, Columbus

CALVIN T. LONG
Washington State University

STEPHEN B. MAURER
Alfred P. Sloan Foundation, New York and
Swarthmore College, Pennsylvania

WARREN PAGE
New York City Technical College, Brooklyn

PETER RENZ
W. H. Freeman and Company, New York and
Bard College, New York

STEPHEN RODI
Austin Community College, Texas

KAREN TOBEY SHARP
Charles Stewart Mott Community College
Flint, Michigan

KEITH SHUERT
Oakland Community College
Auburn Heights, Michigan

KARL SMITH
Santa Rosa Junior College, California

AMBER STEINMETZ
Santa Rosa Junior College, California

ROSS TAYLOR
Minneapolis Public Schools

ALAN TUCKER
State University of New York, Stony Brook

WILLIAM WARREN
Southern Maine Vocational Technical Institute, South Portland and
Council for Occupational Education
Annandale, Virginia

ALLYN WASHINGTON
Dutchess Community College
Poughkeepsie, New York

ANN ATKINS
Los Angeles Pierce College, Woodland Hills

JEROME A. GOLDBEIN
Tulane University, co-authored one of the conference papers.

The 28th Annual AMS Survey was made under the direction of the Society’s Committee on Employment and Educational Policy (CEEP), whose members in 1984 were Lida K. Barrett, Stefan A. Burr, Lisl Novak Gaal, Gerald J. Janusz, Irwin Kra and Donald C. Rung (chairman). A Data Subcommittee of CEEP, consisting of Lida K. Barrett, Susan J. Devlin, Lincoln K. Durst, Wendell H. Fleming, Arthur P. Mattuck and Donald C. Rung (chairman), designed the questionnaires with which the data were collected. The committee is grateful to members of the AMS staff, especially Marcia C. Almeida, for the diligence and efficiency with which the data were collected and compiled. Comments or suggestions regarding this program may be directed to the subcommittee.

Employment of Mathematical Sciences Doctorates, Faculty Mobility, Nonacademic Employment and Enrollments, Fall 1984

by Donald C. Rung

This report is one in a series of annual reports on employment patterns, enrollment and class size in the mathematical sciences. It begins with an update of the fall 1984 employment status of new 1983-1984 doctorates, followed by an analysis of trends in the academic job market based upon the 1984 AMS Survey of Faculty Mobility. It also contains estimates on the total enrollment in courses for fall 1983 and fall 1984 as well as average class size for both fall 1983 and fall 1984. Also included are estimates for the number of majors at the junior and senior level and graduate student enrollment.

Estimates based on AMS Survey data suggest that 910 full-time positions in U.S. colleges and universities were filled by nondoctorates last fall and for 522 of these positions, the department would have preferred someone with a doctorate. Of these positions, 471 were in Groups M and B departments. (See the box for descriptions of the groups.) The estimated total increase for this year in the size of the full-time faculty (682) is the largest in recent years, as is the 134 increase in doctorate faculty for Groups I, II and III (Table 3). This is the largest increase in over eight years. The net increase in the nondoctorate faculty (259) is positive for the fifth consecutive year, after nine consecutive years of decline.

The enrollment data (Table 6) yields several interesting comparisons. Total enrollment showed no increase for the first time in memory, certainly for the first time in these surveys. Given the downturn in total collegiate enrollment caused by demographics, it seems likely that mathematics enrollment will show modest declines over the next decade. Not surprisingly, average class size (Table 7) also declined in most categories. However, the quality of their graduate faculty. 1

Groups I and II include the leading departments of mathematics in the U.S. according to the 1982 assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils in which departments were rated according to the quality of their graduate faculty. 1

Group I is composed of 39 departments with scores in the 3.0–5.0 range.

Group II is composed of 43 departments with scores in the 2.0–2.9 range.

Group III contains the remaining U.S. departments reporting a doctoral program.

Group IV contains U.S. departments (or programs) of statistics, biostatistics and biometrics reporting a doctoral program.

Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research and management science which report a doctoral program.

Group VI contains doctorate-granting departments (or programs) in the mathematical sciences in Canadian universities.

Group M contains U.S. departments granting a master’s degree as the highest graduate degree.

Group B contains U.S. departments granting a baccalaureate degree only.

Response rates varied from one group to another, with the largest response rate from Groups I, II, and III. Of an estimated total in 1983 of 18,527 full-time U.S. mathematical sciences faculty members, 9,425 are members of departments which responded to the survey.

1 These findings were published in An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences, edited by Lyle V. Jones, Gardner Lindsey and Porter E. Coggeshall, National Academy Press, Washington, D.C. 1982. The information on mathematics, statistics and computer science was presented in digest form in the April 1983 issue of the Notices, pages 257–267, and an analysis of the above classifications was given in the June 1983 Notices, pages 392–393.
junior-senior mathematics majors and graduate students continued to show impressive increases (Table 8).

Special note should be taken of the decline in computer science enrollments in Groups M and B. This decline is also reflected in a joint study of the Cooperative Institutional Research Program at UCLA and the American Council on Education, reported in the Chronicle of Higher Education, January 16, 1985, which showed a two-year decline in freshmen interested in careers as computer programmers or analysts. A small fraction of the decline is a result of a reporting change: recently some colleges and universities have established separate departments of computer science. Some of these new computer science departments are not included in this year's survey report. However, an analysis shows that this fact did not account for very much of the reported decline.

Part-time members of the faculty continue to play a significant role in undergraduate instruction in departments in Groups M and B where there are an estimated 5,497 part-time faculty members as compared with 12,700 full-time faculty members. In contrast there are 904 part-time faculty members in Groups I, II, III where there are 5,757 full-time faculty members.

The number of graduate students increased by 9% in Groups I, II and III, as compared to last year's increase of 8% (Table 8). The percentage of new doctorates taking nonacademic employment continued at the same 22% figure as in 1983 (Table 4). There was a large increase in the net outflow of doctorate-holding faculty members (125) to nonacademic employment (Table 5).

**Fall 1984 Employment Status of 1983-1984 New Doctorates**

Table 1 contains the fall 1984 employment status by type of employer and field of degree for 789 new mathematical sciences doctorates who received the degree between July 1, 1983, and June 30, 1984. The names of these 789 people and the titles of their doctoral theses were published in the November 1984 Notices, pages 757–770. Table 1 updates the corresponding table on page 755 of the November 1984 Notices, using more recent information provided by departments and the recipients of the degrees. The total does not include a few more recipients of doctorates who were reported too late to gather employment information for these reports. (A supplementary list of recipients appears in this issue of the Notices.)

**TABLE 1: 1984–1985 Employment Status of New Doctorates in the Mathematical Sciences**

<table>
<thead>
<tr>
<th>Type of Employer</th>
<th>Algebra and Number Theory</th>
<th>Analytical and Stochastic</th>
<th>Geometry and Topology</th>
<th>Logic</th>
<th>Probability</th>
<th>Statistics</th>
<th>Computer Science</th>
<th>Operations Research</th>
<th>Applied Mathematics</th>
<th>Mathematics Education</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>22</td>
<td>23</td>
<td>15</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>9</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Group II</td>
<td>7</td>
<td>10</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>1</td>
<td>16</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Group III</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td></td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>14</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td>Group IV</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>19</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>21</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Group V</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>6</td>
<td>7</td>
<td></td>
<td>17</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Masters</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>3</td>
<td>3</td>
<td>19</td>
<td>4</td>
<td>6</td>
<td>14</td>
<td>9</td>
<td>1</td>
<td>101</td>
</tr>
<tr>
<td>Bachelors</td>
<td>21</td>
<td>11</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
<td>74</td>
</tr>
<tr>
<td>Two-year College</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>7</td>
<td></td>
<td>7</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Other Academic Departments</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>19</td>
<td>2</td>
<td>23</td>
<td>5</td>
<td>16</td>
<td></td>
<td>74</td>
</tr>
<tr>
<td>Research Institutes</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Government</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>12</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>Business and Industry</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>35</td>
<td>8</td>
<td>11</td>
<td>14</td>
<td>19</td>
<td></td>
<td>111</td>
</tr>
<tr>
<td>Canada, Academic</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td></td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>26</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Canada, Nonacademic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Foreign, Academic</td>
<td>14</td>
<td>16</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>20</td>
<td>5</td>
<td>13</td>
<td>10</td>
<td>88</td>
<td></td>
<td>88</td>
</tr>
<tr>
<td>Foreign, Nonacademic</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Not seeking employ.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Not yet employed</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>16</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>11</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>102</td>
<td>80</td>
<td>21</td>
<td>19</td>
<td>173</td>
<td>20</td>
<td>66</td>
<td>110</td>
<td>3</td>
<td>84</td>
<td>789</td>
</tr>
</tbody>
</table>
The first five rows in Table 1 refer to those 1983-1984 new doctorates employed by doctorate-granting departments in the U.S. The next two rows refer to those employed by U.S. mathematical sciences departments which grant masters and bachelors degrees only. Again there seem to be good job prospects for new doctorates in departments in Groups M and B. It should be noted that the survey of enrollments shows that in Groups M and B computer science and statistics enrollments are plentiful. Mathematicians prepared to teach these courses will find no lack of opportunity to do so at those schools.

The numbers in Tables 2, 3, 5, 6 and 8 were obtained by extrapolation from the AMS Survey and are not actual counts. The various totals from each Group were multiplied by the ratio of the size of the faculty in various groups (obtained by adjusting the figures in the 1980 CBMS report or using actual counts in Group VI) to the number of faculty members represented in the responding departments.

Continuing the policy enunciated in the first report of the 1983 Survey, the survey no longer contains data from departments of computer science. The limited response from these departments made reliable estimates difficult. For the second year, returns from Group V departments were too small to be included. This survey, then, is an analysis of what might be called the traditional mathematics and statistics community. Because the response rate in the remaining groups continues at a high level, this year’s survey gives a fairly accurate picture of faculty mobility, enrollments etc. within this community. It should be noted that while departments of computer science are not included in the survey many departments of mathematics in Groups M and B teach the computer science courses whose enrollment (281,000) is at least 60% of all computer science enrollments in the U.S.

**Faculty Mobility**

This part of the Annual AMS Survey is concerned with the number of faculty members newly hired from various sources, as well as with the number of those individuals leaving faculty positions and with information on their subsequent employment status. The Survey also monitors trends in the percentage of faculty members with tenure, and the percentage of faculty members with doctoral degrees. The number of departments in each of Groups I, II, III, IV, M and B responding to the 1984 Survey of Faculty Mobility is similar to that of previous years. The responding departments represent about half (51%) of all mathematical sciences faculty members. About 70% of the faculty members in doctorate-granting mathematics departments (Groups I-III) are included among responding departments.

**TABLE 2: Faculty Flow 1983-1984 To 1984-1985**

<table>
<thead>
<tr>
<th>Full-Time Mathematical Sciences Faculty in Four-Year Colleges and Universities in the U.S.</th>
<th>Sources of New Faculty</th>
<th>Fall 1984 Employment Status, Faculty Leaving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Doctorate-Holding</td>
<td>Nondoctorate</td>
</tr>
<tr>
<td>Graduate School</td>
<td>452</td>
<td>347</td>
</tr>
<tr>
<td>Another college or university position</td>
<td>637</td>
<td>208</td>
</tr>
<tr>
<td>Nonacademic employment</td>
<td>66</td>
<td>83</td>
</tr>
<tr>
<td>Outside U.S.</td>
<td>115</td>
<td>23</td>
</tr>
<tr>
<td>Position outside U.S.</td>
<td>7</td>
<td>48</td>
</tr>
<tr>
<td>Graduate or professional school</td>
<td>27</td>
<td>93</td>
</tr>
<tr>
<td>Seeking employment</td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td>Other sources</td>
<td>66</td>
<td>249</td>
</tr>
<tr>
<td>Total</td>
<td>1336</td>
<td>910</td>
</tr>
<tr>
<td>and not moving</td>
<td>(+39)</td>
<td>(+39)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Mostly in Group M and B departments.
(2) Part-time to full-time in same department, from postdoctoral or two-year college position, etc.
(3) No longer full-time in department, unknown employment status, etc.
Table 2 shows estimated faculty flow between 1983-1984 and 1984-1985 for U.S. departments. Further analyses for Groups I-III are given in Table 3. The left side of Table 2 shows the estimated numbers of new full-time faculty members hired from various sources between fall 1983 and fall 1984. The right side of Table 2 shows the fall 1984 employment status of those full-time faculty members (as of fall 1983) who permanently left their departments by fall 1984. The row “graduate school” on the left side includes new faculty members coming from departments outside the mathematical sciences, or from mathematics education. Similarly, the second row in Table 2 includes some moving to or from departments in other fields or other positions in academia (e.g., in a university computer or statistical laboratory). The number (+39) in parentheses represents a change from nondoctorate to doctorate status of individuals who remained as full-time faculty members in the same department.

Table 2 shows an estimated increase, between fall 1983 and fall 1984, of 422 in the size of the doctorate-holding faculty and an increase of 259 in the nondoctorate faculty, for an overall increase of 681, as compared to last year’s increase of 672.

The pattern of faculty mobility obtained by comparing the two sides of Table 2 continues somewhat the trend of last year. Many full-time nondoctorate faculty members are being hired. The figure of 910 shown in Table 2 corresponds to the estimate of 435 seven years ago (February 1978 Notices, page 101). Most (92%) of the new nondoctorate faculty members were hired by departments in Groups M and B.

Attrition due to deaths and retirements is about (1.2%) of the total faculty. This figure seems to hover about the 1% level. The number of faculty members who received tenure in their institutions is 453, up from last year’s total of 418.

Doctorate-granting Departments of Mathematics (Groups I, II, III). Table 3 gives a somewhat different perspective of faculty mobility in and out of the 155 U.S. departments with doctoral programs. In Table 3 the sources of new tenured and nontenured doctorate-holding faculty members are shown, as well as the employment status of those leaving between academic years 1983-1984 and 1984-1985. The increase of 134 doctorate faculty is one of the largest in recent years.

Group VI. The number of faculty in Canadian doctorate-granting universities (Group VI) increased from 896 in fall 1983 to 953 in fall 1984; with ten receiving tenure.

Groups M and B. The number of nondoctorate faculty members hired by Groups M and B departments had been steadily increasing, from about 350 newly hired for fall 1977 to 734 for fall 1982; there was a slight decrease to 674 for fall 1983, and a large increase to 834 for fall 1984.

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-Time Doctorate-Holding Faculty in 155 Doctorate-Granting Mathematics Departments in the U.S. (Groups I, II, III)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Graduate School</td>
</tr>
<tr>
<td>Another college or university position</td>
</tr>
<tr>
<td>Nonacademic employment</td>
</tr>
<tr>
<td>Outside U.S.</td>
</tr>
<tr>
<td>Other sources</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Received doctorate and not moving</td>
</tr>
<tr>
<td>Received tenure and not moving</td>
</tr>
</tbody>
</table>

Estimated size of full-time faculty, Fall 1984 Groups I–III
- Doctorate, Nonresident: 1,378 (+80 from Fall 1983)
- Doctorate, Rented: 3,996 (+54 from Fall 1983)
- Nondoctorate faculty: 393 (+3 from Fall 1983)

Total full-time faculty: 5,757 (+137 from Fall 1983)
The M and B departments are very diverse, ranging from medium-to-large departments in public institutions to quite small departments in private colleges of varying degrees of selectivity. Besides mathematics instruction, mathematics departments in Groups M and B often have responsibilities in applied areas which in larger universities are taken by separate departments of statistics, operations research or computer science. As mentioned earlier, there are opportunities for young mathematicians with a strong commitment to teaching who fit the needs of Groups M or B departments.

**Nonacademic Employment of Doctorates in the Mathematical Sciences**

Table 4 is a summary of AMS Survey data on the employment of new doctorates during the last six years 1978-1979 to 1983-1984.

<table>
<thead>
<tr>
<th>TABLE 4: New Mathematical Sciences Doctorates Taking Nonacademic Positions in U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In government</td>
</tr>
<tr>
<td>In business/industry</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total new doctorates employed in U.S.</td>
</tr>
<tr>
<td>% in govt./bus./ind.</td>
</tr>
</tbody>
</table>

Table 4 shows a levelling in the hiring of new doctorates by business and industry. Many of these jobs are in companies in high technology, computer-information processing, or communications areas. A significant number are with organizations which do consulting work in operations research, statistics or applied physics, or which provide computer software or data management services. The November 1980 issue of Employment Information in the Mathematical Sciences contains lists of the names and addresses of nonacademic employers of the individuals included in Table 1 on page 608 of the November 1980 Notices, with an indication of the thesis field of the employee. Also see a related article by David H. Bailey in the November 1983 Notices, pages 756-758. (Errata—In the Bailey article, there are two errors. An employer’s name is misspelled. The last entry under Massachusetts should be: Verbex (5) 2 Oak Park, Bedford, MA 01730. Also, there is an incorrect address. The second entry under Virginia should be: Center for Naval Analyses (35) 2000 North Beauregard, Alexandria, VA 22311.)

**TABLE 5: Estimated Net Outflow of Doctorate-Holding Faculty Members To Nonacademic Employment**

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Net outflow</td>
</tr>
</tbody>
</table>

Table 5 shows the estimated annual net outflow of doctorate-holding faculty members to nonacademic positions since 1979. The number 125 for 1984 is the difference between 170 doctorates shown in Table 2 leaving academia and 66 hired in academia from nonacademic positions: the 1984 number is again comparable to earlier figures after a low last year of 46.

In summary, the 1984 AMS Survey showed an increase of 423 in the number of doctorate-holding faculty members in U.S. colleges and universities and a corresponding increase of 259 in nondoctorate faculty members. Most new doctorates (70%) found employment in academic positions, while 22% took positions in government or industry in the U.S. These are the identical figures as given in last year’s survey. There are very few unemployed Ph.D.’s in mathematics at

**TABLE 6: Total Course Enrollments (in Thousands)**

(Percent increase from fall 1983 in parentheses)

<table>
<thead>
<tr>
<th>By Type of Course, Fall 1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Course</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Below calculus</td>
</tr>
<tr>
<td>First year calculus</td>
</tr>
<tr>
<td>Statistics</td>
</tr>
<tr>
<td>Computer Science</td>
</tr>
<tr>
<td>Other undergraduate mathematics courses</td>
</tr>
<tr>
<td>Graduate courses</td>
</tr>
<tr>
<td>All courses</td>
</tr>
</tbody>
</table>

*Enrollments in this type of course amount to less than 5% of total undergraduate enrollments for this group of departments.*

182
TABLE 7: Average Class Size in Fall 1984
(Average class size as reported in Fall 1983 survey in parentheses)

<table>
<thead>
<tr>
<th>Type of Course</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Below calculus</td>
<td>34(38)</td>
</tr>
<tr>
<td>First year calculus</td>
<td>38(35)</td>
</tr>
<tr>
<td>Statistics</td>
<td>--(--)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>--(--)</td>
</tr>
<tr>
<td>Other undergraduate mathematics courses</td>
<td>31(33)</td>
</tr>
<tr>
<td>Graduate courses</td>
<td>11(11)</td>
</tr>
<tr>
<td>All courses</td>
<td>32(34)</td>
</tr>
</tbody>
</table>

A dash indicates that these courses represent less than 5% of total undergraduate enrollment for departments in this category.

TABLE 8: Junior-Senior Majors and Graduate Enrollment
(Percent increase over fall 1983 enrollment in parentheses)

<table>
<thead>
<tr>
<th>Fall 1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I, II, III</th>
<th>IV</th>
<th>VI</th>
<th>M, B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total junior-senior majors in department</td>
<td>18,600 (6%)</td>
<td>712 (23%)</td>
<td>4245 (11%)</td>
<td>68,430 (10%)</td>
</tr>
<tr>
<td>Total full-time graduate students (including teaching assistants)</td>
<td>7,797 (9%)</td>
<td>1,935 (-5%)</td>
<td>804 (6%)</td>
<td>4,693 (10%)</td>
</tr>
<tr>
<td>Total full-time first year graduate students (including teaching assistants)</td>
<td>2,595 (10%)</td>
<td>553 (-11%)</td>
<td>277 (-14%)</td>
<td>2,218 (10%)</td>
</tr>
</tbody>
</table>

Changes in Enrollments and Class Size

For the second year total enrollments have been estimated. Table 6 gives these figures.

Table 7 gives class sizes for mathematical sciences departments for Fall 1983 and Fall 1984.

Junior-Senior Major and Graduate Student Enrollments. Another set of data is given in Table 8, where total enrollment of junior-senior majors and graduate students is presented. Doctorate-granting mathematics departments in the U.S. (Groups I, II, III) reported a 9% increase in the number of full-time graduate students from fall 1983 to fall 1984. Further, the number of entering full-time first-year graduate students in Groups I, II, III increased by 10%.

This was the fourth year of such increases. Junior-senior majors also showed a good increase in all categories.

By way of a postscript the author welcomes any comments or suggestions on the format, data presented, etc. of these annual reports, as well as the various ad hoc reports of CEEP. Please send your remarks to Donald Rung, Department of Mathematics, 203 McAllister Building, Pennsylvania State University, University Park, Pennsylvania 16802.
Doctorates Conferred in 1983–1984 (Supplementary List)

The following list supplements the list of thesis titles published in the November 1984 issue of the Notices (see page 757 for an explanation of the numbers in parentheses).

**CALIFORNIA**

University of California, Berkeley

(1;1,0,0,0,0,0,0)

MATHEMATICS

Aitchison, Iain Roderick, Isotorsing and twisting knots and ribbons.

**MARYLAND**

Johns Hopkins University

(8;2,6,0,0,0,0,0)

BIOSTATISTICS

Burt, Vicki Lynn, Variance estimation for a stratified multistage sample in the analysis of the health care experiences of primary individuals.

Diener, Marie Diane, Reaction time models—a mixed model and Bayesian approach.

Dorfman, Alan Harvey, T-robust variance estimation in least squares linear regression.

Friedman, Lisa Aronson, Alcohol consumption and CHD mortality in the Framingham study.

Ross, Eric Andrew, Changes in obstetrical practices and infant mortality. New York State.

Salvo, Edward Lawrence, A statistical description of nutrient flux rates of the Patuxent River of Maryland.

Yates, Katherine Parker, The design of occupational studies to assess the effects of low level exposure to ionizing radiation.

**MASSACHUSETTS**

Harvard University

(4;0,4,0,0,0,0,0)

STATISTICS

Donoho, David L., A tool for research in data analysis.

Goodall, Colin R., The statistical analysis of growth in two dimensions.

Jonas, Andrew B., Persistent memory random processes.

Singer, Judith Donna, An intraclass model for the effects of group composition on individual outcomes.

**OHIO**

Case Western Reserve University

(2;0,1,0,0,1,0,0)

MATHEMATICS AND STATISTICS

Akhbarzadeh-Yazdi, Abolfazl, Optimal attribute life testing.

Ambar, Gregory Steven, Riccati equations and the numerical matrix eigenvalue methods.

**TENNESSEE**

Memphis State University

(4;1,3,0,0,0,0,0)

MATHEMATICAL SCIENCES

Gastardo, Maria T., A stochastic model for carcinogenesis with special applications to the initiation and promotion phenomena.

Gubbi, Ananda V., A class of projective topological spaces.

Tabatabai, Mohammad A., Robust procedures for comparing several means and testing for parallelism of several straight lines under heteroscedasticity and non-normality.

Tou, Kung-Pau, Statistical analysis of some mutation models useful in testing carcinogenesis and mutagenesis.

**TEXAS**

Texas Tech University

(2;0,1,0,0,1,0,0)

MATHEMATICS

Ford, Ceicle Henry, Numerical and symbolic methods for transforming control systems to canonical form.

Sciarano, Stephen, Regression analysis with correlated observations.

**WISCONSIN**

University of Wisconsin, Madison

(11,0,11,0,0,0,0,0)

STATISTICS

Atigian, Taskin, Parameter parsimony, model selection, and smooth density estimation.
The 1984 AMS Nonacademic Salary Survey

by Arthur Mattuck

The AMS conducted salary surveys in 1977 and 1980 of mathematicians with full-time nonacademic employment. The survey, somewhat modified, was repeated last year, with the data taken as of June 1, 1984. The results are summarized in the tables following.

How the survey was conducted. The questionnaire shown was sent to 2,000 persons randomly selected from the geographic listings at the end of the Combined Membership List, after those affiliated with academic institutions were eliminated. Thus it represents members of the AMS, MAA and SIAM; it does not really sample statisticians or computer scientists, who tend to belong to other professional organizations.

People were asked to respond only if they had full-time nonacademic professional employment in the United States. We hope they interpreted professional as meaning mathematics-related in some way, perhaps entirely in a supervisory role. About one-third—682 in all—responded.

In most surveys this would not be considered a high enough response rate to avoid bias. Here however it is hard to say, since the non-responders could be in large part retired and part-time mathematicians, academics who prefer to use their home address in the Combined Membership List, or MAA members who retain an avocational interest in mathematics even though they are now doing other things professionally.

People were asked to indicate their employer, and this has been suggested as a possible source of bias. At an agency or company employing very few female mathematicians, for example, these might be identifiable by their questionnaire responses. This possible loss of confidentiality may have produced a lower response rate, even though assurances were offered in the questionnaire. In the future, the employer's name will not be asked.

Profile of the respondents. The two earlier surveys concentrated on Ph.D. mathematicians. The present one includes a sampling of those whose highest degree is a master's or bachelor's degree. Since they belong to one of the three societies, they are not entirely typical of the general lower-degree-holding population; as a group we think they are likely to have higher salaries.

The following charts and tables give some picture of the respondents.

Type of Employer
- Industry 66%
- Government 19%
- Federal Contract Research Center 13%

Highest Degree
- Bachelors 11%
- Masters 29%
- Ph.D. 59%

Comments about the tables. The vertical bars in each table run between the first and third quartiles. The median salary is marked.

Below each table is noted the number of respondents in each category, to give some feel for the validity of the data.

In Table 1, “Federal Contract Research Center” refers to places like Los Alamos that receive essentially all of their funding from the federal government but are not run directly by the government. Thus their employees are not under the Civil Service salary schedules.

In Table 3, “manager” refers to those who answered “yes” to question 3: “do you have managerial responsibilities …?”

Tables similar to the three shown, but based upon actual years of experience since the highest degree, turn out to be not significantly different from the ones given.

American Mathematical Society, P.O. Box 6248, Providence, RI 02940

NONACADEMIC SALARY QUESTIONNAIRE

This questionnaire is addressed to individuals who have a degree in the mathematical sciences, who have full-time nonacademic professional employment in the U.S. If you are not in this category, please do not return this questionnaire.

Answers to the questions will be kept confidential. Published summaries will not permit identification of individuals or employers. The information furnished should be as of June 1, 1984.

1. Employer __________________ City __________________ State __________ Zip __________
2. Type of employer:
   □ Business or industry □ Government □ Federal contract research centers □ Other (Describe): _______
3. Do you have management responsibilities — that is, are you a supervisor, group leader, section head, etc.? □ Yes □ No
4. □ Female □ Male 5. Annual professional income: $ __________
6. Highest degree: □ Bachelor's □ Master's □ Doctorate 7. Number of years since receipt of highest degree __________
8. Number of years of full-time-equivalent professional experience since receipt of highest degree __________
9. Primary field of graduate study (if applicable): □ Pure mathematics □ Probability and statistics □ Operations research
   □ Computer Science □ Other applied mathematics □ Other (Describe): _______
10. How do you spend your time at work? (Total should equal 100%)
    ___% Supervising others or administration ___% Applied research ___% Computer programming
    ___% Consulting or problem solving ___% Basic research ___% Other (Describe): _______
FIGURE 1—BY PLACE OF WORK

- ALL
- BUSINESS
- GOVT
- FCRS

YEARS

FIGURE 2—BY HIGHEST DEGREE

- ALL
- DOCT
- MAST
- BACH

YEARS

All 100 171 66 103 138
B 87 117 197 64 80
G 3 32 32 27 36
F 10 19 25 10 20

All 100 171 166 103 138
D 47 96 95 66 67
M 39 52 60 27 43
B 13 24 10 10 28

The third quartile
median
first quartile

Years means years since the highest degree.
Salary is in thousands of dollars.
Number of respondents is shown beneath the graph.

PRIMARY FIELD OF GRADUATE STUDY

Applied Math
O.R.
Comp. Sci.
Pure Math
52%
22%
11%
6%
3%
5%

ACTIVITY AT WORK TAKING MOST TIME

Consulting, Prob. Sales
Basic Res.

29%
14%
9%

23% 19% 29%

Supvgs., Admin.
Program

5% 5%
Chapter 9 of Ramanujan’s Second Notebook: Infinite Series Identities, Transformations, and Evaluations
Bruce C. Berndt and Padmanee T. Joshi

Professor Bruce Berndt is successfully pursuing the important task of presenting to the mathematical public a complete, edited version of Ramanujan’s famous notebooks. In this instance he and P. T. Joshi present the material in Chapter 9 of the Second Notebook together with the proofs (for the most part omitted by Ramanujan). The material has special interest today. There are many formulas for the Riemannian Zeta function with integer argument. Also the polylogarithm occurs often.

Despite the wide-spread interest in these topics, it is clear that Ramanujan was able to discover many things which would probably have gone unnoticed. Formulas like

\[
f \left( \frac{1}{\sqrt{5}} \right) = \frac{\pi^2}{20},
\]

where

\[
f(x) = \sum_{k=1}^{\infty} \frac{h_k x^{2k-1}}{2k - 1}
\]

and

\[
h_n = \sum_{k=1}^{n} \frac{1}{2k - 1}
\]

are truly wonderful.

—George E. Andrews

Contemporary Mathematics
Number 23, viii + 84 pages (softcover)
1980 Mathematics Subject Classifications:
33A15, 33A30, 10A40, 40-00.
ISBN 0-8218-5024-5; LC 83-11803
Publication date: September 1983
List price $17, institutional member $14,
individual member $10
To order, please specify CONM/23N

Shipping and handling charges: surface delivery — $2 first book, $1 additional, maximum $25; air delivery — $5 first book, $3 each additional, maximum $100. Prepayment is required. Order from American Mathematical Society, PO Box 1571, Annex Station, Providence, RI 02901-1571 USA.
Kodaira and Lewy Awarded Wolf Prize

The Wolf Foundation has announced that the 1984–1985 prize in mathematics is to be shared by Kunihiko Kodaira of the Japan Academy, and Hans Lewy of the University of California at Berkeley. The prize for mathematics is $100,000.

Kunihiko Kodaira is being honored for his outstanding contributions to the study of complex manifolds and algebraic varieties. His study of harmonic integrals has incisive applications to algebraic and complex geometry. These include the projective imbedding theorem, deformations of complex structures (with D. C. Spencer), and the classification of complex analytic surfaces. Kodaira received his Ph.D. from the University of Tokyo, has been a member of the Institute for Advanced Study at Princeton, and has taught at Princeton University, Harvard University, Johns Hopkins University, Stanford University, the University of Tokyo and Gakushuin University.

Hans Lewy is being awarded this prize for initiating many developments, now classic and essential, in partial differential equations. His early work with Courant and Friedrichs heralded the development of numerical methods for solving partial differential equations. He produced the famous example of a smooth linear partial differential equation having no solution. His other contributions include the study of the Monge-Ampere equation, work in fluid dynamics and the theory of cavities, and an early study of variational inequalities. Lewy was awarded a Ph.D. from Gottingen University, Germany, and began his American career at Brown University. He has since taught at Harvard University, Stanford University, New York University, in Italy and China, and at the University of California, Berkeley, where he is currently Professor Emeritus.

Freedman Named MacArthur Fellow

Twenty-five new grants have been awarded by the MacArthur Fellows Program of the John D. and Catherine T. MacArthur Foundation. Among the recipients is Michael Freedman, professor of mathematics at the University of California, San Diego.

The MacArthur Fellows Program endeavors to promote creativity by relieving creative scholars and artists from financial constraints. Ranging from $128,000 to $300,000, depending on the age of the Fellow, grants are allotted over a five year period. In addition, the Foundation offers a comprehensive health insurance plan and the
possibility for a further grant of $15,000 to the university or institution with which the Fellow is associated. No performance standards or follow-up reports are involved in this program; recipients have the freedom to range within their subject areas, or to experiment with different fields.

There are no applications for MacArthur grants. Instead, nominees are chosen by specifically designated nominators, who refer their choices to a fifteen member selection committee. Nominees are not informed that they are being considered for selection. With the addition of these twenty-five new Fellows, the Foundation now supports the creative efforts of 141 individuals.

Michael Freedman has proven the four-dimensional Poincaré conjecture, one of the most outstanding problems in his field, topology. In addition, his work has involved taut submanifolds, surgery theorems, and knots.

**Everett Pitcher Honored by MAA**

Everett Pitcher, Secretary of the AMS, was presented the 1985 MAA Award for Distinguished Service to Mathematics at the MAA business meeting in Anaheim. He was honored as “a man who has given long, devoted and outstanding service to the American Mathematical Society and to the larger mathematics community.”

Pitcher was born in Hanover, New Hampshire, where his father, Arthur Dunn Pitcher (who had taken a Ph.D. in general analysis under E. H. Moore at the University of Chicago in 1910) was a faculty member at Dartmouth. It is of interest that Arthur Dunn Pitcher served as a member of the Council of the AMS.

Pitcher attended Adelbert College of Western Reserve University (A.B., 1932). He proceeded to Harvard University where he received an M.A. (1933) and a Ph.D. (1935).

At Harvard, Pitcher became a student of Marston Morse. Pitcher and Morse worked on a problem on distribution of conjugate points and this problem became the body of Pitcher’s dissertation. When Morse left Harvard University in 1935 to take up an appointment at the Institute for Advanced Study, he took Pitcher with him as his first assistant.

Pitcher returned to Harvard in 1936 and served two years as a Benjamin Peirce Instructor. He was looking for a position of more permanence during 1937-1938 and learned of just one opening, namely an instructorship at Lehigh, which he accepted. He was on active duty in the U.S. Army Ordnance Department from May 1942 until the end of 1945.

Subsequent to his Army assignment, Pitcher returned to the Institute for Advanced Study for the year 1945-1946 where he and J. L. Kelley co-authored Exact sequences in homology theory, Annals of Mathematics (2) 48 (1947), 682–709. He returned to Lehigh University in the fall of 1946 and was promoted twice in two years, the second time to the rank of professor. In 1960 he was given the title Distinguished Professor of Mathematics; in 1978 he became Distinguished Professor Emeritus. In addition to his faculty assignments, he has served Lehigh University as Department Chairman (1960–1978) and as Consultant to the President (1978–).

Pitcher has long been active in the professional activities of the mathematical community. He was Associate Secretary of the AMS (1959–1966), a founder of SIAM and a member of its Board of Trustees (1961–1963). He has served as Secretary of the American Mathematical Society since 1967. He was elected to Phi Beta Kappa (1930), Sigma XI (1939) and is a member of the Pi Kappa Alpha fraternity. His service to AMS, MAA, SIAM and Lehigh University have been noteworthy. (Complete citation is to appear in an upcoming issue of the American Mathematical Monthly.)

**Keller Awarded Timoshenko Medal**

Joseph B. Keller, professor of mathematics and mechanical engineering, Department of Mathematics, Stanford University, has been awarded the Timoshenko Medal of the American Society of Mechanical Engineers (ASME). This medal is conferred annually in recognition of distinguished contributions to the field of applied mathematics. Keller’s award notes his “...development of powerful mathematical methods for the solution of significant problems in mechanics, engineering, and science; ...his preeminence in employing
Academy, presented the award to Kemeny for his writing and teaching. He is chairman of the Office of Naval Research, 1953-1954. Among his awards are two Lester R. Ford awards from the MAA; Doctor Technics Honoris Causa, Technical University of Denmark; and the Von Karman Prize, SIAM. He is chairman of the U.S. National Committee on Theoretical and Applied Mechanics, and a member of the National Academy of Sciences, American Academy of Arts and Sciences, AMS, SIAM, and International Society for Biorehology.

Kemeny Receives the New York Academy of Sciences Award

John G. Kemeny, Professor of Mathematics and President Emeritus of Dartmouth College, is the recipient of the annual New York Academy of Sciences Award. Craig Burrell, President of the Academy, presented the award to Kemeny for his brilliant contributions to the computer sciences and to the mathematical aspects of the social sciences.

Kemeny’s contributions to mathematics include the development of novel mathematical curricular materials which resulted from the publication of his book, Introduction to finite mathematics (co-authored with Thompson and Snell), his application of mathematical models for the social sciences, his creation (with Thomas Kurtz) of the computer language BASIC, his development of time sharing in computers, and his chairmanship of the commission (often called the Kemeny Commission) to investigate the accident at Three Mile Island.

Kemeny came to the United States in 1940 from Hungary and became a naturalized citizen in 1945. He served in the U.S. Army as an assistant in the theoretical division of the Los Alamos Project (1945–1946). Kemeny received his Ph.D. in mathematics from Princeton University (1949), and, during 1948–1949, he was a research assistant to Albert Einstein at the Institute for Advanced Study. He has been associated with Dartmouth College since 1953.

Carl M. Pearcy Acquisition Editor

Professor Carl M. Pearcy was recently appointed to serve as an Acquisition Editor for the American Mathematical Society. In this capacity, he will work with potential AMS authors, referring book manuscripts to the particular AMS committee responsible for final acceptance for publication. Professor Pearcy is interested in manuscripts or proposals for various types of publication projects, including lecture notes, surveys, advanced research monographs, advanced-level graduate textbooks, and general books about mathematics. See Publishing a Book with the AMS elsewhere in this issue for related details of interest to potential authors.

News from the Institute for Mathematics and its Applications

Minneapolis

After a highly successful period of concentration on liquid crystals, polymers, and non-newtonian fluids, the 1984–5 program in Continuum Physics and Partial Differential Equations will turn to problems in dynamics and stability. This period will be highlighted by three workshops.

The first workshop, Oscillation Theory, Computation and Methods of Compensated Compactness, will be held April 1–5. One goal of this workshop is to examine the implications of the methods of compensated compactness and dispersion in analysis and in numerical analysis. In their present form, these methods are not powerful enough to be applied to very realistic models. It is expected that specialists in these and related fields will work together with physicists and engineers who are experts in numerical methods and related problems.

The second workshop, Metastability and Incompletely Posed Problems of Contemporary Continuum Physics will take place from May 6–10. Most equilibrium events in nature do not actually realize configurations of minimum energy. They are only metastable. The configurations may not be unique and it may not be possible to know all boundary conditions or constitutive relations. The central purpose of this workshop is to approach these questions mathematically. Methods of global functional analysis and nonconvex variational problems are especially pertinent. Speakers will include theoreticians and experimentalists from mathematics and other sciences.

The third workshop, Dynamical Problems in Continuum Physics will be held June 3–7.

Jerald Ericksen and David Kinderlehrer are coordinating this program. A list of speakers and organizers will appear in the Special Meetings Sections of the Notices.

The Participating Institutions of the IMA, a consortium of midwestern universities which provide advice and support to the IMA, are co-sponsoring a Symposium on the Occasion of the Proof of the Bieberbach Conjecture. This symposium, which will take place at Purdue University from March 11–15, is the second annual meeting sponsored the Consortium.

For additional information please contact H. Weinberger (612) 373-0355.
Fulbright Awards for 1984-1985

Among the Fulbright Scholar Awards conferred for the 1984–85 academic year are thirteen for mathematics and five for computer sciences. The awards, for lecturing, research, or travel, were announced by the Council for International Exchange of Scholars.

In mathematics: Charles F. Amelin (California State Polytechnic University) will lecture in differential equations, functional analysis, and complex variables at the University of Iasi, Romania. Florencio G. Asenjo (University of Pittsburgh) will lecture in logic and probability at the University of Lisbon, Portugal. Vernon L. Bakke (University of Arkansas) will lecture in mathematics at Sardar Patel University, Vallabh Vidyangar, India. Bernard R. Gelbaum (State University of New York, Buffalo) will lecture on and research mathematics at University College, Galway, Ireland. Larry C. Grove (University of Arizona) will lecture on and research mathematics at Technical University, Aachen, West Germany. Robert A. Gustafson (Texas A & M, College Station) will research mathematics at Tata Institute of Fundamental Research, India, on an Indo-American Fellowship. William B. Jones (University of Colorado, Boulder) will research the analytic theory of continued fractions at the University of Trondheim, Norway. Shirley Kolmer (St. Louis University) will lecture in determinants and matrices at the University of Liberia. Ronald L. Lipsman (University of Maryland, College Park) will research mathematics at Tel Aviv University, Israel. Torrence D. Parsons (California State University, Chico) will research algebraic and topological graph theory at the University of Ljubljana, Yugoslavia. Paul C. Shields (University of Toledo) will research interaction between ergodic and information theory at the Mathematics Institute of the Hungarian Academy of Science, Budapest. Stanley Wearden (West Virginia University) will lecture in computer science at the University of the West Indies, Jamaica. Gregory P. Wene (University of Texas, San Antonio) will lecture in mathematics and computer science at the University of Cluj, Romania.

In computer science: George J. Boggs will research production engineering at the University of Nottingham, United Kingdom. Thomas J. Higginbothom (Southern Louisiana University) will lecture in and research computer science at the University of Coimbra, Portugal. James I. Hoath (AGENA/SAFECOM, Seattle) will research computer processing of Yugoslav languages at the University Computer Center, Zagreb, Yugoslavia. Assaf J. Kfoury (Boston University) will lecture in computer science at the University of Jordan in Amman. Robert David Preuss (Nitre Corporation, Bedford) will lecture in computer design technology at Tampere University of Technology, Finland.

Travel Support Available for Foreign Graduate Students

The Institute of International Education has informed the Society that its STEP program has been funded again this year by the U.S. Information Agency, and the Society anticipates receiving a grant of at least $2,500. The grant will be made to the AMS to assist non-U.S.-government sponsored foreign students to participate in the joint Summer Research Conferences in the Mathematical Sciences, June 23–August 31, 1985, Arcata, California; the AMS-SIAM Summer Seminar in Applied Mathematics, June 30–July 13, Ithaca, New York; and the AMS Summer Research Institute, July 8–26, Brunswick, Maine. For topics of the Summer Research Conferences, please refer to the October 1985 issue of the Notices. For the Summer Seminar and Summer Research Institute topics, please see the announcements elsewhere in this issue. Awards to individual students may be made up to a maximum of $250.

To be eligible for these grants the foreign student must be enrolled in full-time graduate studies at a U.S. institution of higher learning. A student is ineligible if he/she is receiving any U.S. government funds for either academic or travel expenses or if one is on refugee, immigrant or tourist visa status. Previous recipients of STEP awards are ineligible for a second grant.

Interested applicants should send all necessary information, including the conference for which the grant is requested, to Dr. James W. Maxwell, Associate Executive Director, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

AMS Trustees Honor

Two More Twenty-Year Employees

At its meeting in November 1984, the Board of Trustees of the Society adopted the following resolution:

Statement of the Proceedings and Transactions Editorial Committees

It has been the policy of the respective editorial committees that shorter papers be published in the Proceedings and longer papers in the Transactions. As a general rule, papers of eleven manuscript pages or fewer have appeared in the Proceedings and those longer than eleven pages in the Transactions or Memoirs. The size of the Proceedings has remained substantially constant at about 2000 pages per year while that of the Transactions has grown steadily in recent years to more than 5000 pages annually. As a result, the editorial committees of these journals have agreed to change the threshold between the journals from eleven to fifteen manuscript pages.
“This year the Board of Trustees takes special note of the fact that two more employees of the Society have completed twenty years of service. The Board expresses its profound gratitude to Thomas Benedetti and Sandra E. Scott, who bring to fourteen the number of employees of the Society who have devoted more than twenty years as members of the AMS staff. The Trustees offer their special thanks and their best wishes to all of these long-term employees, wish them well in the future, and hope that they continue to serve the Society for many years to come.”

For several years these reports have appeared in the Notices, as employees on the staff of the AMS have completed terms of service extending over twenty years or more. (The most recent such report will be found in the January 1984 issue, page 9.)

Thomas Benedetti joined the staff of the AMS in January, 1964. He was first assigned to an unused Multilith machine located in a corner of the Society’s basement. Office forms, memo pads, and stationery were his bailiwick for some time. From that basement operation, manned by Tom and one assistant, the Society’s in-house printing activity has increased gradually but steadily, as has Tom’s expertise in the field. His first major undertaking was the reprinting of small quantities of journal issues. With the Society’s acquisition of the necessary equipment, he and his staff expanded the printing program considerably. He is now responsible for the printing and binding of most of the Society’s journals, and all of its softcover books.

Sandra Scott became a member of the Editorial Department in September, 1983, leaving only for a three-month period during which time she lived in Norfolk, Virginia. She has been involved in all phases of editorial work: proofreading, copyediting, corrections and issue makeup. Over the years she has been production editor of several journals, including Transactions, Proceedings and Mathematics of Computation. Today she continues in this role with the Transactions and Proceedings journals, as well as handling some of the production work on the two journals of the Australian Mathematical Society, one of the societies for which AMS does composition work. Throughout these past twenty years, Sandra has seen an evolution in the composition of AMS journals, from using outside typesetters such as Clowes in England, to keyboarding in-house on Varitype machines and then IBM Composers, to using computerized systems, first CTI, then STI and now TEX also.

Symposium at Courant Institute

Courant Institute of Mathematical Sciences of New York University is planning to celebrate its fiftieth anniversary with a scientific symposium October 21-24, 1985. The celebration will also honor the eightieth birthday of former director J. J. Stoker and the sixtieth birthdays of Louis Nirenberg and Peter Lax. Further information will be available at a later date.

—Cathleen S. Morawetz, Director

Tamkang University Book Drive

The largest university in Taiwan, Tamkang University, is currently holding a book drive. As a private university, Tamkang receives no government assistance. With a book collection of 340,000 volumes, the university cannot respond appropriately to the needs of its 16,000 students and 2,000 faculty members.

Your assistance in donating any used, duplicate, extra print resources, monographic or serial, or your own publications would be greatly appreciated. If mailing expenses are a concern, the university is prepared to cover the cost of shipping upon receiving notice of your proposed donations. Among the subject areas needed are physics, mathematics, engineering, computer science, and statistics.

Notice of proposed donations should be sent to Shih-Hsion Huang, Director, Tamkang University Library, Tamsui, Taipei, Taiwan 251, Republic of China.

AFOSR Initiative on the Control of Distributed Parameter Systems

The Air Force Office of Scientific Research (AFOSR) is planning a major initiative for basic research to develop analytical tools and computational algorithms for identification, control, and optimization of systems modeled by partial differential equations, integro-differential equations and functional differential equations. The objective of the initiative is to stimulate basic mathematical research on the control of a variety of infinite dimensional systems useful in the study of aeroelastic systems, large space structures, combustion models, and thermodynamical systems. Research proposals should pay careful attention to the question of which mathematical models best describe the physical process to be controlled, and simplifications introduced in order to design and analyze the control system must have physical fidelity. The primary issues of interest in the control of distributed parameter systems are approximation methods for parameter estimation, stabilizability, computation of stabilizing controllers, and optimization methods for control design.

Prospective investigators should submit proposals prior to July 1, 1985. Proposals submitted at a later date will be evaluated but will have less opportunity for funding. AFOSR assumes no obligation to support proposals submitted. Proposals should define a specific technical problem, outline the proposed approach and
explain the uniqueness of the proposed approach in the context of other ongoing research. They should describe the expected payoff to the Air Force if the proposed research is successful. The qualifications of the principal personnel to perform the basic research in the control of distributed parameter systems should be included. Proposals from individual researchers will be considered, as will those for potential centers comprising several researchers with related interests.


Proposals for basic research in the control of distributed parameter systems should be sent to: Air Force Office of Scientific Research, Initiative on the Control of Distributed Parameter Systems, AFWSEL/NM, Bolling AFB, Washington, D.C. 20332-6448. Prior to submitting a proposal, AFOSR encourages investigators to contact the AFOSR Program Advisor, Marc Q. Jacobs, 202-767-4940.

**Budapest Semesters in Mathematics**

Through this program, mathematics and computer science majors in their junior/senior years may spend one or two semesters in Budapest and study under the tutelage of eminent Hungarian scholar-teachers. Initiated by Paul Erdős and László Lovász, Budapest Semesters in Mathematics provide a unique opportunity for North American undergraduates to study in Hungary, a country with a long tradition of excellence in mathematics research and education. All courses are taught in English. Classes are held in small groups.

Instructors are members of Eötvös University and the Mathematical Institute of the Hungarian Academy of Sciences. Credits are transferable to American and Canadian universities. Living costs in Budapest are modest. Tuition is $1850 (U.S.) per semester.

The semesters begin around the first of September and February, and end around the 20th of December and May, respectively.

For further information about this program, write to the American Representative of Budapest Semesters in mathematics: W. T. Trotter, Jr., Chairman, Department of Mathematics and Statistics, University of South Carolina, Columbia, South Carolina 29208.

**Hardy Lecture**

The 1985 London Mathematical Society (LMS) Hardy Lecturer is R. H. Bott of Harvard University. He will present the Hardy Lecture to the LMS in London on June 21, 1985.

Bott will also present other lectures at participating institutions during his time in the United Kingdom.

– London Mathematical Society Newsletter

**U.S. Withdraws from UNESCO**

On December 31, 1984, U.S. membership in the United Nations Educational, Scientific, and Cultural Organization (UNESCO) terminated. The U.S. had charged that UNESCO is overly politicized and hostile towards the institutions of a free society, particularly in the areas of communications and human rights. The U.S. has vowed to continue its efforts to bring about reform to UNESCO so that re-entry might be considered. While it had been anticipated that resources previously earmarked to support U.S. membership in UNESCO might be available to permit continued U.S. association with valuable UNESCO-related programs, it now appears that only a token amount of resources may be proposed in the Administration's FY 1986 budget for this purpose.

During 1984 the State Department conducted a review of U.S. participation in UNESCO. As a part of that effort, the National Academy of Sciences was invited to assess the impact of a U.S. withdrawal on the science component of UNESCO’s work and to suggest alternative interim arrangements whereby essential U.S. scientific collaboration might be maintained. A report was issued in the fall of 1984 which identified a number of key areas in the sciences, including UNESCO's work in strengthening national research potential and infrastructures in mathematics in the developing world. The UNESCO program for 1984-1985 includes the organization of mathematics courses for developing countries, research grants, the convening of seminars and some support for publications, including preparation of the World Directory of Mathematicians in cooperation with IMU. Some support is also provided in the International Center for Pure and Applied Mathematics in France. In addition UNESCO provides an annual subvention to the International Council of Scientific Unions (ICSU) which is in turn apportioned among the constituent unions of ICSU, including the IMU. At this time, it is not known how the U.S. withdrawal will affect these programs and patterns of financial support. It is expected that the cutbacks will be less severe in the sciences than in other areas covered by UNESCO. Nonetheless, the present uncertainties are bound to create disruptions in terms of future program planning, as well as discontinuities in U.S. participation, and a concern with respect to the U.S. commitment to international cooperation in general. The NAS report concluded that the present situation emphasizes the need to examine the objectives, consequences, and benefits of U.S. participation in intergovernmental organizations and the kinds of multilateral institutions that...
are needed to deal with the contemporary requirements of international science cooperation.

New Center for Research of Stochastic Process

With the support of the Volkswagenstiftung, a new center, "Bielefeld-Bochum Stochastic Processes-Mathematics and Physics" (BuBoS) has been established at the Universities of Bielefeld and Bochum. The activities of the center have begun with a symposium at the Center of Interdisciplinary Research (ZfI), University of Bielefeld.

The center is devoted to the study of stochastic processes, with particular attention to the close interaction between mathematical theory and applications, especially in physics. There will be symposia arranged twice a year. The center will offer both long and short term appointments for established mathematicians and scientists as well as for promising newcomers. A number of working seminars will be arranged.

For more information write to: S. Albeverio, Ph. Blanchard, L. Streit, BuBoS, Universität Bielefeld, D 5-147, Postfach 8640 D-4800 Bielefeld 1, Federal Republic of Germany; Telephone 0521/106 5305.

Office at Home

The federal tax deductibility of an office at home has been a source of contention between individuals and the Internal Revenue Service. There are three criteria to be met to justify deductibility by an employee. The home office must be used exclusively for business purposes on a regular basis, it must be maintained for the convenience of the employer, and it must be the principal place of business of the employee.

In a recent case before the U.S. Court of Appeals for the Second Circuit, it was ruled that a professor whose institution did not provide him with a suitable private office in which to work is entitled to the deduction for an office at home. The argument centered on the office at home as the principal place of business.

Interested parties may wish to explore the applicability and the precedential weight of the decision. A news reference is the Chronicle of Higher Education for January 9, 1985. They may wish also to consider that their consulting and/or publishing constitutes a separate trade or business, and that the office in the home is the principal place of that business.

Colloquium Lecture Notes

A set of four Colloquium Lectures was presented by Daniel Gorenstein of Rutgers University, New Brunswick, at the annual meeting of the Society in Anaheim, California in January 1985. Copies of the lecture notes, The classification of the finite simple groups, are still available.

Requests should be accompanied by a check or money order for $3 per copy to cover the costs of handling, and mailed to the Society at P.O. Box 1571, Annex Station, Providence, Rhode Island 02901. The notes, which were distributed to those who attended the Colloquium Lectures in Louisville, do not constitute a formal publication. Please note that informally distributed manuscripts and articles should be treated as personal communications and are not for library use. Reference to the contents of such an informal publication should have the prior approval of the author.

New Quarterly on Mathematical Ecology

The Rocky Mountain Mathematics Consortium announces the establishment of a new quarterly journal, Natural Resource Modeling.

Natural Resource Modeling is an interdisciplinary journal devoted to mathematical modeling of natural resource systems: of their inherent physical, chemical, and biological processes, and of the economic and operational basis for their management. The major theme for the journal is the development of analytical mathematical models as tools for resource management and policy development. The analysis may be applied to a wide variety of resources: renewable and exhaustible resources, terrestrial and marine resources, energy, minerals and materials, land and soils, water resources, problems of pollution and residuals, managed biological populations, integrated pest management, agriculture and fisheries, rangeland and forest, wildlife and wilderness, preservation of endangered species and of genetic diversity, and still others.

The journal will publish both primary research articles and expository survey articles on resource modeling themes. It will attempt to keep its readers abreast of important new thrusts in research, and to encourage new research initiatives. Through its Short Communications section it will promote lively debate on current issues in dispute.

The Editor is Robert McKelvey, Department of Mathematical Sciences, University of Montana, Missoula, MT 59812; Associate Editor is Roland Lamberson, Department of Mathematics, Humboldt State University, Arcata, CA 95521. Thomas L. Sherman, Executive Director of the RMMC, Department of Mathematics, Arizona State University, Tempe, AZ 85287 will serve as Business Manager.
NSF Director Responds
to the David Report

In an interview published in the November 15, 1984 issue of Science and Government Report, Erich Bloch, director of NSF, responded to questioning concerning the David Report by saying: “Let me say a couple of things about this, because I happened to talk to the advisory committee on it. First of all, the thing I asked them to do was to go take the David report, and I told them you might agree 100 percent with it, but go look at it through your own eyes, and tell me what is the right level of funding that you would think is practical. Also, knowing what goes on in the rest of the Foundation, you know that we don’t have infinite resources. So tell me what is the right level that we should put in and in what areas. They came back with an answer which was different from the David report. Their answer was roughly a 60 percent level of what the David report called for. We asked them to break it down on how many people to support and so forth, and they came out with the 60 percent level.

I promised them what we would try to do is take that into consideration, over a period of years. They agreed it couldn’t all be done in one year. The David report didn’t contemplate that, either. But the advisory committee was a lot more careful, and they really looked at where do we want to be 5 years from now. I promised them I would take [their views] into consideration as we moved through the years, and we would tell them at all times what we’re going to do about it, so we’d have a continuous kind of a dialog, and they’d see that we’re going to take it seriously.”

NSB Views the David Report

The following statement and resolution was approved by the National Science Board at a meeting of its execution committee on December 20, 1984:

The National Science Board is concerned with the strength of a balance among scientific and engineering disciplines, especially where a specific field, such as mathematical sciences, affects much of the scientific, engineering and technological enterprise of the nation.

The ad hoc committee on resources for mathematical sciences of the National Research Council and its chairman, Edward E. David, Jr., are to be commended for their timely and compelling report “Renewing U.S. Mathematics—Critical Resources for the Future.” This broadly based group, including scientists and engineers, as well as mathematicians representing both industry and academia, has documented requirements to keep mathematics research in balance with other fields. The very core of most science and engineering efforts is dependent on mathematics and owes many advancements to sophisticated application of the techniques of mathematicians.

The National Science Foundation has made important increases in support for graduate students and young researchers in mathematical sciences. Various funding agencies have also increased funding. The National Science Board, therefore,

resolves that a concerted effort should be made by all funding agencies to increase support for the mathematical sciences for several years until a proper level of sustaining support has been achieved.”

—NSF News Release

National Science Board Increases
Strategic, Oversight Roles

The National Science Board (NSB), governing body of the National Science Foundation, has made a sweeping set of changes in its committee structure and operations, aimed at increasing the Board’s involvement in strategic NSF and national science policy, its oversight of NSF programs, and its attention to education and human resources.

“The Board believes,” Roland Schmitt, Chairman of the NSB, said, “that right now many of the threats and opportunities for the U.S. scientific and technical enterprise focus on people. For that reason, the Board voted to establish as one of its two principal committees a new Committee on Education and Human Resources.” The new Committee will oversee the Foundation’s Directorate for Science and Engineering Education, now being rebuilt, and the new programs being put in place there. It will address issues and programs that deal with efforts to bring minorities, women, the handicapped, and the disadvantaged into scientific careers—issues that had been assigned to a smaller Board Committee, but now will get more attention.

—NSF News Release

Cooperative Science Programs
with Latin American
and the Caribbean

The National Science Foundation will consider several types of interactions between United States and Latin American and Caribbean scientists for financial support. Such activities include: cooperative research projects, research-oriented workshops, short-term visits for cooperative activities, and developing detailed plans for joint
projects. To receive such grants, the co-principal investigators must submit parallel proposals. Foreign investigators may be affiliated with specific counterpart agencies of the NSF in Latin America and the Caribbean, or with other agencies, which will be considered on an ad hoc basis. U.S. investigators must hold a doctoral degree or equivalent professional experience, and be U.S. citizens. All branches of science and technology are eligible for consideration, so long as the goal of the project is the advancement of knowledge or methodology.

Proposals should follow the guidelines established by the NSF pamphlet 78-41, “Grants for Scientific Research.” Yearly deadlines fall on May 1 and November 1; the NSF requests that submissions be restricted to these approximate time periods. The Cooperative Science Program is located in room 1212, 1800 G Street, N.W., Washington, DC, (202)357-8563. Correspondence should be addressed: U.S.-Latin American Cooperative Science Programs Division of International Programs, NSF, Washington, DC 20550.

Science in Developing Countries Program

In order to encourage cooperation between scientists in the United States and those in developing countries, the NSF is offering grants for a number of research activities in the third world. Grants are made directly to the U.S. scientists; this money may potentially be used to support counterparts in the host country. Local enthusiasm and planning for the proposed projects are considered essential to this program.

Categories of grant awards include research participation, conferences, and dissertation improvement. The latter grants are awarded to students from developing countries who are enrolled in universities in the United States, and who wish to undertake a dissertation research project.

Those applying for principle investigator positions must be professionally qualified through training and work experience, and currently employed by a U.S. institution. Grant proposals are read twice a year, on March and September 1, but accepted at any other time. Proposals should be submitted in deca-copy to the following address: Central Processing Section, National Science Foundation, Washington, DC 20550.

For more information concerning programs in specific geographic areas, contact the following: North Africa and Turkey: Francis E. Field 202-357-9402, Sub-Saharan Africa: Robert Bell 202-357-9550, South and West Asia: Osman Shinashin 202-357-9402, East Asia: Gordon Hiebert 202-357-9537, Latin American and Caribbean: Christine French 202-357-9563. All the above may be reached by mail at: Division of International Programs, National Science Foundation, Washington, DC 20550.

United States-Japan Cooperative Science Program

One of the earliest cooperative science programs of the NSF, the United States-Japan program continues to offer a variety of grants for scientific and technological advancement. The NSF is the "Implementing Agency" for the United States, and the Japan Society for the Promotion of Science (JSPS) and the Science and Technology Agency play this role in Japan. Operating as a liaison between the two countries, and as an overseer of the program as a whole, the U.S.-Japan Committee on Scientific Cooperation coordinates the exchange of research and personnel.

The U.S.-Japan Committee mandates that both Japan and the U.S. must participate in each project supported by the committee. Both countries must jointly approve each project, and the government of each will support its own scientists.

Projects eligible for funding under this program include: cooperative research, joint seminars, and long-term visits to Japan by U.S. scientists. Proposals should be paralleled between the cooperating scientists. U.S. scientists should follow standard NSF guidelines, as outlined in "Grants for Scientific Research" (NSF 78-41). Japanese investigators should request current guidelines from the following address: Research Cooperative Division, Japan Society for the Promotion of Science, 5-3-1, Kojimachi, Chiyoda-ku, Tokyo 102, Japan.

Deadlines for proposal submissions are: April 1, cooperative research; June 1, joint seminar; rolling applications, long term visits. All proposals must be submitted, in deca-copy, to: Central Processing Section, U.S.-Japan Cooperative Science Program, NSF, Washington, DC 20550.

U.S.-Australia/U.S.-New Zealand Cooperative Science Programs

The NSF continues to offer grants for collaborative work between scientists of the U.S. and those of Australia and New Zealand. Proposals for cooperative research or joint seminars are accepted and considered for funding.

Deadlines for application for research are April 1 for proposals which would be effective the following January through to the following June 1, and October 1 for problems which would be implemented from July 1 to December 31. To apply, or for more information, contact: U.S.-New Zealand or U.S.-Australia Cooperative Science Program, Division of International Programs, National Science Foundation, Washington, DC 20550.
Cooperative Science Programs with Western Europe

The NSF announces the availability of grants for joint efforts between United States and Western European scientists. Various types of coordinated programs are eligible for funding, such as cooperative research projects, joint seminars (workshops), long-term research visits, and regional seminars. The NSF has specific programs with Belgium, Finland, France, the Federal Republic of Germany, Italy, Sweden, Switzerland, and the United Kingdom. However, selection will consider activities within the region as a whole, or with countries not specifically covered by formal programs.

Deadlines for application vary by the countries involved. Interested scientists should write: Data Support Services Section, National Science Foundation, 1800 G Street N.W., Washington, DC 20550, French scientists may write Service des Relations Internationales, Centre National de la Recherche Scientifique, 15 Quai Anatole France, 75700 Paris, France; and Belgian scientists Fonds National de la Recherche Scientifique, Nationaal Fonds voor Wetenschappelijk Onderzoek, 5 Egmont, B-1050 Brussels, Belgium.

AMS SHORT COURSE LECTURE NOTES

Introductory Survey Lectures
(Proceedings of Symposia in Applied Mathematics)

Population Biology
Simon A. Levin, Editor

The lecture notes contained in this volume were presented at the AMS Short Course on Population Biology, held August 6–7, 1983 in Albany, New York, in conjunction with the eighty-seventh summer meeting of the American Mathematical Society.

Population biology is probably the oldest area in mathematical biology, but remains a constant source of new mathematical problems and the area of biology best integrated with mathematical theory. The need for mathematical approaches has never been greater, as evolutionary theory is challenged by new interpretations of the paleontological record and new discoveries at the molecular level, as world resources for feeding populations become limiting, as the problems of pollution increase, and as both animal and plant epidemiological problems receive closer scrutiny.

The purpose of this course was to acquaint the participant with the mathematical ideas that pervade almost every level of thinking in population biology and to provide an introduction to the many applications of mathematics in the field. Research mathematicians, college teachers of mathematics, and graduate students should all find this book of interest. A background of advanced calculus, introduction to ordinary and partial differential equations, and linear algebra will make the book accessible.

All of the papers included have high research value. They are:
- Simon Levin, Mathematical population biology
- James Frauenthal, Population dynamics and demography
- Thomas Nagylaki, Some mathematical problems in population genetics
- Ethan Akin, Evolution: game theory and economics
- Wayne Getz, Optimal control and principles in population management
- George Sugihara, Graph theory, homology and food webs

1980 Mathematics Subject Classifications: 92A15, 92A10, 92A17

Proceedings of Symposia in Applied Mathematics
Volume 30, x + 102 pages
Soft cover prices: List $21, institutional member $17, individual member $13
Hard cover prices: List $27, institutional member $22, individual member $16
ISBN 0-8218-0083-3; LC 83-21389
Publication date: March 1984
To order, please specify PSAPM/30N (hard cover) or PSAPMS/30N (soft cover)

Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
Queries

Edited by Hans Samelson

QUESTIONS ARE WELCOMED from AMS members regarding mathematical matters such as details of, or references to, vaguely remembered theorems, sources of exposition of folk theorems, or the state of current knowledge concerning published or unpublished conjectures. This is not intended as a problem corner, except for occasional lists of problems collected at mathematical meetings.

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

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

Queries

322. Dennis Spellman ([Department of Mathematics, Sacred Heart University, P. O. Box 6460, Bridgeport, CT 06606-0460]). We consider natural numbers $n$ that are composite and relatively prime to $\varphi(n)$. For which of these $n$ does there exist a non-Abelian group of order $n$?


A. On a differentiable manifold the set of noncausal metrics (Lorentz metrics with a closed time-like curve) is easily seen to be of 2nd category in the space of metrics ($C$-topology). Is it true that for any elementary formula $A$ involving causal ordering $x < y$ either the set of metrics for which $A$ holds or its complement is of 1st category ("the general 0-1 law")? (V. Ya. Kreinovich)

B. Let $q_n$ be the number obtained by reversing the order of the binary digits of the $n$th prime. The fraction of primes in this list is abnormally high up to $n$ about 40. Is this true for larger $n$? If so, is there a reason? (R. R. Pimenov)

C. For linear programming the notion of dual program is useful. But the new methods (ellipsoid, Karmarkar's) don't use duality. Is there any interpretation or use of duality for these new methods? (I. M. Davidova)

D. What algorithms are known for solving Boolean equations in intuitionistic logic? (G. E. Minc)

E. Define a version of Kolmogorov complexity as follows: $K(x,t)$ is the minimal possible length of a program $y$ that allows $x$ to be obtained in time $t$ (on some fixed universal machine). Is the problem to construct such a $y$ from $x$, $t$, and $k$ (with $K(x,t) \leq k$) NP-difficult (i.e., equivalent to NP-complete problems)? (L. A. Levin)

Responses

The editor would like to thank all those who sent in replies.

308. (vol. 31, p. 480, August 1984, Francis D. Londergan) Techniques for determining whether a group given by generators and relations is finite. (See earlier reply these Notices 31, p. 784). Reply: There is a group theory computer system called CAYLEY that can handle questions of this sort. For the two groups in question (with the relation $x = 1$ added) it gave the answer "infinite" (printout available from the AMS office). (Contributed by M. C. Slattery)

313. (vol. 31, p. 631, October 1984, Elvin Lee) Conjecture about amicable pairs of numbers. Reply: The numbers 967947856 and 1031796176, $= 7$ and $= 5 \mod 9$, respectively, contained in a list of 183 new amicable pairs found by H. J. J. te Riele, Stichting Centrum, Amsterdam, give a counterexample. (According to te Riele there are 586 pairs with the smaller number under one billion.) (Contributed by E. J. Lee)

314. (vol. 31, p. 631, October 1984, Marwan Awartani) Explicit analytic functions $f$, whose set $S$ of local maxima and minima on $[0,1]$ is discrete and that take each value in $f(S)$ infinitely often in $S$. Reply: Such functions can be constructed in a reasonably explicit way. The construction uses the functions $x^n - x^{n+1}$, which have a fairly sharp maximum $\sim 1/ek$ at $k/(k+1)$. One now superimposes these functions, with $k$ running through a rapidly increasing sequence, with suitable coefficients. This gives "almost" the answer; now one corrects the coefficients inductively by an explicit, converging process. Details available through the AMS office. (Contributed by G. Piranian)

319. (vol. 1, p. 9, January 1985, T. M. Rassias) Distance 1 preserving maps $R^2 \rightarrow R^3$. Reply: With $R^6$ instead of $R^3$ the existence of such maps that are not isometries has been announced by B. V. Dekster (these Notices 32, p. 64; Abstracts Amer. Math. Soc. 6(1985), 42). (Contributed by D. Lenard)

Corrections

1. In Volume 31, page 631 in the response to Query 299, M. Seller should be M. Satile. We apologize for the error.
2. In Volume 31, page 633, column 2, line 2, read "$B = V$" for "$B = V - \Lambda". 

198
Article by Arthur M. Jaffe

The fine survey article by Arthur M. Jaffe, “On the Role of Mathematics in Ordering the Universe” (Notices, October 1984, pages 589–608) may be misleading in its recounting of the early development of computers. At issue is the reference (page 593) to “devices like von Neumann’s ENIAC, built at the Institute for Advanced Study in Princeton.”

The ENIAC (Electronic Numerical Integrator and Computer) was built at the Moore School of Electronic Engineering of the University of Pennsylvania.

It is not clear in what sense the ENIAC was von Neumann’s. Readers interested in his contribution to the early developments of computers may consult an article by J. Presper Eckert, “Thoughts on the History of Computing” (Computer, December 1976, pages 58–65). Eckert was co-inventor, with John W. Mauchly, of the ENIAC. According to Eckert, von Neumann is “frequently (improperly) credited with the concept of internal programming and internal storage.... We had fully discovered this idea before his arrival [at the Moore School]. I verified this fact by looking at old records and also checking the dates of the clearance papers on which he got permission to visit the project...”. The Computer article contains some further discussion of von Neumann’s contributions in this area.

Leo Hellerman
Lake Katrine, New York
(Received October 25, 1984)

Editor’s Note: H. H. Goldstine, who was associated with Eckhart and Mauchly as a representative of the U.S. Army during the development of ENIAC and with von Neumann during the development of the IAS Machine makes these comments:

1. The U.S. Federal District Court decided that Eckhart and Mauchly were not the sole inventors of the ENIAC and threw out their patents as being invalid.

2. von Neumann did not contribute to the design and development of the original ENIAC project. In fact, he did not become aware of it until about 1944. At that time, he did become enormously involved in the successor machines to the ENIAC, and he did program the ENIAC to be a centrally-programmed machine.

Polish Mathematics

One of the consequences of the current economic and political situation in Poland has been a drastic reduction in the funds provided to the main scientific libraries for the purchase of monographs and books (funds for periodicals are for the moment being continued). In many cases this support has been cut off altogether. Although this is an intolerable situation for any library, it is particularly disastrous for the library of the Mathematical Institute of the Polish Academy of Sciences in Warsaw. This library is a central resource for all scientific research in Poland and, until recently, could boast a collection of current works second to none in Eastern Europe. For the library, the inability to purchase new books for even a few years will create a gap which will not be easily closed in the future.

We are seeking help from our colleagues around the world to enable Polish mathematicians to maintain the quality of at least this library. At the moment, we see the problem as an issue of short-term support to avoid rapid deterioration of the collection. Simultaneously, with this appeal we are trying to apply political pressure to convince the Polish government to restore the funds. We recognize that outside help will not suffice to support the library in the long run.

Persons wishing to help may do so in one of several ways. We have a list of books which the library would like to have, but cannot buy. Some of you may have spare copies of these to donate. This list may be obtained from any of the undersigned. If you prefer to give money toward the purchase of books, please send it to Polish Book Fund, c/o Peter G. Hinman, Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109. Finally, if you are writing or have recently written a mathematics book at any level, please earmark at least one

Policy on Letters to the Editor

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

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

The committee reserves the right to edit letters.

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

Letters should be mailed to the Editor of the Notices, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, and will be acknowledged on receipt.
of your complimentary copies for the library of the Polish Academy. Books may be sent directly to: Bibliotek, Instytut Matematyczny PAN, ul. Sniadeckich 8, Warszawa 00-950, Poland. The Institute has a large number of its publications, both journals and books, which it would be happy to trade for your books. If you have some particular desires, please contact any one of us.

Peter G. Hinman
University of Michigan, 
Ann Arbor
Alistair H. Lachlan
Simon Fraser University
Angus Macintyre
Yale University and 
University of Illinois, Urbana-Champaign
(Received November 15, 1984)

Scientific Cooperation with Vietnam

I am writing to you concerning a most grievous matter.

On 13 October, in the Los Angeles area, Professor of Physics Edward L. Cooperman, chairman of the U.S. Committee for Scientific Cooperation with Vietnam, was shot and killed in his office at California State University at Fullerton. A Vietnamese émigré has been charged with the killing. The shooting was preceded by a series of threats from extremist factions of the Los Angeles Vietnamese émigré community. These threats were reported to law enforcement authorities. The killing also followed, by four months, the attempted murder in San Francisco of the president of a U.S.-Vietnam friendship group (whose wife was killed in the shooting).

Cooperman, like many of us, believed that scientists from technologically advanced countries have a duty to assist scientists in developing countries. Cooperman took full responsibility for the difficult work of the U.S. Committee for Scientific Cooperation with Vietnam in several fields of science. His extensive personal, professional and government contacts both in the U.S. and Vietnam enabled him to obtain financial support, donations of supplies, visas, and other necessary materials.

Except for the medical sciences and agriculture, the largest program of exchange and cooperation was in the mathematical sciences. In recent years, about ten of Vietnam's leading mathematical researchers were able to visit American universities and attend international conferences in the U.S., in each case because of the personal efforts of Cooperman.

At the time of his death, Cooperman was planning to arrange for several mathematicians from Vietnam to participate in the 1986 International Congress of Mathematicians in Berkeley. Now, however, the killing has cast grave doubts on these plans.

I am writing to each officer and member of the International Mathematical Union and the IMU Committee on Development and Exchange in order to ask for your assistance in these difficult times. I respectfully request that the IMU:

(1) condemn the killing of Cooperman, and ask the U.S. government for an investigation of all circumstances surrounding the attack;
(2) strongly urge the U.S. government to take appropriate measures to guarantee the safety of mathematicians from Vietnam and other potential target-countries who attend the ICM in Berkeley;
(3) urge the governments of Vietnam and other potential target-countries to continue to support the participation in the ICM of mathematicians from those countries.

Neal Koblitz
U.S. Committee for Scientific Cooperation with Vietnam
University of Washington
(Received October 26, 1984)

EDITOR'S NOTE: Professor Koblitz's letter presents only one of many current theories as to the motivation for Professor Cooperman's murder. The other theories are of a nonpolitical nature.
Automated Theorem Proving: After 25 Years
W. W. Bledsoe and D. W. Loveland, Editors

This volume contains papers based on a special session for automated theorem proving held at the annual meeting of the American Mathematical Society in Denver, January, 1983. At the meeting special awards were given to honor historically significant work (the Milestone Prize: Hao Wang, awardee) and to honor excellent current work (the Current Research prize: Lawrence Wos and Steven Winker, awardees). Roughly a dozen leading contributors to the field were invited to present papers: papers characterizing their research work or a broader perspective were encouraged. Papers range from a historical overview of twenty-five years of research in the automated theorem proving field to significant technical papers, including a reprint of a Scientia Sinica paper giving a new and elegant decision procedure for a portion of elementary geometry.

Most of the major efforts in building automated theorem provers (or theorem proving assistants) are covered by papers in this volume, a notable but less familiar example (to the ATP community) being the Suppes interactive theorem prover for teaching logic and axiomatic set theory. The well-known provers of Andrews, Bledsoe, Boyer and Moore, and Wos et al. are represented as are term rewriting, combining decision procedures and automating mathematical discovery. The book is intended for every mathematician and computer scientist interested in the state-of-the-art in automated theorem proving, but in particular, it is intended to encourage active research mathematicians to contribute their insight to this field.

Contents

D. W. Loveland. Automated theorem proving: a quarter century review
Citation to Hao Wang
Hao Wang. Computer theorem proving and artificial intelligence
Citation to Lawrence Wos and Steven Winker
L. Wos and S. Winker. Open questions solved with the assistance of AURA
W. W. Bledsoe. Some automatic proofs in analysis
R. S. Boyer and J. S. Moore. Proof-checking, theorem-proving, and program verification
R. S. Boyer and J. S. Moore. A mechanical proof of the Turing completeness of pure LISP
P. B. Andrews, D. A. Miller, E. L. Cohen and F. Pfenning. Automating higher-order logic
D. Lankford, G. Butler and B. Brady. Abelian group unification algorithms for elementary terms
G. Nelson. Combining satisfiability procedures by equality sharing
Wu Wen-Tsun. On the decision problem and the mechanization of theorem-proving in elementary geometry
Wu Wen-Tsun. Some recent advances in mechanical theorem-proving of geometries
Shang-Ching Chou. Proving elementary geometry theorems using Wu’s algorithm
D. B. Lenat. Automated theory formation in mathematics
J. McDonald and P. Suppes. Student use of an interactive theorem prover

To order, please specify CONM/29N
1985 AMS Elections

Nominations by Petition

Vice-President or Member-at-Large

Two positions of vice-president and member of the Council ex officio for a term of two years are to be filled in the election of 1985. The Council intends to nominate four candidates, whose names may be expected to appear in the June issue of the Notices, which is scheduled to be mailed by the printer on May 17. Nominations by petition as described in the box are acceptable.

Five positions of member-at-large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate seven candidates, whose names may be expected to appear in the Notices, which is scheduled to be mailed by the printer on May 17. Nominations by petition as described in the box are acceptable. The Council has stated its intent to have at least ten candidates and will bring the number up to ten if the nominations by petition do not do so.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in aid of a candidate for the position of vice-president or of member-at-large of the Council must have at least 50 valid signatures and must conform to several rules and operational considerations, which are described in the box.

The Nominating Committee for 1986

Four places on the Nominating Committee will be filled by election. There will be four continuing members of the Nominating Committee, namely Vera S. Pless Mary Ellen Rudin Michael Shub R. O. Wells, Jr.

The new members will be elected in a preferential ballot. The President will name six candidates for these four places. The names may be expected to appear in the June issue of the Notices. Nominations by petition, in the manner described in the box, will be accepted. Should the final number of candidates be less than eight, the President will bring it up to eight.

The name of a candidate for member of the Nominating Committee may be placed on the ballot by petition. The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations which are described in the box should be followed.

Rules and Procedures

Use separate copies of the form for each candidate for vice-president, member-at-large, or member of the Nominating Committee.

1. To be considered, petitions must be addressed to Everett Pitcher, Secretary, P.O. Box 6248, Providence, Rhode Island 02940, and must arrive by July 8, 1985.

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

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

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

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the Combined Membership List and the mailing lists. No attempt will be made to match variants of names with the form of name in the CML. A name neither in the CML nor on the mailing lists is not that of a member. (Example: The name Everett Pitcher is that of a member. The name E. Pitcher appears not to be. Note that the mailing label of the Notices can be peeled off and affixed to the petition as a convenient way of presenting the printed name correctly.)

7. When a petition meeting these various requirements appears, the Secretary will ask the candidate whether he is willing to have his name on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving his consent.
NOMINATION PETITION FOR 1985 ELECTION
The undersigned members of the American Mathematical Society propose the name of

[Blank line]
as a candidate for the position of (check one):

- [ ] Vice-President
- [ ] Member-at-Large of the Council
- [ ] Member of the Nominating Committee


<table>
<thead>
<tr>
<th>Name and Address (printed or typed, or Notices mailing label)</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
V. N. Temlyakov, Approximation of periodic functions of several variables with bounded mixed derivative

1980 Mathematics Subject Classifications: 26, 35, 41, 42, 45 and others

Proceedings of the Steklov Institute
Volume 156, x + 285 pages (soft cover)
List price $86, institutional member $69,
Individual member $52
ISBN 0-8218-3017-1; LC 68-1677
Publication date: September 1983
To order, please specify STEKLO/156N

TRANSLATIONS OF MATHEMATICAL MONOGRAPHS
(ISSN 0065-9282)

Integral Representations and Residues in Multidimensional Complex Analysis
L. A. Aizenberg and A. P. Yuzhakov

Abstract
This book deals with integral representations of holomorphic functions of several complex variables, the multidimensional logarithmic residue, and the theory of multidimensional residues. Applications are given to implicit function theory, systems of nonlinear equations, computation of the multiplicity of a zero of a mapping, and computation of combinatorial sums in closed form. Certain applications in multidimensional complex analysis are considered.

The monograph is intended for specialists in theoretical and applied mathematics and theoretical physics, and for post graduate and graduate students interested in multidimensional complex analysis or its applications.

Contents
I. Integral representations and the logarithmic residue
II. Integral representations of special form for holomorphic functions
III. The theory of residues
IV. Applications to implicit functions, systems of nonlinear equations, computation of the multiplicity of a zero, and combinatorics
V. Some applications in multidimensional complex analysis

1980 Mathematics Subject Classifications: 32-02, 32A25, 32A27
Translations of Mathematical Monographs
Volume 58, x + 283 pages (hard cover)
List price $68, institutional member $54,
individual member $41
ISBN 0-8218-4511-X; LC 83-15549
Publication date: November 1983
To order, please specify MMONO/58N

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air 1st book $5, each add'l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
The eight hundred and seventeenth meeting of the American Mathematical Society will be held at the University of Illinois, Chicago, Illinois, on Friday and Saturday, March 22 and 23, 1985. All sessions will be held in the Lecture Center on the University campus.

Invited Address

By invitation of the Committee to Select Hour Speakers for Central Sectional Meetings, there will be four invited one-hour addresses. The speakers, their affiliations, the titles of their talks, and the scheduled times of presentation are as follows:

Graham Higman, University of Illinois, Urbana-Champaign, Infections in characteristic 2, 11:00 a.m. Saturday.

Michael Marcus, Texas A&M University, College Station, Random Fourier series, 1:30 p.m. Friday.

J. Marshall Osborn, University of Wisconsin, Madison, What are nonassociative algebras?, 1:30 p.m. Saturday.

Roger Penrose, Mathematical Institute, Oxford, England, and Rice University, Some results of twistor theory in general relativity, 11:00 a.m. Friday.

Special Sessions

By invitation of the same committee, there will be eight special sessions of selected twenty-minute papers. The topics of these special sessions, the names and affiliations of the organizers, and the final lists of speakers, are as follows:

Plethysms, Joseph Brennan, Michigan State University. The speakers will be Joseph P. Brennan, Young-Ming Chen, Peter Hoffman, Tadeusz Józefiak, Philbert A. Morris, Jiri Patera, Ronald C. Read, Frank Servedio, Jacob Towber and Hiroshi Uehara.


Mathematical computer science, Wolfgang Maass, University of Illinois at Chicago. The speakers will be Eric Bach, Joel Berman, Andreas R. Blass, Allan B. Borodin, John Case, Deborah S. Franzblau, Harvey Friedman, Merrick L. Furst, Yuri Gurevich, Kenneth Kunen, Jeffery S. Leon, Angus MacIntyre, Glenn K. Manacher, Vera Pless, Franco P. Preparata, and Georg Schnitger.

Stochastic analysis and related topics, Philip Protter, Purdue University. The speakers are Klaus Bichteler, Donald L. Burkholder, Erhan Cinlar, R. Dante DeBlassie, Allan Gut, Wolfgang Kliemann, Joanna B. Mitro, P. Ney, Steven Orey, Mark Pinsky, Philip Protter, and Thomas S. Salisbury.


Contributed Papers

There will also be five sessions for contributed ten-minute papers.

Registration

The meeting registration desk will be located in Room 120 Science and Engineering Offices Building. (Number 61 on the map.) The desk will be open from 8:30 a.m. to 3:30 p.m. on Friday, and from 8:30 a.m. to 11:00 a.m. on Saturday. The registration fees are $10 for members, $15 for nonmembers, and $5 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information can be found in a box on page 26 in the Anaheim meeting announcement in the January issue of the Notices.
Association for Women in Mathematics

The Association for Women in Mathematics (AWM) will have a luncheon meeting at 12:15 p.m. on Saturday at a restaurant in the University area. Information about the location and other details will be available at the AWM desk near the meeting registration desk in Room 120 Science and Engineering Offices Building.

Accommodations

A block of rooms is being held at the following location for participants attending the meeting. These rooms were to be held until February 21, after which reservations will be accepted on a space available basis. Participants should make their own arrangements directly with the hotel and be sure to mention the AMS meeting at UIC when making reservations. A daily buffet breakfast is complimentary for hotel guests; however, individuals are expected to pay the appropriate tax and gratuity.

Hyde Park Hilton
4900 S. Lake Shore Drive, Chicago 60615
Telephone: 312-288-5800

- Single $40 Double $46

The Hilton is several miles from the campus; however, complimentary limousine service is provided to and from McCormick Place as well as to and from the UIC campus. Parking is complimentary for hotel guests.

Rooms have not been blocked at any of the following locations, and they are listed here for information purposes. Participants should make their own arrangements directly with the hotel or motel of their choice and identify themselves as attending the AMS meeting at the University of Illinois when making reservations.

Americana Congress
520 S. Michigan Avenue, Chicago 60605
Telephone: 312-427-3800

- Single $40 Double $50

The Americana Congress is a mile and a half east of the campus.

Bismark Hotel
171 West Randolph, Chicago 60601
Telephone: 312-236-0123

- Single $32 Double $40

The Bismark is on the north side of the Loop, about two miles from campus.

Blackstone Hotel
636 S. Michigan Avenue, Chicago 60605
Telephone: 312-427-4300

- Single $42 Double $47

The Blackstone Hotel is about a mile and a half east of the campus.

Comfort Inn
506 W. Harrison Street, Chicago 60607
Telephone: 312-427-6969

- Single $35 Double $45

Comfort Inn (formerly Ramada Inn) is five blocks east of campus and just south of the Eisenhower Expressway.

Quality Inn
1 S. Halsted Street, Chicago 60606
Telephone: 312-829-5000

- Single $32 Double $38

Quality Inn (formerly Holiday Inn) is six blocks north of campus and just west of the Kennedy Expressway.

University of Illinois Housing Office
1933 West Polk Street, Chicago 60612
Telephone: 312-996-8100

- Single $36–40 Double $42–46

Reservations for University Housing Service guest rooms are handled by the Housing Office (Number 65 on the map); both are located on the west end of the campus (Health Sciences Center), a mile west of the University Center end of campus where the scientific sessions will take place. Shuttle buses run a continuous circuit between the east and west campus about every 20 minutes.

Food Service

The cafeteria in the Chicago Circle Center (Number 12 on the map) will be open on Friday from 7:30 a.m. until 2:00 p.m., but will not be open on Saturday. A few blocks north of the campus (on Halsted Street) is Greek Town, where several Greek restaurants are located. Immediately to the west of the campus are numerous Italian restaurants. Participants who wish to go into the Loop to eat should note that bus and subway transfers (10 cents in addition to the base 90 cents fare) are good for one hour and can be used for the return trip from the Loop.

Travel

The University of Illinois at Chicago University Center is located just west and south of the junction of the three major expressways: the Kennedy (I-90), Eisenhower (I-294), and Dan Ryan (I-94). Arriving by car from the north take I-90 to I-294 westbound and keep to the right. Take the first exit (Morgan Street) from I-294 and go one block south to the campus. From the south take the Dan Ryan (I-94) and exit at 1200 South (Roosevelt Road) or 1000 South (Taylor Street); go west one block on either Roosevelt or Taylor to the campus. From the west take the Eisenhower Expressway (I-294) to the Racine Avenue exit; go one-half block south to Harrison Street, then east one block to the campus. From the east take Harrison Street west to the campus.

If coming to the campus by bus, participants should use any of the following: No. 60 Blue Island–26th St.; No. 8 Halsted Street; No. 7 Harrison St.; No. 12 Roosevelt Road; or No. 37 Taylor Street.

The Halsted/University of Illinois stop on the route of the Douglas-Milwaukee-Congress elevated-subway trains is at the north edge of the campus in the middle of the Eisenhower Expressway (Number 25 on the map). Both the A and B trains stop at Halsted, which is the first stop above ground after the
authority buses and trains can be obtained by calling 312-836-7000. This line provides service all the way to O'Hare Airport; the trip from O'Hare to Halsted takes about 45 minutes. Information about the Chicago Transit Authority buses and trains can be obtained by calling 312-836-7000.

Trains of the Burlington Northern, Penn Central, Milwaukee Road and the Illinois Central Gulf railroads arrive at Chicago's Union Station, one mile north and east of the campus. Northwestern University trains arrive at the Northwestern railroads arrive at Chicago's Union 

street station. Rock Island trains arrive at the Rock Island trains arrive at Chicago's Union Station. Some Illinois Central, and all South Shore trains, arrive at the IC Station. From the station walk three blocks west to Dearborn Street and take a westbound A or B train on the Douglas-Congress Milwaukee subway to the Halsted/UIC station. Rock Island trains arrive at the LaSalle Street Station; take westbound subway at LaSalle and Congress to Halsted (second stop).

Elevated-subway trains run every 10 minutes from O'Hare Airport to the Loop, and the fare is 90 cents. Taxicabs charge about $20 for the trip from O'Hare to the Loop, and airport buses charge $6.75 for the same trip. C & W Limousine Service from O'Hare to the Hilton at Hyde Park is $7.50.

Parking
Visitors to the University may park in any one of the following cash lots; the fee is $3.

Lot 4: Garage on Halsted with entrances on Polk and Taylor Streets.

Lot 5C: Lot on Morgan Street near Roosevelt Road.

Lot 7: Garage between Morgan Street and Racine Avenue, with visitor's entrance on Harrison.

Participants driving to the campus should be aware that street parking in the residential area just west of the campus is restricted to area residents by special permit only.

Presenters of Papers

Numbers following the names indicate the speakers' positions on the program.

• Invited one-hour lecturer
• Special session speaker

Agarwal, A. K., 39
Anellis, I. H., 35
• Anellis, I. H., 112
Arasu, K. T., 48
• Arino, O., 64
• Armstrong, T. E., 75
• Aschbacher, M., 66
• Aspray, W., 54
• Babai, L., 145
• Bach, E., 72
• Baica, M., 38
Bankston, P., 51
• Bell, W. C., 80
• Berman, J., 103
• Berntfeld, S. R., 99
• Berrick, A. J., 87
• Bhaskara Rao, K. P. S., 24
• Richteler, K., 84
• Blass, A., 19
• Borodin, A. B., 102
• Brennan, J. P., 118
• Brooks, J. K., 19
• Brown, J. B., 25
• Burkholder, D. L., 128
• Case, J., 100
• Chen, Y.-M., 120
• Church, A., 140
• Cinlar, E., 81
• Corduneanu, C., 96
• Currey, B., 49
• Darrel, R. B., 78
• Dauben, J. W., 115
• Davis, M., 141
• Dawson, J. W., Jr., 53
• DeBiasio, R. D., 45
• Delgado, A. L., 67
• Deveney, J. K., 40
• Dinculeanu, N., 131
• Dudley, R. M., 108
• Dywer, W. G., 152
• Edgar, G. A., 132
• Fenton, W. E., 33
• Finke, A. M., 5
• Fransblau, D. S., 74
• Friedman, H., 21
• Furst, M. L., 101
• Gardiner, C. J., 91
• Gillet, H. A., 88
• Grayson, D. R., 149
• Green, J., 111
• Gurevich, Y., 20
• Gut, A., 125
• Haddock, J., 59
• Hall, J. L., 124
• Harary, F., 49
• Higman, G., 129
• Ho, C. Y., 68
• Hoffman, P., 139
• Houser, N., 110
• Huotari, R., 12
• Islam, M. N., 62
• Jardine, J. P., 150
• Johnson, R. A., 76
• Józefiak, T., 138
• Kang, S. L., 37
• Kass, S., 89
• Kenevan, J. R., 8
• Kishore, M., 36
• Kleene, S. C., 142
• Kleinnann, W., 83
• Komkov, V., 3
• Kunen, K., 23
• Lair, A. V., 9
• Langenhop, C. E., 58
• Leon, J. S., 71
• Levine, D. S., 61
• Levine, M., 86
• Liebler, R. A., 122
• Loud, W. S., 98
• MacIntyre, A., 22
• Mahfoud, W. E., 6
• Manacher, G. K., 73
• Marcus, M., 52
• Mason, C., 121
• Mauldin, D., 134
• Merritt, S. J., 2
• Miel, G., 18
• Miller, A. W., 27
• Mitro, J. B., 137
• Morgan, J. C., II, 28
• Morris, P. A., 135
• Mycielski, J., 114
• Nerode, A., 144
• N ey, P., 46
• O'Leary, D. J., 113
• Orey, S., 47
• Osborn, J. M., 130
• Ostaszewski, K., 15
• Paters, J., 119
• Payne, S. E., 148
• Peddada, S. D., 42
• Penrose, R., 51
• Peterson, A. C., 60
• Peterson, J. K., 63
• Pfeffer, W., F., 79
• Pinkus, M., 44
• Pless, V., 70
• Preparata, F. P., 69
• Prikry, K., 109
• Protter, P., 82
• Ramachandran, D., 106
• Ramakrishnan, S., 107
• Read, R. C., 198
• Rees, S., 123
• Ruitenbufn, W., 56
• Salisbury, T. S., 126
• Sankappanavar, H. P., 29
• Scanlon, J. C., 7
• Schnitger, G., 104
• Seifert, G., 4
• Senger, S., 34
• Servedio, F., 116
• Shaw, S-Y., 14
• Shiskowski, K., 90
• Shortt, R. M., 105
• Shult, E., 65
• Stiekes, D., 143
• Silva, C. E., 133
• Smith, K. W., 50
• Smorynski, C., 55
• Soare, R. L., 57
• Srebreny, M., 32
• Stone, A. H., 26
• Stone, D., 77
• Suroski, D. B., 147
• Thomason, R. W., 151
• Towber, J., 137
• Uhara, H., 117
• Upsham, M. H., 43
• Van Buskirk, J. M., 92
• Wang, L., 93
• Wang, M.-Q., 94
• Weber, J. S., 10
• Weibel, C. A., 85
• Weinberg, S. L., 11
• Weiss, R., 145
• Wen, S.-liang, 17
• Wilkinson, R. W., 13
• Wu, J., 95
• Yorke, M. F., 30
• Zhang, S., 97
• Zhicling, W., 1
Program of the Sessions

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

Abstracts of papers presented in AMS sessions at this meeting will be found in the March 1985 issue of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Friday, March 22, 1985, 8:00 a.m.

Special Session on Periodic and Almost Periodic Solutions to Differential Equations, I Lecture Center D4
8:00–8:20 (1) Periodic solutions of neutral integrodifferential equations. Preliminary report. Wang Zhicheng, Hunan University, People's Republic of China (817-34-60) (Sponsored by T. A. Burton)
8:25–8:45 (2) O-limits in a multi-parameter model of the immune response. Preliminary report. Stephen J. Merrill, Marquette University (817-34-41) (Sponsored by T. A. Burton)
8:50–9:10 (3) Singular perturbations near the zero of a leading coefficient for periodic solutions of a nonlinear equation. Vadim Komkov, Winthrop College (817-34-65)
9:15–9:35 (4) Nonlinear evolution equations with almost periodic time dependence. George Seifert, Iowa State University (817-34-76)
9:40–10:00 (5) Disconjugacy of periodic equations. A. M. Fink*, Iowa State University and S. B. Eliason, University of Oklahoma, Norman (817-34-66)
10:30–10:50 (7) Entrainment of frequency in singularly perturbed syste...
9:00–9:20 (20) Extensions of first-order logic by fixed point operators. YURI GUREVICH, University of Michigan, Ann Arbor (817-68-125) (Sponsored by Wolfgang Maass)

9:30–9:50 (21) Computational complexity of real functions. HARVEY FRIEDMAN, Ohio State University, Columbus (817-68-134)

10:00–10:20 (22) Relative effectiveness in the Siegel-Mahler Theorem. Preliminary report. ANGUS MACINTYRE, Yale University and University of Illinois, Urbana-Champaign (817-03-103)

10:30–10:50 (23) Quantifier elimination and automated deduction. Preliminary report. KENNETH KUNEN, University of Wisconsin, Madison (817-68-135)

Friday, March 22, 1985, 8:30 a.m.

Special Session on Borel Structures and Classical Measure Theory, I

Lecture Center D5


9:00–9:20 (25) Countable Baire order and singular sets. JACK B. BROWN, Auburn University, Auburn (817-28-04)


10:00–10:20 (27) Two remarks on Borel sets. ARNOLD W. MILLER, University of Texas, Austin (817-04-25)


Friday, March 22, 1985, 8:45 a.m.

Session on Set Theory

Lecture Center F4

8:45–8:55 (29) Heyting algebras with a dual lattice endomorphism. HANAMANTAGOUDA P. SANKAPPA NAVAR, State University of New York, New Paltz (817-03-139)

9:00–9:10 (30) Maximal p-subgroups and the axiom of choice. Preliminary report. PAUL E. HOWARD and MARY F. YORKE*, Eastern Michigan University (817-03-01)


9:30–9:40 (32) Measurability and the Baire property in higher levels. M. SREBRNY, Polish Academy of Sciences, Warsaw (817-03-54) (Sponsored by A. S. Kechris)


10:00–10:10 (34) Existential definability in, and undecidable extensions of, the theory of concatenation. Preliminary report. J. R. BUCHH, Purdue University, West Lafayette, and STEVEN SINGER*, University of Wisconsin, La Crosse (817-03-132)

10:15–10:25 (35) The Tarski algorithm for ORD. IRVING H. ANELLIS, University of Iowa (817-03-02)

Friday, March 22, 1985, 8:45 a.m.

Session on Algebra

Lecture Center F6

8:45–8:55 (36) Odd triperfect numbers are divisible by at least twelve distinct primes. MASAO KISHORE, East Carolina University (817-11-99)

9:00–9:10 (37) Integer division. SOO I. KANG, East Carolina University (817-11-131)

9:15–9:25 (38) Pythagorean triangles of equal area. Preliminary report. MALVINA BAICA, University of Wisconsin, Whitewater (817-11-84)


10:00–10:10 (41) The Kirillov correspondence for exponential solvable Lie groups: Application of Pedersen's character formula. Preliminary report. BRADLEY CURREY, Purdue University, West Lafayette (817-22-120)


10:30–10:40 (43) Serial rings with right Krull dimension one. MARY H. UPHAM, Southern Illinois University, Carbondale (817-16-90)
Friday, March 22, 1985, 9:00 a.m.

Special Session on Stochastic Analysis and Related Topics, I

Lecture Center F1

9:00– 9:20 (44) On non-euclidean harmonic measure. Mark Pinsky, Northwestern University (817-60-80)

9:30– 9:50 (45) Exit times from cones in $\mathbb{R}^3$ of Brownian motion. R. Dante deBlasi, Texas A&M University, College Station (817-60-57)

10:00–10:20 (46) Large deviations of Markov additive processes. P. Ney*, University of Wisconsin, Madisson, and E. Nummelin, University of Helsinki (817-60-100)

10:30–10:50 (47) Getting to zero fast (or slowly). Steven Orey, University of Minnesota, Minneapolis (817-60-137)

Friday, March 22, 1985, 9:30 a.m.

Session on Graph Theory

Lecture Center D1


9:45– 9:55 (49) On the euclidean dimensions of a wheel. Fred Buckley, Baruch College, City University of New York, and Frank Harary*, University of Michigan, Ann Arbor (817-05-119)

10:00–10:10 (50) Association schemes on the flags of a symmetric design. Ken W. Smith, Central Michigan University (817-05-128)

Friday, March 22, 1985, 11:00 a.m.

Invited Address

Lecture Center F6

11:00–12:00 (51) Some results of twistor theory in general relativity. Roger Penrose, Mathematical Institute, Oxford, England, and Rice University (817-83-97)

Friday, March 22, 1985, 1:30 p.m.

Invited Address

Lecture Center F6

1:30– 2:30 (52) Random Fourier series. Michael Marcus, Texas A&M University, College Station (817-60-109)

Friday, March 22, 1985, 3:00 p.m.

Special Session on History of Logic, I

Lecture Center F4

3:00– 3:20 (53) The reception of Gödel’s incompleteness theorems. John W. Dawson, Jr., Pennsylvania State University, York (817-01-48)

3:30– 3:50 (54) Oswald Veblen and the origins of mathematical logic in Princeton. Preliminary report. William Aspray, Charles Babbage Institute, Minneapolis (817-01-56) (Sponsored by Thomas L. Drucker)


4:30– 4:50 (56) Some aspects of changes in the use of intuitionistic logic. Preliminary report. Wim Ruitenburg, Marquette University (817-03-116)

5:00– 5:20 (57) Methods in recursion theory. Robert I. Soare, University of Chicago (817-03-70)

Friday, March 22, 1985, 3:00 p.m.

Special Session on Periodic and Almost Periodic Solutions of Differential Equations, II

Lecture Center D4


3:50– 4:10 (60) Comparison theorems for difference equations. Preliminary report. Allan C. Peterson, University of Nebraska, Lincoln (817-34-49)

4:15– 4:35 (61) Stable or semi-stable periodic solutions for a class of autonomous systems in $\mathbb{R}^3$. Preliminary report. Daniel S. Levine, University of Texas, Arlington (817-34-44)


211
On functional differential systems having as solutions sums of periodic functions with distinct periods. OVIDE ARINO, Faculté des Sciences, Pau, France (817-34-27) (Sponsored by T. A. Burton)

Friday, March 22, 1985, 3:00 p.m.

Special Session on Groups and Geometries, I

3:00–3:20 Gamma-spaces whose planes are affine. Preliminary report. ERNEST SHULT, Kansas State University (817-51-23) (Sponsored by Stephen D. Smith)

3:30–3:50 The 27 dimensional module for E8. Preliminary report. MICHAEL ASCHBACHER, California Institute of Technology (817-20-14)

4:00–4:20 Folding trees. ALBERTO L. DELGADO, Kansas State University (817-99-150)

4:30–4:50 Flag collineation groups and projective planes of square orders. CHAT Y. HO, University of Toronto (817-99-152) (Sponsored by Mark A. Ronan)

Friday, March 22, 1985, 3:00 p.m.

Special Session on Mathematical Computer Sciences, II

3:00–3:20 Some open problems in computational geometry. FRANCO P. PREPARATA, University of Illinois, Urbana-Champaign (817-68-142) (Sponsored by Wolfgang Maass)

3:30–3:50 Decoding the Golay codes. Preliminary report. VERA PLESS, University of Illinois, Chicago (817-68-83)

4:00–4:20 Permutation group algorithms based on partitions. Preliminary report. JEFFREY S. LEON, University of Illinois, Chicago (817-20-94) (Sponsored by Wolfgang Maass)

4:30–4:50 Factoring with cyclotomic polynomials. Preliminary report. ERIC BACH, University of Wisconsin, Madison (817-11-124) (Sponsored by Wolfgang Maass)

5:00–5:20 An efficient average-case algorithm for finding a maximum clique of intersecting chords. Preliminary report. GLENN K. MANACHER, University of Illinois, Chicago (817-68-136)

5:30–5:50 Greedy algorithms for covering polygons with rectangles. Preliminary report. DEBORAH S. FRANZBLAU, Massachusetts Institute of Technology (817-68-71)

Friday, March 22, 1985, 3:00 p.m.

Special Session on Borel Structures and Classical Measure Theory, II

3:00–3:20 Bayesian states on quantum logics. THOMAS E. ARMSTRONG*, University of Maryland, Baltimore County, and University of Minnesota, Minneapolis, and STANLEY GUDDER, University of Denver (817-28-07)

3:30–3:50 An exhaustive submeasure which dominates no nonzero measure. ROY A. JOHNSON, Washington State University (817-28-24)

4:00–4:20 Truncation and density for non-negative sequences. Preliminary report. DOROTHY STONE, University of Rochester (817-28-32)

4:30–4:50 Monotone L1-approximation on the unit n-cube. Preliminary report. RICHARD B. DARST*, Colorado State University, Fort Collins, and ROBERT HUOTARI, Indiana University-Purdue University, Fort Wayne (817-28-06)

5:00–5:20 A Riemann integral and the divergence theorem. WASHEK F. PFEFFER, University of California, Davis (817-28-33)

5:30–5:50 Compact sets of measures. Preliminary report. WAYNE C. BELL, University of Tennessee, Knoxville (817-28-87)

Friday, March 22, 1985, 3:00 p.m.

Special Session on Stochastic Analysis and Related Topics, II

3:00–3:20 A measure valued Markov process. Preliminary report. ERHAN CINLAR, Northwestern University (817-60-73)

3:30–3:50 A two-sided stochastic integral. Preliminary report. ETIENNE PARDOUX, Université de Provence, France, and PHILIP PROTTER*, Purdue University, West Lafayette (817-60-63)

4:00–4:20 Lyapunov exponents of linear stochastic systems. WOLFGANG KLIEMANN, Iowa State University (817-60-102) (Sponsored by Philip Protter)

4:30–4:50 Malliavin calculus with jumps. KLAUS BICHTELER, University of Texas, Austin (817-60-145)

Friday, March 22, 1985, 3:00 p.m.

Special Session on K-theory, I

3:00–3:20 Problem Session
3:00--4:00 (86) Localization sequences in algebraic K-theory. MARC LEVINE, Northeastern University (817-14-51) (Sponsored by Henri Gillet)

4:15--5:15 (87) Applications of a K"unneth formula trick to algebraic K-theory and homology of groups. Preliminary report. A. J. Berrick, National University of Singapore (817-55-77)

5:00--6:00 (88) Relative algebraic K-theory. Preliminary report. HENRI A. GILLET, University of Illinois, Chicago (817-14-29)

5:30--6:30 Problem Session

Friday, March 22, 1985, 3:00 p.m.

Session on Geometry

Lecture Center D2

3:00--3:10 (89) Collinearity and correlation. SEYMOUR KASS, University of Massachusetts, Boston (817-51-93)


3:45--3:55 (92) A version of the generalized Jones polynomial which is positive for positive knots. JAMES M. VAN BUSKIRK, University of Oregon, Eugene (817-57-121)

Saturday, March 23, 1985, 8:00 a.m.

Special Session on Periodic and Almost Periodic Solutions of Differential Equations, III

Lecture Center D4

8:00--8:20 (93) On steady-state oscillation of linear periodic dissipative systems with time slowly varying coefficients. Preliminary report. LIAN WANG* and MU-QIU WANG, Academia Sinica, People's Republic of China (817-34-52)

8:25--8:45 (94) On existence of periodic solution of large scale system. Preliminary report. MU-QIU WANG* and LIAN WANG, Academia Sinica, People's Republic of China (817-34-53)

8:50--9:10 (95) On stability and boundedness of nonautonomous systems. Preliminary report. LI SENLIN and JIANHONG WU*, Hunan University, People's Republic of China (817-34-59) (Sponsored by T. A. Burton)

9:15--9:35 (96) Periodic and almost periodic solutions to some nonconvolution integral equations. Preliminary report. C. CORDUNEANU, University of Texas, Arlington (817-45-114)

9:40--10:00 (97) Boundedness and periodicity in Volterra equations. Preliminary report. T. A. BURTON, Southern Illinois University, Carbondale, and SHUHANG CHANG*, Anhui University, People's Republic of China and Southern Illinois University, Carbondale (817-45-112)


10:30--10:50 (99) Bifurcation to periodic orbits and tori for ordinary differential systems. Preliminary report. STEPHEN R. BERNEFELD* and LUIGI SALVADORI, University of Texas, Arlington (817-34-67)

Saturday, March 23, 1985, 8:30 a.m.

Special Session on Mathematical Computer Sciences, III

Lecture Room F3

8:30--8:50 (100) Recursion theoretic learning theory. Preliminary report. JOHN CASE, State University of New York, Buffalo (817-68-110) (Sponsored by Wolfgang Maass)


9:30--9:50 (102) Overview of some open problems in algebraic and parallel complexity. ALLAN B. BORODIN, University of Toronto (817-68-143) (Sponsored by Wolfgang Maass)

10:00--10:20 (103) Generalized Boolean dependencies. Preliminary report. JOEL BERMAN* and W. J. BLOK, University of Illinois, Chicago (817-68-91)

10:30--10:50 (104) On some graph-theoretical problems arising in complexity theory. GEORG SCHRITGER, Pennsylvania State University and University of Chicago (817-68-129) (Sponsored by Tom Leighton)

Saturday, March 23, 1985, 8:30 a.m.

Special Session on Borel Structures and Classical Measure Theory, III

Lecture Center D5

8:30--8:50 (105) Notions of independence for random variables. Preliminary report. R. M. SHORTT, Michigan Technological University (817-60-08)
9:00–9:20 (106) On independent complements. D. Ramachandran, California State University, Sacramento (817-28-20)

9:30–9:50 (107) Disintegrations and perfect measures. A. Maitra, Indian Statistical Institute, Calcutta, and S. Ramakrishnan*, University of Miami (817-28-05) (Sponsored by R. M. Shortt)

10:00–10:20 (108) Perfect functions and Wichura's theorem. Preliminary report. R. M. Dudley, Massachusetts Institute of Technology (817-60-12)


Saturday, March 23, 1985, 8:30 a.m.

Special Session on History of Logic, II

8:30–8:50 (110) Peirce and the law of distribution. Nathan Houser, Indiana University-Purdue University, Indianapolis (817-01-62) (Sponsored by Thomas L. Drucker)

8:55–9:15 (111) The problem of elimination in the algebra of logic. Preliminary report. Judy Green, Rutgers University, Camden (817-01-122)

9:20–9:40 (112) The first Russell paradox. Irving H. Anellis, University of Iowa (817-01-37)


10:10–10:30 (114) Intuition versus computation in foundations of mathematics. Jan Mycielski, University of Colorado, Boulder (817-01-74)


Saturday, March 23, 1985, 8:55 a.m.

Special Session on Plethysms, I

8:55–9:15 (116) Multiplicities of $GL(V)$ in $S^t(S^r(V))$–Computation methods. Frank Servedio, Montclair State College (817-20-123)

9:20–9:40 (117) $\lambda$-operations in the representation of finite classical groups. Hiroshi Uehara, Oklahoma State University, Stillwater (817-05-38)

9:45–10:05 (118) The restriction of a plethysm to a Young subgroup. Joseph P. Brennan, Michigan State University (817-20-133)


10:35–10:55 (120) Algorithms for plethysm. Young-Ming Chen*, Western Illinois University, and A.M. Garsia and J. Remmel, University of California at San Diego, La Jolla (817-99-151)

Saturday, March 23, 1985, 9:00 a.m.

Special Session on Groups and Geometries, II

9:00–9:20 (121) Klein's correspondence and the ubiquity of translation planes. Geoffrey Mason, University of California, Santa Cruz (817-05-03) (Sponsored by Stephen D. Smith)

9:30–9:50 (122) On the nonexistence of certain geometries of hyperoctahedral type. Robert A. Liebler, Colorado State University, Fort Collins (817-51-26)

10:00–10:20 (123) The search for Tits geometries for the sporadic simple group $M_{12}$. Sarah Rees, University of Illinois, Chicago (817-20-40)


Saturday, March 23, 1985, 9:00 a.m.

Special Session on Stochastic Analysis and Related Topics, III

9:00–9:20 (125) A central limit theorem for certain stopped sums and some applications. Allan Gut, Uppsala University, Sweden, and Cornell University (817-60-50) (Sponsored by Philip Protter)

9:30–9:50 (126) An increasing diffusion. Thomas S. Salisbury, Purdue University, West Lafayette (817-60-64)

10:00–10:20 (127) A discontinuous time change for natural additive functionals which preserves duality. Joanna B. Mitro, University of Cincinnati (817-60-58)

10:30–10:50 (128) Sharp inequalities for stochastic integrals and the optimal control of martingales. Donald L. Burkholder, University of Illinois, Urbana-Champaign (817-60-96)
Saturday, March 23, 1985, 11:00 a.m.

Invited Address
Lecture Center F6
11:00–12:00 (129) Inflexions in characteristic 3. Grahm Higman, University of Illinois, Urbana-Champaign (817-20-149)

Saturday, March 23, 1985, 1:30 p.m.

Invited Address
Lecture Center F6
1:30– 2:30 (130) What are nonassociative algebras? J. Marshall Osborn, University of Wisconsin, Madison (817-17-30)

Saturday, March 23, 1985, 3:00 p.m.

Special Session on Borel Structures and Classical Measure Theory, IV
Lecture Center D5
3:00– 3:20 (131) A Radon-Nikodym theorem for vector valued processes with finite variation. Nicolae Dinculeanu, University of Florida (817-28-34)
3:30– 3:50 (132) Complex Martingale convergence. G. A. Edgar, Ohio State University, Columbus (817-28-21)
4:00– 4:20 (133) Radon-Nikodym derivatives and ergodic theorems. C. E. Silva, Williams College (817-28-13)
4:30– 4:50 (134) Random constructions: asymptotic geometric and topological properties. Dan Mauldin*, North Texas State University, and Stan Williams, Utah State University (817-28-47)
5:00– 5:20 Problem Session

Saturday, March 23, 1985, 3:00 p.m.

Special Session on Plethysms, II
Lecture Center, D2
3:00– 3:20 (135) On calculating plethysms. Philbert A. Morris, University of the West Indies, Trinidad and Tobago (817-20-140) (Sponsored by Harold Ramkissoon)
4:00– 4:20 (137) Shape-functors the plethysm $S^n S^2$, and James polynomials. Jacob Towber, Depaul University (817-15-11) (Sponsored by Joseph P. Brennan)
5:00– 5:20 (139) Adams operations on the projective representations of $S_n$ and $A_n$. Preliminary report. Peter Hoffman, University of Waterloo (817-20-141) (Sponsored by Joseph Brennan)

Saturday, March 23, 1985, 3:00 p.m.

Special Session on History of Logic, III
Lecture Center F4
3:00– 3:20 (140) Frege's distinction of sense and denotation of names and Russell's notion of proposition. Preliminary report. Alonso Church, University of California, Los Angeles (817-01-117)
3:30– 3:50 (141) Turing's work on computability and the history of computers. Martin Davis, Courant Institute of Mathematical Sciences, New York University (817-01-98)
4:00– 4:20 (142) The writing of "Introduction to Metamathematics". Stephen C. Kleene, University of Wisconsin, Madison (817-01-45)
5:00– 5:20 (144) The finite injury method of recursion theory. Anil Nerode, Cornell University (817-01-146)

Saturday, March 23, 1985, 3:00 p.m.

Special Session on Groups and Geometries, III
Lecture Center F6
3:00– 3:20 (145) Distance-transitive graphs. Richard Weiss, Tufts University (817-05-10)
3:30– 3:50 (146) Coherent configurations and asymptotic group theory. László Babai, University of Chicago and Eötvös University, Budapest (817-05-78) (Sponsored by Mark A. Ronan)
4:00– 4:20 (147) On a class of principal series unipotent representations of groups of type $B_n$. David B. Surowski, Kansas State University (817-20-85)
Special Session on K-theory, II

Saturday, March 23, 1985, 3:00 p.m.

Lecture Center D1


4:00–4:20 (151) Equivariant algebraic versus topological K-theory. Preliminary report. R. W. Thomason, Johns Hopkins University, Baltimore (817-14-16)


5:00–6:00 Problem Session

Combinatorics and Algebra

Curtis Greene, Editor

(Contemporary Mathematics. Volume 34)

This volume contains the Proceedings of the AMS-NSF Joint Summer Research Conference on Combinatorics and Algebra held at the University of Colorado during June 1983.

Although combinatorial techniques have pervaded the study of algebra throughout its history, it is only in recent years that any kind of systematic attempt has been made to understand the connections between algebra and combinatorics. This Conference drew together specialists in both algebra and combinatorics, and provided an invaluable opportunity for them to collaborate.

The topic most discussed was representation theory of the symmetric group and complex general linear group. The close connections with combinatorics, especially the theory of Young tableaux, was evident from the pioneering work of G. Frobenius, I. Schur, A. Young, H. Weyl, and D. E. Littlewood. Phil Hanlon gave an introductory survey of this subject, whose inclusion in this volume should make many of the remaining papers more accessible to a reader with little background in representation theory.

Ten of the papers impinge on representation theory in various ways. Some are directly concerned with the groups. Lie algebras, etc., themselves, while others deal with purely combinatorial topics which arose from representation theory and suggest the possibility of a deeper connection between the combinatorics and the algebra.

The remaining papers are concerned with a wide variety of topics. There are valuable surveys on the classical subject of hyperplane arrangements and its recently discovered connections with lattice theory and differential forms, and on the surprising connections between algebra, topology, and the counting of faces of convex polytopes and related complexes. There also appears an instructive example of the interplay between combinatorial and algebraic properties of finite lattices, and an interesting illustration of combinatorial reasoning to prove a fundamental algebraic identity.

In addition, a highly successful problem session was held during the conference: a list of the problems presented appears at the end of the volume.

Papers are included by the following:

Eiichi Bannai
Margaret M. Bayer
Louis J. Billera
Anders Björner
Gian Carlo Rota
Y. M. Chen
Paul Edelman
A. M. Garsia
Ira M. Gessel
Curtis Greene
Phil Hanlon

N. Metropolis
Peter Orlik
Amitai Regev
J. Remmel
Jeffrey B. Remmel
Louis Solomon
Richard P. Stanley
Dennis Stanton
Hiroaki Terao
Michelle Wachs
Dennis E. White

1980 Mathematics Subject Classifications:
05A15, 05A17, 05A19, 20C30, 22E46
ISBN 0-8218-5029-6, LC 84-18608
ISSN 0271-4132
x + 318 pages (softcover), December 1984
List price $30; institutional member $24,
Individual member $18
Shipping and handling charges must be added
To order, please specify CONM/34N

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air, 1st book $5, each add'l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
The eight hundred eighteenth meeting of the American Mathematical Society will be held at the University of Arizona, Tucson, on Friday and Saturday, April 12 and 13, 1985. This meeting will be held in conjunction with meetings of the Mathematical Association of America (MAA) and the Sociedad Matematica Mexicana (SMM).

Invited Addresses

By invitation of the Committee to Select Hour Speakers for Far Western Sectional Meetings, there will be two invited one-hour addresses. The speakers and the titles of their talks are:

GEORGE M. BERGMAN, University of California, Berkeley, *Representable functors among categories of algebras*.

GREGORY BRUMFIELD, Stanford University, *Modern real algebra*.

Special Sessions

By invitation of the same committee, there will be four special sessions of selected twenty-minute papers. The topics of these special sessions, names of the organizers, and final lists of speakers, are as follows:


*The arithmetic of algebraic function fields of one variable*, DANIEL J. MADDEN, University of Arizona. The speakers are Michael D. Fried, Gerhard Frey, David M. Goss, David R. Hayes, Michael I. Rosen, Robert Alan Wake, and Horst H. Zimmer.

*Galois module structure of algebraic number fields*, ALBRECHT FRÖHLICH, King's College, University of London, England, and the University of Arizona. The speakers are Stephen U. Chase, Lindsay N. Childs, Ted Chinburg, Gary Cornell, Kurt Foster, Donald E. Maurer, Leon R. McCulloh, Olga Taussky-Todd, Martin Taylor, Stephen V. Ullom, and Stephen B. Watt.

*New ideas in nonlinear science*, ALAN C. NEWELL, University of Arizona. The speakers are Gregory Baker, J. Doyne Farmer, F. C. Hoppensteadt, Christopher Jones, and Maciej Wojtkowski.

Contributed Papers

There will also be a session for contributed ten-minute papers on Saturday morning.

MAA Program

The MAA Program will include two invited speakers. At the Friday evening banquet, IVAN NIVEN of the University of Oregon, President of the MAA, will deliver an address titled *Some observations on mathematics and mathematicians*. CONSTANCE REID, San Francisco, will deliver an address, the title of which will be announced at the meeting. In conjunction with the Sociedad Matematica Mexicana, a panel discussion on *The history of the mathematical relations between Mexico and the United States* will also take place.

Registration

The meeting registration desk will be located in Mathematics 402, and will be open from 9:00 a.m. to noon and 1:00 p.m. to 5:00 p.m. on Friday, and from 9:00 a.m. until noon on Saturday. The registration fees are $6 for members of the AMS, MAA, or SMM, $8 for nonmembers, and $2 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about the petition table can be found in a box on page 26 in the Anaheim meeting announcement in the January issue of the Notices.

Accommodations

The following motels are located five miles or less from the campus. Participants should make their own reservations directly with the motel of their choice. Rates are subject to possible change, and do not include any applicable local taxes.

**Arizona Inn** (One mile from campus)
2200 East Elm Street 85719
Telephone: 602-325-1541
Toll free in Arizona: 800-421-1093

- Single $75 and up
- Double $80 and up

Limousine fare from the airport to motel is $5 per person.

**Motel 6** (Five miles from campus)
960 South Freeway 85745
Telephone: 602-624-6345

- Single $16.95
- Double $20.95

Limousine fare from the airport to motel is approximately $5.25 per person.

**Santa Rita Hotel and Conference Center**
(Two miles from campus)
88 East Broadway 85701
Telephone: 602-791-7581 or toll free 800-528-3444
Toll free in Arizona: 800-362-3470

- Single $34
- Double $38

Complimentary limousine service from airport to the hotel. Limousine service also provided between hotel and campus; the fare is $1.50 per person. A welcome reception with complimentary margarita cocktails and dry snacks will be provided for hotel guests at
poolside from 8:30 to 9:30 p.m. on Thursday, April 11.

Western 6 (Five miles from campus)  
1338 West Grant Road 85745  
Telephone: 602-622-4784

Single $21.95  Double $25.95
Limousine fare from airport to motel is $6.25 per person. Limousine service also available between motel and campus.

Food Service
Restaurants in the Student Union will be open during both days of the meeting. In addition, there are several restaurants within three blocks of the Mathematics Department.

Social
A banquet will be held at 7:00 p.m. on Friday in the Fiesta Room at the Santa Rita Hotel and Conference Center. The cost for the prime rib dinner will be $13 per person. Preceding the banquet there will be a no-host cash bar beginning at 6:00 p.m. Reservations and payment for the banquet should be sent by March 15 to William Y. Velez, Department of Mathematics, University of Arizona, Tucson, Arizona 85721.

Travel
Tucson is served by Greyhound and Trailways bus lines. The air carriers serving the Tucson Airport include Aero Mexico, Airways of New Mexico, American, American West, Eastern, Frontier, Northwest, PSA, Republic, Sun World, TWA, USAir, United, and Western Airlines. Arizona Stagecoach Limousine Service provides transportation between the airport and the university; the fare is approximately $5.25 per person. By reservation, Arizona Stagecoach will also transport participants from hotels to the university or back to the Tucson Airport. These reservations are required 24 hours in advance; the telephone number to call is 602-889-9681.

The University of Arizona campus is situated to the east of Interstate Route #10 (I-10), which runs from north to south. Drivers entering Tucson from either direction should take the Speedway Boulevard Exit and travel east for a distance of approximately two miles until reaching Euclid Avenue. Make a right turn onto Euclid Avenue; at the second traffic light turn left onto Sixth Street and proceed four blocks until reaching Santa Rita Avenue. A left turn at Santa Rita Avenue will lead directly to the Mathematics Building, a right turn will lead to the on-street parking, or drivers can continue on Sixth Street and make a left turn onto Highland Avenue. The latter will lead directly to the pay parking lot adjacent to the Science Library.

Parking
Free parking is available in the pay parking lots adjacent to the Science Library, or off Second Street north of the Administration Building. In order to obtain free parking, drivers must identify themselves to the attendants as participants at the AMS meeting. On-street parking is also available approximately three to four blocks directly south of the Mathematics Building.

Presenters of Papers
Numbers following the names indicate the speakers’ positions on the program.  
*Invited one-hour lecturer  +Special session speaker

Program of the Sessions

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

Abstracts of papers presented in AMS sessions at this meeting will be found in the March 1985 issue of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Friday, April 12, 1985, 8:30 a.m.

<table>
<thead>
<tr>
<th>Special Session on the Arithmetic of Algebraic Function Fields of One Variable</th>
<th>Mathematics 609</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30– 8:50 (1) A quantitative theory of “bad primes” for arithmetic statements based on Euler factors. <strong>MICHAEL D. FRIED</strong>, University of California, Irvine (818-12-04)</td>
<td></td>
</tr>
<tr>
<td>9:00– 9:20 (2) On the strong Lefschetz principle for function fields. <strong>GERHARD FREY</strong>, Universität des Saarlandes, West Germany (818-14-21) (Sponsored by Daniel J. Madden)</td>
<td></td>
</tr>
<tr>
<td>9:30– 9:50 (3) Global class field theory for function fields of characteristic zero. <strong>ROBERT ALAN WAKE</strong>, University of California, Santa Cruz (818-12-35)</td>
<td></td>
</tr>
<tr>
<td>10:00–10:20 (4) Special values of abelian L-functions in function fields. Preliminary report. <strong>DAVID R. HAYES</strong>, University of Massachusetts, Amherst (818-12-26) (Sponsored by Daniel J. Madden)</td>
<td></td>
</tr>
<tr>
<td>10:30–10:50 (5) P-class groups of curves in characteristic-p. <strong>DAVID M. GOSS</strong>, Ohio State University, Columbus (818-12-51)</td>
<td></td>
</tr>
<tr>
<td>11:00–11:20 (6) Fourier series and special values of L-functions. <strong>BENEDICT H. GROSS</strong> and <strong>MICHAEL I. ROSEN</strong>*, Brown University (818-11-45)</td>
<td></td>
</tr>
<tr>
<td>11:30–11:50 (7) Torsion groups of elliptic curves over quadratic fields. Preliminary report. <strong>HANS H. MÜLLER</strong> and <strong>HORST G. ZIMMER</strong>*, University of the Saarland, West Germany (818-11-20) (Sponsored by Daniel J. Madden)</td>
<td></td>
</tr>
</tbody>
</table>

Friday, April 12, 1985, 12:30 p.m.

<table>
<thead>
<tr>
<th>MAA Invited Address</th>
<th>Mathematics 501</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:30– 1:30 Title to be announced. <strong>CONSTANCE REID</strong>, San Francisco, California</td>
<td></td>
</tr>
</tbody>
</table>

Friday, April 12, 1985, 1:40 p.m.

<table>
<thead>
<tr>
<th>Special Session on Galois Module Structure of Algebraic Number Fields, I</th>
<th>Mathematics 714</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:40– 2:00 (8) Group laws and rings of integers. <strong>MARTIN TAYLOR</strong>, Trinity College, United Kingdom (818-11-13) (Sponsored by Albrecht Frohlich)</td>
<td></td>
</tr>
<tr>
<td>2:05– 2:25 (13) Generalized direct summands in an abelian category. <strong>TEMPLE H. FAY</strong>*, University of Southern Mississippi, and <strong>MARIUS J. SCHREGER</strong>, University of Pretoria, Republic of South Africa (818-20-02)</td>
<td></td>
</tr>
<tr>
<td>2:30– 2:50 (14) Irreducible groups, fields of definition and E-rings. <strong>CHARLES VINSCHNHALER</strong> and <strong>WILLIAM WICKLESS</strong>*, University of Connecticut, Storrs (818-20-03)</td>
<td></td>
</tr>
<tr>
<td>3:00– 3:30 (10) Multiplicator free groups. Preliminary report. <strong>STEPHEN V. ULLOM</strong>, University of Illinois, Urbana-Champaign (818-12-19)</td>
<td></td>
</tr>
<tr>
<td>3:40– 4:10 (11) Ideal matrices for normal fields. <strong>OLGA TAUSKSY-TODD</strong>, California Institute of Technology (818-11-22)</td>
<td></td>
</tr>
</tbody>
</table>

Friday, April 12, 1985, 1:40 p.m.

<table>
<thead>
<tr>
<th>Special Session on Abelian Group Theory, I</th>
<th>Mathematics 609</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:40– 2:00 (12) Countable N0-indecomposable mixed abelian groups of finite torsion-free rank. <strong>SAHARON SHELAH</strong>, Hebrew University, Jerusalem, and <strong>ALEXANDER SOIFER</strong>*, University of Colorado, Colorado Springs (818-20-01)</td>
<td></td>
</tr>
<tr>
<td>2:30– 2:50 (14) Irreducible groups, fields of definition and E-rings. <strong>CHARLES VINSCHNHALER</strong> and <strong>WILLIAM WICKLESS</strong>*, University of Connecticut, Storrs (818-20-03)</td>
<td></td>
</tr>
<tr>
<td>2:55– 3:15 (15) On essentially finitely indecomposable Abelian p-groups. <strong>JOHN IRWIN</strong>*, Wayne State University, and <strong>DOYLE CUTLER</strong>, University of California, Davis (818-20-05) (Sponsored by Togo Nishiura)</td>
<td></td>
</tr>
<tr>
<td>3:45– 4:05 (17) Stable augmentation quotients of abelian groups. <strong>ALFRED W. HALES</strong>, University of California, Los Angeles (818-20-07)</td>
<td></td>
</tr>
</tbody>
</table>
Friday, April 12, 1985, 4:20 p.m.

AMS Invited Address
Mathematics 501
4:20–5:20 (18) Modern real algebra. GREGORY BRUMFIELD, Stanford University (818-12-39)

Friday, April 13, 1985, 6:00 p.m.

Banquet and MAA Special Address
Fiesta Room, Santa Rita Hotel and Conference Center
6:00– No host bar
7:00– Banquet
Some observations on mathematics and mathematicians, IVAN NIVEN, University of Oregon

Saturday, April 13, 1985, 8:00 a.m.

Special Session on Abelian Group Theory, II
Biology West 210
8:00–8:20 (19) Immediate subgroups of totally projective Abelian groups. PATRICK W. KEEF, Whitman College (818-20-08)
8:25–8:45 (20) Strongly homogeneous torsion-free abelian groups and generalizations. JUTTA HAUSEN, University of Houston, University Park (818-20-09)
8:50–9:10 (21) Pure projective resolutions in the category of p-primary abelian groups. DOYLE CUTLER, University of California, Davis (818-20-10)
9:15–9:35 (22) Modules with the summand intersection property. GEORGE V. WILSON, University of Georgia (818-20-11)
9:40–10:00 (23) Torsion-free E-modules. C. VINSONHALER, University of Connecticut, Storrs (818-20-12)
10:30–10:50 (25) Properties of IT-groups, pseudo d.s.c.'s, and the classification problem. PAUL HILL*, Auburn University, Auburn, and CHARLES MEGIBBEN, Vanderbilt University (818-20-16) (Sponsored by Ross Beaumont)
10:55–11:15 (26) On c-valued groups and the equivalence of IT-groups. PAUL HILL, Auburn University, Auburn, and CHARLES MEGIBBEN*, Vanderbilt University (818-20-18) (Sponsored by Ross Beaumont)
11:20–11:40 (27) Endomorphism rings of abelian groups. ULRICH ALBRECHT, Auburn University, Auburn (818-20-14)

Saturday, April 13, 1985, 8:00 a.m.

Special Session on the Galois Module Structure of Algebraic Number Fields, II
Biology West 212
8:00–8:30 (28) Root numbers and Galois module structure. Preliminary report. TED CHINBURG, University of Pennsylvania (818-11-23)
8:35–9:05 (29) Tame Hopf objects and local normal bases. LINDSAY N. CHILDs, State University of New York, Albany (818-13-24)
9:10–9:40 (30) Base-change formulae in Galois module structure and class field theory. Preliminary report. STEPHEN U. CHASE, Cornell University (818-11-25) (Sponsored by Albrecht Fröhlich)
9:45–10:15 (31) Distribution of Galois module classes. Preliminary report. KURT FOSTER, University of Illinois, Urbana-Champaign (818-11-29)
10:55–11:25 (33) Relative genus theory and a class number problem for imaginary quadratic number fields. STEPHEN B. WATT, University of Iowa (818-12-31)
11:30–12:00 (34) Abelian p-extensions of Q. GARY CORNELL*, University of Connecticut, Storrs, and MICHAEL ROSEN, Brown University (818-11-46)

Saturday, April 13, 1985, 8:40 a.m.

Special Session on New Ideas in Nonlinear Science
Mathematics 714
10:00–10:30 (37) The Maslov index and the nonlinear Schroedinger equation. Preliminary report. CHRISTOPHER JONES, University of Arizona (818-35-48)

10:40–11:10 (38) Principles for the design of billiards with nonvanishing Lyapunov exponents. MACIEJ WOJTKOWSKI, University of Arizona (818-58-40)

11:20–11:50 (39) Some aspects to the numerical solution of nonlinear boundary-value problems. GREGORY BAKER, University of Arizona (818-65-47) (Sponsored by Alan C. Newell)

**Saturday, April 13, 1985, 8:40 a.m.**

<table>
<thead>
<tr>
<th>Session for Contributed Papers</th>
<th>Biology West 219</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:40– 8:50 (40) Boundary values of generalizations of $H^p$ functions in tubes. Preliminary report. RICHARD D. CARMICHAEL, New Mexico State University, Las Cruces, and Wake Forest University (818-32-49)</td>
<td></td>
</tr>
<tr>
<td>9:00– 9:10 (41) Comparison of convergence rates for Newton's method and power series solutions of Ricatti's equation. Preliminary report. STANLEY R. LENIHAN, U.S. Army Yuma Proving Ground (818-34-37)</td>
<td></td>
</tr>
<tr>
<td>9:20– 9:30 (42) Stability criteria for conjugate points of indefinite second order differential systems. Preliminary report. KURT KREITH, University of California, Davis (818-34-41)</td>
<td></td>
</tr>
<tr>
<td>9:40– 9:50 (43) On indecomposable projective modules. JOHN D. O'NEILL, University of Detroit (818-16-42)</td>
<td></td>
</tr>
<tr>
<td>10:00–10:10 (44) The d.g. near-ring generated by the endomorphisms of a one dimensional noncommutative formal group law. Preliminary report. JAMES R. CLAY, University of Arizona (818-16-50) (Sponsored by Albrecht Fröhlich)</td>
<td></td>
</tr>
<tr>
<td>10:20–10:30 (45) On graphs with signed inverses. FRED BUCKLEY, Baruch College, City University of New York, and FRANK HARARY*, University of Michigan, Ann Arbor (818-05-43)</td>
<td></td>
</tr>
<tr>
<td>10:40–10:50 (46) Symmetric media are embeddable in distributive lattices. ARTHUR KNOEBEL, New Mexico State University, Las Cruces (818-06-44)</td>
<td></td>
</tr>
</tbody>
</table>

**Saturday, April 13, 1985, 1:30 p.m.**

<table>
<thead>
<tr>
<th>AMS Invited Address</th>
<th>Mathematics 501</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30– 2:30 (47) Representable functors among categories of algebras. GEORGE M. BERGMAN, University of California, Berkeley (818-08-52)</td>
<td></td>
</tr>
</tbody>
</table>

**Saturday, April 13, 1985, 2:40 p.m.**

<table>
<thead>
<tr>
<th>Special Session on Abelian Group Theory, III</th>
<th>Biology West 210</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:40– 3:00 (48) When two groups always have the same group of extensions. Preliminary report. H. PAT GOETERS, Fairfield University (818-20-28) (Sponsored by William J. Wickless)</td>
<td></td>
</tr>
<tr>
<td>3:10– 3:30 (49) Balanced projectives and axiom 3. MARK LANE, Vanderbilt University (818-20-17) (Sponsored by Ross Beaumont)</td>
<td></td>
</tr>
<tr>
<td>3:35– 3:55 (50) Simply presented valued groups. Preliminary report. ROGER HUNTER*, FRED RICHMAN and ELBERT WALKER, New Mexico State University, Las Cruces (818-20-33)</td>
<td></td>
</tr>
<tr>
<td>4:00– 4:20 (51) One dimensional rings. Preliminary report. ROBERT B. WARFIELD, JR., University of Washington (818-16-34)</td>
<td></td>
</tr>
<tr>
<td>4:25– 4:45 (52) Some remarks on Warfield duality. Preliminary report. J. D. REID, Wesleyan University (818-20-36)</td>
<td></td>
</tr>
</tbody>
</table>

Salt Lake City, Utah
Worcester, April 20–21, 1985, College of the Holy Cross

Program for the 819th meeting

The eight hundred and nineteenth meeting of the American Mathematical Society will be held at the College of the Holy Cross in Worcester, Massachusetts, on Saturday and Sunday, April 20 and 21, 1985. The scientific sessions will be held in Haberlin Hall and in Swords Hall, the new science and mathematics complex at the College.

Invited Addresses

By invitation of the Committee to Select Hour Speakers for Central Sectional Meetings, there will be four invited one-hour addresses. These invited addresses will be presented in Room 103 Haberlin Hall. The speakers, their affiliations, the titles of their talks, and the scheduled times of presentation are as follows:

**WILLIAM ABBIKOFF**, University of Connecticut, Storrs, *Kleinian groups—an invitation to mathematics*, 1:30 p.m. Saturday.

**IRA M. GESSEL**, Brandeis University, *Recent work in enumerative combinatorics*, 11:00 a.m. Sunday.

**ROBERT W. THOMASON**, Johns Hopkins University, *Algebraic and topological *K*-theory*, 1:30 p.m. Sunday.

**STEPHEN S.-T. YAU**, University of Illinois at Chicago and Yale University, *Isolated singularities and finite dimensional solvable Lie algebras*, 11:00 a.m. Saturday.

Special Sessions

By invitation of the same committee, there will be six special sessions of selected twenty-minute papers. The topics of these special sessions, names of the organizers, and final lists of speakers, are as follows:


*Singularities and complex geometry*, **THOMAS E. CECIL** and **STEPHEN S.-T. YAU**. The speakers will be Shreeram Abhyankar, Max Benson, Denis Blackmore, Alan Durfee, Robert Ephraim, Yih-Nan Gau, Anatoly S. Libgober, T. T. Moh, Peter Orlik, Donal B. O'Shea, Mark Spivakovsky, Alphonse T. Vasquez, and Bun Wong.


Contributed Papers

There will also be sessions for contributed ten-minute papers on Saturday afternoon and Sunday morning.

Council

The Council of the Society will meet at 1:00 p.m. on Friday, April 19, in Room A or B at the Howard Johnson's Motor Lodge which is adjacent to the Holy Cross campus.

Registration

The meeting registration desk will be located in Haberlin or Swords Hall, and signs will be posted directing participants to the registration area. The desk will be open from 8:00 a.m. until 3:00 p.m. on Saturday, and from 8:00 a.m. to 11:00 a.m. on Sunday. The registration fees are $10 for members, $16 for nonmembers, and $5 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about the petition table can be found on page 26 in the Anaheim meeting announcement in the January issue of the Notices.

Accommodations

Rooms have been blocked at the Howard Johnson’s Motor Lodge adjacent to the campus, and at the Quality Inn which is about a mile from the campus in downtown Worcester. Participants should make their own reservations directly with the motel of their choice and identify themselves as attending the meeting of the American Mathematical Society at

223
the College of the Holy Cross. The cutoff date for reservations at these two locations was **February 15.** The rates listed below are subject to change and do not include applicable taxes.

**Howard Johnson’s Motor Lodge**
800 Southbridge Street  
Worcester, MA 01610  
Telephone: 617-791-5501

- Single $41  
- Double $51

**Quality Inn**
70 Southbridge Street  
Worcester, MA 01610  
Telephone: 617-791-2291

- Single $42  
- Double $48

The following motels are located between two and five miles from campus. Although rooms have not been blocked at any of these locations, they are included here for information purposes.

**Best Western Centrum Inn**
110 Summer Street  
Worcester, MA 01610  
Telephone: 617-757-0400

- Single $45  
- Double $51

**Days Lodge of Worcester**
50 Oriol Drive  
Worcester, MA 01610  
Telephone: 617-852-2800

- Single $42.88  
- Double $47.88

**Howard Johnson’s Motor Lodge**
West Boylston Street  
West Boylston, MA 01583  
Telephone: 617-835-4456

- Single $47  
- Double $54

**Sheraton – Lincoln Inn**
500 Lincoln Street  
Worcester, MA 01610  
Telephone: 617-852-4000

- Single $67–$73  
- Double $76–$81

**Worcester Marriott**
10 Lincoln Square  
Worcester, MA 01610  
Telephone: 617-791-1600

- Single $77  
- Double $89

**Yankee Budget Motor Lodge**
551 Lincoln Street  
Worcester, MA 01610  
Telephone: 617-852-5800

- Single $26.96  
- Double $30.94

**Yankee Drummer Inn**
624 Southbridge Street  
Auburn, MA 01501  
Telephone: 617-832-3221

- Single $49.90  
- Double $52.90

---

**Food Service**

A variety of options are available for luncheon in Hogan Center on Saturday and Sunday. A special section in the Center will be designated as the dining area for meeting participants, where meal service is cafeteria-style. Those who prefer to do so may wish to eat at Kimball Hall instead. Information about various restaurants in the Worcester area will be available at the meeting registration desk.

**Social Event**

A beer and pizza party will take place on Saturday evening in the atrium between Haberlin and Swords Halls. Although beer and soft drinks may be purchased on a cash basis during the party, participants must order and pay for their pizza at the meeting registration desk before 3:00 p.m. on Saturday.

**Travel**

The Worcester Airport is located about five miles from the Holy Cross campus. Airline service to Worcester is provided by Bar Harbor Airlines, with flights from Logan Airport in Boston and Laguardia Airport in New York. Tri State Airlines also provides service from Newark Airport, however, service on both of these carriers is very limited or nonexistent on Saturday and Sunday. Participants who fly to Logan Airport should make use of the Worcester Limousine Service, which will transport passengers directly to the campus or elsewhere in Worcester. The cost is $18 each way, but reduced rates usually apply when two or more passengers are transported to the same destination in Worcester. **Reservations are necessary** and may be obtained by calling 617-756-4834; at the same time information will be provided concerning passenger pickup at Logan.

Worcester is also served by both Greyhound and Trailways bus lines. The bus station is about one mile from the campus. Taxicab service is available from the bus station, and the cost for transportation to the campus is approximately $3.

Participants driving to the meeting should use Auburn Exit No. 10 from the Massachusetts Turnpike, then take Route 290 East to Worcester. The College Square Exit from Route 290 is a block from the campus.

**Parking**

Free parking is available at several lots located on the Holy Cross campus.
Program of the Sessions

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

Abstracts of papers presented in AMS sessions at this meeting will be found in the March 1985 issue of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Saturday, April 20, 1985, 9:00 a.m.

Special Session on Geometric Function Theory, I

Haberlin Hall, Room 236

9:00-9:20 (1) Quadratic vector classes on Riemann surfaces. Eric Robert Jablow, State University of New York, Stony Brook (819-30-22)


10:00-10:20 (3) Accessory parameters for punctured spheres. Preliminary report. Irwin Kra, State University of New York, Stony Brook (819-30-39)

10:30-10:50 (4) Schoenflies theorem for plane quasiregular homeomorphisms. Frederick W. Gehring, University of Michigan, Ann Arbor (819-30-19)

Saturday, April 20, 1985, 9:00 a.m.

Special Session on Differential Geometry of Submanifolds, I

Haberlin Hall, Room 412

9:00-9:20 (5) Isoparametric hypersurfaces. Preliminary report. Patrick J. Ryan, McMaster University (819-53-49)


10:00-10:20 (7) Dupin hypersurfaces. Thomas E. Cecil, College of the Holy Cross (819-53-52)

10:30-10:50 (8) New tight polyhedra in 3-space. Thomas F. Banchoff, Brown University (819-53-84)

Saturday, April 20, 1985, 9:00 a.m.

Special Session on Singularities and Complex Geometry, I

Haberlin Hall, Room 408

9:00-9:20 (9) Topology of quasi-ordinary singularities. Yih-Nan Gau, Rutgers University, New Brunswick (819-32-28)

9:30-9:50 (10) Mixed Hodge structure on certain homotopy groups. Preliminary report. Anatoly S. Libgober, University of Illinois, Chicago (819-14-37)

10:00-10:20 (11) The Betti numbers of an algebraic variety. Alan Durfee, Mount Holyoke College (819-14-12)

10:30-10:50 (12) Jacobian conjecture. Preliminary report. T. T. Moh, Purdue University, West Lafayette (819-14-54)

Saturday, April 20, 1985, 9:00 a.m.

Special Session on Enumerative Combinatorics, I

Swords Hall, Room 312


9:30-9:50 (14) On an inclusion-exclusion formula based on the reflection principle. T. Watanabe, Gifu University, Japan, and S. G. Mohanty*, McMaster University (819-05-86) (Sponsored by Ira M. Gessel)

10:00-10:20 (15) Orthogonality in Sn. Preliminary report. Dennis White, University of Minnesota, Minneapolis (819-05-20)


Saturday, April 20, 1985, 9:00 a.m.

Special Session on Fractal Geometry, I

Haberlin Hall, Room 237

9:00-9:20 (17) Fractals constructed from paths in directed graphs. Preliminary report. William J. Gilbert, University of Waterloo (819-51-07)
9:30–9:50 (18) Estimation of the fractal dimension by packing the complementary set. Preliminary report. CLAUDE TRICOT, University of British Columbia (819-28-40) (Sponsored by Benoit B. Mandelbrot)

10:00–10:20 (19) Multiple points of Brownian motion. NILS TONGLING, Yale University (819-60-90) (Sponsored by Benoit B. Mandelbrot)

10:30–10:50 (20) The use of packing measure to define a fractal index. S. JAMES TAYLOR, University of Virginia (819-60-10)

Saturday, April 20, 1985, 11:00 a.m.

Invited Address Haberlin Hall, Room 103
11:00–12:00 (21) Isolated singularities and finite dimensional solvable Lie algebras. STEPHEN S.-T. YAU, Yale University and University of Illinois, Chicago (819-32-60)

Saturday, April 20, 1985, 1:30 p.m.

Invited Address Haberlin Hall, Room 103
1:30–2:30 (22) Kleinian groups—an invitation to mathematics. WILLIAM ABIKOFF, University of Connecticut, Storrs (819-30-71)

Saturday, April 20, 1985, 2:45 p.m.

Special Session on Geometric Function Theory, II Haberlin Hall, Room 236
2:45–3:05 (23) On Sullivan’s proof of the finiteness theorem and the eventual periodicity theorem. LIPMAN BERS, Columbia University and Graduate Center, City University of New York (819-30-09)
3:15–3:35 (24) A finiteness theorem for a dynamical class of entire functions. LISA R. GOLDBERG, Brooklyn College, City University of New York, and LINDA KEEN*, Herbert H. Lehman College, City University of New York (819-30-34)
3:45–4:05 (25) Algebraic linearity for a surface diffeomorphism acting on simple curves. Preliminary report. JOAN BIRMAN, Columbia University, and CAROLINE SERIES*, University of Pennsylvania (819-30-81) (Sponsored by William Abikoff)
4:15–4:35 (26) Diophantine approximation on hyperbolic surfaces. ANDREW HAAS, University of Connecticut, Storrs (819-30-65)

Saturday, April 20, 1985, 2:45 p.m.

Special Session on Methods of K-theory, I Haberlin Hall, Room 414
2:45–3:05 (28) Cyclic homology and comodule structure. CHRISTIAN KASSEL, Institute for Advanced Study (819-18-11)
3:45–4:05 Problem Session

Saturday, April 20, 1985, 2:45 p.m.

Special Session on Differential Geometry of Submanifolds, II Haberlin Hall, Room 412
2:45–3:05 (31) 2-type hypersurfaces and applications. BANG-YEN CHEN, Michigan State University (819-53-03) (Sponsored by Thomas E. Cecil)
4:45–5:05 (34) Planar geodesic immersions in pseudo-Euclidean space. carol bloomstrom, Wellesley College (819-53-83)

Saturday, April 20, 1985, 2:45 p.m.

Special Session on Singularities and Complex Geometry, II Haberlin Hall, Room 408
2:45–3:05 (35) Singularities of basic invariants for reflection groups. PETER ORLIK* and LOUIS SOLOMON, University of Wisconsin, Madison (819-14-27)

226

3:45– 4:05 (37) Characteristic pairs. SHREERAM ABHYANKAR, Purdue University, West Lafayette (819-14-61)


4:45– 5:05 (39) Some results and counterexamples in complex differential geometry. BUN WONG, University of California, Riverside (819-32-70) (Sponsored by James Stafney)

Saturday, April 20, 1985, 2:45 p.m.

Special Session on Fractal Geometry, II Haberlin Hall, Room 237

2:45– 3:05 (40) Fractal interpolation. Preliminary report. MICHAEL BARNSLEY, Georgia Institute of Technology (819-26-80) (Sponsored by Stephen Demko)


3:45– 4:05 (42) On Devaney hairs and the rays of the Mandelbrot set of $z^2 + c$. JOHN H. HUBBARD, Cornell University (819-58-94) (Sponsored by Benoit B. Mandelbrot)

4:15– 4:35 (43) On the size of the Mandelbrot elephants. ADRIEN DOUADY, Université de Paris-Sud, France (819-58-93)

4:45– 5:05 Discussion

Saturday, April 20, 1985, 2:45 p.m.

Special Session on Enumerative Combinatorics, II Swords Hall, Room 312

2:45– 3:05 (44) The seventh order mock theta functions. GEORGE E. ANDREWS, Pennsylvania State University, University Park (819-05-43)

3:15– 3:35 (45) Elementary polytopes. GIL KALAI, Massachusetts Institute of Technology (819-52-85)

3:45– 4:05 (46) Bijective proofs of basic hypergeometric series identities. Preliminary report. J. JOCHI and D. STANTON*, University of Minnesota, Minneapolis (819-05-14)


4:45– 5:05 Problem Session

Saturday, April 20, 1985, 2:45 p.m.

Session on Geometry and Topology Swords Hall, Room 314


3:00– 3:10 (49) An example concerning strong extreme points. S. SWAMINATHAN, Dalhousie University (819-46-59)


3:30– 3:40 (51) Homeomorphic displacements and the infinitesimal pentagons. DOMINA EBERLE SPENCER, University of Connecticut, Storrs (819-53-78)

3:45– 3:55 (52) Geometric deformations of the evolution equations and Bäcklund transformations. BOHUML CENKL, Northeastern University (819-53-77)

4:00– 4:10 (53) Aspects of Morse theory. DIANA KALISH, Fordham University (819-53-76)

Sunday, April 21, 1985, 8:30 a.m.

Special Session on Geometric Function Theory, III Haberlin Hall, Room 236

8:30– 8:50 (54) Symmetric Riemann surfaces, torsion subgroups, and Schottky coverings. BLAISE HELTAI, Indiana University, Bloomington (819-30-47)

9:00– 9:20 (55) Holomorphic deformations of fuchsian groups by earthquaking/bending. D. B. A. EPSTEIN, University of Warwick, England, and A. MARDEN*, University of Minnesota, Minneapolis (819-30-46)

9:30– 9:50 (56) Iterates of Teichmüller modular transformations. WILLIAM ABIKOFF, University of Connecticut, Storrs (819-30-82)

10:00–10:20 (57) Some deformations in high codimension. BERNARD MASKIT, State University of New York, Stony Brook (819-57-16)

## Sunday, April 21, 1985, 8:30 a.m.

### Special Session on Differential Geometry of Submanifolds, III

Haberlin Hall, Room 412

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00–10:20</td>
<td>(62)</td>
<td>Deforming convex plane curves with the heat equation.</td>
<td>Michael E. Gage*, University of Rochester, and Richard S. Hamilton, University of California at San Diego, La Jolla (819-53-58)</td>
</tr>
<tr>
<td>10:30–10:50</td>
<td>(63)</td>
<td>The role of Riemannian submersions in differential geometry.</td>
<td>Richard H. Escobales, Jr., Canisius College (819-53-29)</td>
</tr>
</tbody>
</table>

## Sunday, April 21, 1985, 8:30 a.m.

### Special Session on Fractal Geometry, III

Haberlin Hall, Room 237

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30– 8:50</td>
<td>(64)</td>
<td>Dyadic interpolation.</td>
<td>Serge Dubuc, University of Montréal (819-26-55) (Sponsored by Aubert Daigleauit)</td>
</tr>
<tr>
<td>9:30– 9:50</td>
<td>(66)</td>
<td>Julia sets and localization properties of iterated families of algebraic integers.</td>
<td>Daniel J. Bessis* and Jeffrey S. Geronimo, Georgia Institute of Technology, and Pierre Moussa, Cen-Saclay, France (819-11-67)</td>
</tr>
<tr>
<td>10:00–10:20</td>
<td>(67)</td>
<td>Renormalization and fractal structure of singularities.</td>
<td>Claude Itzykson, CEN-Saclay, France (819-58-92) (Sponsored by Benoit B. Mandelbrot)</td>
</tr>
<tr>
<td>10:30–10:50</td>
<td>(68)</td>
<td>Dynamics of rational maps after continuous-time interpolation and time reversal.</td>
<td>Benoit B. Mandelbrot, IBM and Harvard University (819-58-91)</td>
</tr>
</tbody>
</table>

## Sunday, April 21, 1985, 8:30 a.m.

### Special Session on Enumerative Combinatorics, III

Swords Hall, Room 312

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30– 8:50</td>
<td></td>
<td>Problem Session</td>
<td></td>
</tr>
<tr>
<td>9:00– 9:20</td>
<td>(69)</td>
<td>A combinatorial integral calculus. Preliminary report.</td>
<td>Pierre Leroux*, Université du Québec à Montréal, and Gerard X. Viennot, Université de Bordeaux, France (819-05-42)</td>
</tr>
<tr>
<td>10:00–10:20</td>
<td>(71)</td>
<td>Continued fractions and Galois numbers.</td>
<td>Louis Shapiro, Howard University (819-05-96)</td>
</tr>
<tr>
<td>10:30–10:50</td>
<td>(72)</td>
<td>The Möbius function of the weak order of the symmetric group.</td>
<td>Paul H. Edelman, University of Pennsylvania (819-05-64)</td>
</tr>
</tbody>
</table>

## Sunday, April 21, 1985, 9:00 a.m.

### Special Session on Methods of K-theory, II

Haberlin Hall, Room 414

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00– 9:20</td>
<td>(73)</td>
<td>Computation of $K_1$ via Meninicke symbols.</td>
<td>Leonid Nison Vaserstein, Pennsylvania State University, University Park (819-18-73)</td>
</tr>
<tr>
<td>10:00–10:20</td>
<td>(75)</td>
<td>On algebraic and topological $K$-theory with finite coefficients.</td>
<td>Thomas Fischer, University of Notre Dame (819-55-18)</td>
</tr>
</tbody>
</table>

## Sunday, April 21, 1985, 9:00 a.m.

### Special Session on Singularities and Complex Geometry, III

Haberlin Hall, Room 408

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00– 9:20</td>
<td>(76)</td>
<td>Topological equivalence of real singularities.</td>
<td>Denis Blackmore, New Jersey Institute of Technology (819-57-17)</td>
</tr>
<tr>
<td>9:30– 9:50</td>
<td>(77)</td>
<td>Sandwiched surface singularities and the Nash resolution problem.</td>
<td>Mark Spivakovsky, Harvard University (819-14-50)</td>
</tr>
<tr>
<td>10:00–10:20</td>
<td>(78)</td>
<td>Limits of tangent spaces to singular points of complete intersections.</td>
<td>Donal B. O'Shea, Mount Holyoke College and University of Massachusetts, Amherst (819-32-26)</td>
</tr>
<tr>
<td>10:30–10:50</td>
<td>(79)</td>
<td>Cusp singularities for Hilbert modular varieties for cyclic biquadratic fields.</td>
<td>Alphonse T. Vasquez, Graduate School and University Center, City University of New York (819-32-98)</td>
</tr>
<tr>
<td>Time</td>
<td>Session</td>
<td>Speaker(s)</td>
<td>Location</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>9:20-9:30</td>
<td></td>
<td>Holding sets for linear control systems. Preliminary report. Emilio O. Roxin, University of Rhode Island (819-49-56)</td>
<td></td>
</tr>
<tr>
<td>9:50-10:00</td>
<td></td>
<td>Multiplicative cocycles under an irrational rotation. Lawrence W. Baggett, University of Colorado, Boulder (819-42-57)</td>
<td></td>
</tr>
<tr>
<td>10:05-10:15</td>
<td></td>
<td>On normal subgroups of the general linear groups over Banach algebras and von Neumann regular rings. Leonid Nison Vaserstein, Pennsylvania State University, University Park and Institute for Advanced Study (819-22-74)</td>
<td></td>
</tr>
<tr>
<td>10:20-10:30</td>
<td></td>
<td>Fermat's last theorem. Gerard Coutu, Colchester, Connecticut (819-11-100)</td>
<td></td>
</tr>
<tr>
<td>11:00-12:00</td>
<td>Invited Address</td>
<td>Recent work in enumerative combinatorics. Ira M. Gessel, Brandeis University (819-05-35)</td>
<td></td>
</tr>
<tr>
<td>1:30-2:30</td>
<td>Invited Address</td>
<td>Algebraic and topological K-theory. Robert W. Thomason, Johns Hopkins University, Baltimore (819-14-04)</td>
<td></td>
</tr>
<tr>
<td>2:45-3:05</td>
<td>Special Session on Geometric Function Theory, IV</td>
<td>A metric for Fricke space which is invariant under the modular group. Preliminary report. Lipman Bers, Graduate Center, City University of New York, and Frederick P. Gardiner*, Brooklyn College, City University of New York (819-30-06)</td>
<td></td>
</tr>
<tr>
<td>3:15-3:35</td>
<td></td>
<td>Constructing realizations of finite subgroups of the mapping class group. Jane Gilman, Rutgers University, Newark (819-30-45)</td>
<td></td>
</tr>
<tr>
<td>3:45-4:05</td>
<td></td>
<td>Geometry of the geodesic length functions. Scott A. Wolpert, University of Maryland, College Park (819-30-13)</td>
<td></td>
</tr>
<tr>
<td>2:45-3:05</td>
<td>Special Session on Differential Geometry of Submanifolds, IV</td>
<td>New embedded minimal surfaces via symmetry function theory and computer graphics. David A. Hoffman, University of Massachusetts, Amherst (819-53-30)</td>
<td></td>
</tr>
<tr>
<td>2:45-3:05</td>
<td>Special Session on Fractal Geometry, IV</td>
<td>Universality for period N-couplings. P. Cvitanovic, University of Goteborg, Sweden (819-58-95) (Sponsored by Benoit B. Mandelbrot)</td>
<td></td>
</tr>
<tr>
<td>3:45-4:05</td>
<td></td>
<td>On absolutely continuous invariant measures for x → 1 - ax^2 on (-1, 1). Michael Benedicks*, Royal Institute of Technology, Stockholm, and Lennart Carleson, Institut Mittag-Leffler, Djursholm (819-58-102)</td>
<td></td>
</tr>
<tr>
<td>2:45-3:05</td>
<td>Special Session on Enumerative Combinatorics, IV</td>
<td>Properties of a popular partition tree. D. I. A. Cohen, Hunter College, City University of New York (819-05-68)</td>
<td></td>
</tr>
</tbody>
</table>
3:15–3:35  (98) **Labelled graphs with vertex degrees at least three.** Ian P. Goulden, University of Waterloo (819-05-87) (Sponsored by Ira M. Gessel)

3:45–4:05  (99) **Self-complementary plane partitions.** Richard P. Stanley, Massachusetts Institute of Technology (819-05-23)

Middletown, Connecticut

**Presenters of Papers**

Numbers following the names indicate the speakers' positions on the program.

- Invited one-hour lecturer
- Special session speaker

- Abe, K., 93
- Abhyankar, S., 37
- Abikoff, W., 22
- Abikoff, W., 56
- Andrews, G. E., 44
- Baggett, L. W., 83
- Banchoff, T. F., 8
- Barnsley, M., 40
- Benedicks, M., 96
- Benson, M., 36
- Bers, L., 23
- Bessis, D. J., 66
- Björner, A., 16
- Blackmore, D., 76
- Blair, D. E., 60
- Blanchard, P., 65
- Bloometrom, C., 34
- Bressoud, D. M., 47
- Cenkl, B., 52
- Chen, B.-Y., 31
- Cohen, D. I. A., 97
- Comfort, W. W., 48
- Coutu, G., 85
- Cvitanovic, P., 94
- Devaney, R. L., 41
- Douady, A., 43
- Dubuc, S., 64
- Durfee, A., 11
- Earle, C. J., 2
- Edelman, P. H., 72
- Ephraim, R., 38
- Escobales, R. H., Jr., 63
- Fischer, T., 75
- Fisher, R. J., Jr., 59
- Gage, M. E., 62
- Gardiner, F. P., 88
- Gau, Y.-N., 9
- Gehring, F. W., 4
- Gessel, I. M., 86
- Gilbert, W. J., 17
- Gilman, J., 89
- Goulden, I. P., 98
- Gromoll, D., 32
- Haas, A., 26
- Haney, R. P., 80
- Heltai, B., 54
- Hoffman, D. A., 92
- Hubbard, J. H., 42
- Itaiyson, C., 67
- Jablow, E. R., 1
- Jardine, J. F., 30
- Joshua, R., 29
- Kalai, G., 45
- Kalish, D., 53
- Kassel, C., 28
- Keen, L., 24
- Kra, I., 3
- Labelle, G., 70
- Lee, R., 74
- Leroux, P., 69
- Libgober, A. S., 10
- Ludden, G. D., 61
- Magid, M. A., 33
- Mandelbrot, B. B., 68
- Maralino, J., 91
- Marden, A., 55
- Maskit, B., 57
- Masur, H. A., 27
- McGehee, R. P., 95
- Moh, T. T., 12
- Mohanty, S. G., 14
- Nomizu, K., 33
- Orlit, F., 35
- O’Shea, D. B., 78
- Riley, R. F., 58
- Rino, J. S., 82
- Roxin, E. O., 81
- Ryan, P. J., 5
- Sagun, B., 13
- Series, C., 25
- Shapiro, L., 71
- Spencer, D. E., 51
- Spivakovsky, M., 77
- Stanley, R. P., 99
- Stanton, D., 46
- Swaminathan, S., 49
- Taylor, S. J., 20
- Terao, C.-L., 6
- Thomason, R. W., 87
- Tongling, N., 19
- Tricot, C., 18
- Uma, S. Y., 50
- Vaserstein, L. N., 73
- Vaserstein, L. N., 84
- Vasquez, A. T., 79
- White, D., 15
- Wolpert, S. A., 90
- Wong, B., 39
- Yau, S. S.-T., 21
Mobile, May 3–4, 1985, University of South Alabama

Program for the 820th meeting

The eight hundred twentieth meeting of the American Mathematical Society will be held at the University of South Alabama Brookley Center in Mobile, Alabama, on Friday and Saturday, May 3 and 4, 1985. Sessions will be held at the Brookley Center, which also has guest rooms.

Invited Addresses

By invitation of the Committee to Select Hour Speakers for Southeastern Sectional meetings, there will be four invited one-hour addresses. The speakers, their affiliations, and the titles of their talks are as follows:

Fred F. R. Cohen, University of Kentucky, Loop spaces and classical homotopy theory.

Dennis M. Deturck, University of Pennsylvania, Can you hear the shape of a manifold?

John Gilbert, University of Texas, Austin, Invariant differential operators in harmonic analysis.

Jeffery Lagarias, AT&T Bell Laboratories, Short vectors in lattices and knapsack public key cryptosystems.

Special Sessions

By invitation of the same committee, there will be six special sessions of selected twenty-minute papers. The topics of these special sessions, names of the organizers, and final lists of speakers, are as follows:

Combinatorics and graph theory, Thomas H. Brylawski, University of North Carolina, Chapel Hill, 1:15 p.m. Friday, 8:30 a.m. and 2:45 p.m. Saturday. The speakers will be Thomas H. Brylawski, Ying Cheng, Ralph Faudree, Robert L. Hemminger, Robert E. Jamison, Henry A. Kierstead, C. C. Lindner, James G. Oxley, Rhodex Peele, Michael D. Plummer, William T. Trotter, Jr., Michelle L. Wachs, and Neil White.

Nonlinear problems in geometry, Dennis Deturck, 1:30 p.m. Friday, 8:00 a.m. and 2:45 p.m. Saturday. The speakers will be William K. Allard, Alfred Balles, David E. Blair, Carolyn S. Gordon, R. J. Knill, Robert C. McQwen, Wei-Ming Ni, Vladimir Oliker, Jon Pitts, Al Vitter, Steven Wilkinson, and Deane Yang.

Analysis on homogeneous spaces, Ray Kunze, University of Georgia, Athens, 1:15 p.m. Friday and 2:45 p.m. Saturday. The speakers are Brian Blank, Jean-Louis Clerc, R. Coifman, Roe Goodman, Alan Greenleaf, Kenneth I. Gross, Kenneth D. Johnson, Christopher Meaney, Donald St. P. Richards, and Ernest Thieleker.

Number theory and its applications, Jeffery Lagarias, 8:30 a.m. and 2:45 p.m. Saturday. The speakers will be Ernest Brickell, Duncan A. Buell, Harvey Cohn, Alice A. Deanin, Michael Filaseta, Douglas Hensley, Richard H. Hudson, Helmut Maier, Charles F. Osgood, Carl Pomerance, David R. Richman, Randy Tuler, and Theresa P. Vaughan.

Algebraic topology, Joseph Neisendorfer, Ohio State University, 1:15 p.m. Friday and 2:45 p.m. Saturday. The speakers are David J. Anick, H.E.A. Campbell, Paul G. Goerres, Hans-Werner Henn, J. F. Jardine, Haynes Miller, John C. Moore, Stewart B. Priddy, William Ralph, Paul Selick, Jeffrey H. Smith, Victor Snaith, and James Stasheff.

Symbolic dynamics and ergodic theory, Susan Williams, University of South Alabama, and Bruce Kitchens, IBM T. J. Watson Research Center, 1:15 p.m. Friday and 8:30 a.m. Saturday. The speakers will be Kirby A. Baker, Ethan M. Cohen, Douglas Lind, N. Markley, Karl Petersen, V. S. Prasad, F. W. Roush, Daniel J. Rudolph, John Smillie, Paul Trow, William A. Veech, J. B. Wagoner, and Susan Williams.

Contributed Papers

There will also be sessions for contributed ten-minute papers.

Registration

The meeting registration desk will be located in the lobby of Building 2002, and will be open from 8:00 a.m. to 5:00 p.m. on Friday, and from 8:00 a.m. until noon on Saturday. The registration fees are $10 for members, $16 for nonmembers, and $5 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information can be found in a box on page 26 in the Anaheim meeting announcement in the January issue of the Notices.

Accommodations

Rooms will be available for participants at Oak Tree Lodge, Pine Tree Lodge, and Building 2002 at Brookley Center. All are centrally located and within easy walking distance of the meeting activities. Private units at the lodges include one or two bedroom suites with living area, small kitchenette, and bath, while Building 2002 contains standard motel-style rooms. All accommodations have individually controlled heating and air conditioning, as well as closed circuit color television. Accommodations are available the nights of May 3 and 4; however, only a limited number of rooms will be available on May 2. The daily rates are $25, $30, $36, and $40 for single, double, triple, or quadruple occupancy, respectively, and are tax free. Participants should make their own reservations by writing to Ms. Sharon Davis, University of South Alabama Brookley Center, 2002 Old Bay Front Road, Mobile, AL 36615, or by telephoning her at 205-431-6410 (or 205-433-4966).
between the hours of 8:00 a.m. and 4:00 p.m. Monday through Friday. The deadline for reservations is April 15.

The following accommodations are also available in the area of Brookley Center. The Ramada and Rodeway Inns are within two miles, while the Malaga Inn and Stouffer’s Riverview Plaza are five miles or less from the Center. Rates quoted are subject to change, and do not include the additional 8 percent tax.

**Malaga Inn**
359 Church Street, Mobile 36602
Telephone: 205-438-4701
- Single $38 or $44
- Double $44 or $52

**Ramada Inn**
1705 Dauphin Island Parkway, Mobile 36605
Telephone: 205-471-6114
- Single $32
- Double $40

**Rodeway Inn**
1724 Michigan Avenue, Mobile 36605
Telephone: 205-478-3014
- Single $25
- Double $30

**Stouffer’s Riverview Plaza**
64 South Water Street, Mobile 36602
Telephone: 205-438-4000
- Single $49
- Double $49

**Food Service**
The Brookley Center cafeteria will be serving breakfast from 7:00 a.m.–9:00 a.m., and lunch from 11:00 a.m.–1:00 p.m. on Thursday, Friday, and Saturday. The cafeteria is not open for dinner and is closed on Sunday. Many restaurants are located within five miles of the Center, and a restaurant guide will be available at the registration desk.

**Social**
A beer party will be held at the Conference Center (Building 254) on Friday evening. The cost for the party is $11.50 per person, and includes as hors d’oeuvres boiled shrimp, oysters on the half shell, chicken nuggets, creole meatballs, relish and cheese trays, and mini sandwiches, as well as beer and iced tea. Participants not residing at the Center should make their checks payable to the University of South Alabama Brookley Center and send them by April 15 to Ms. Sharon Davis. The mailing address is included in the section above titled Accommodations. Participants who will be lodging at Brookley Center can arrange to attend the beer party when making their room reservations.

**Parking**
There is ample free parking in lots at the Brookley Center, including the residence areas.

**Travel**
Mobile is served by several of the major airlines, including American, Delta, Eastern, and Republic. Bates Field, the Mobile municipal airport, is approximately sixteen miles from Brookley Center. Taxi and limousine service is available from the airport to Brookley Center. Car rental agencies also located at the airport include Avis, Budget, Dollar, Hertz, National, and Thrifty. Participants driving from Bates Field to the Center should take Airport Boulevard east for approximately eight miles until reaching Interstate 65 (I-65), then turn south on I-65 for approximately three miles to Interstate 10 (I-10). Take I-10 East toward Pensacola, Florida for approximately four miles and exit on Michigan Avenue. Go south on Michigan Avenue and take the first possible left turn, which will be onto Broad Street. Stay on Broad Street for approximately 6/10 of a mile until the road veers to the left and intersects Old Bay Front Road. Turn right onto Old Bay Front Road and continue to Brookley Center.
Program of the Sessions

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

Abstracts of papers presented in AMS sessions at this meeting will be found in the March 1985 issue of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Friday, May 3, 1985, 12:00 p.m.

Invited Address
12:00—1:00 (1) Can you hear the shape of a manifold? DENNIS M. DETURCK, University of Pennsylvania (820-58-39)

Friday, May 3, 1985, 1:15 p.m.

Special Session on Combinatorics and Graph Theory, I
Learning Circle #4182
1:15—1:35 (2) Matroid invariants and error-correcting codes. Preliminary report. THOMAS H. BYLAWSKI, University of North Carolina, Chapel Hill (820-05-67)
1:45—2:05 (3) A characterization of the ternary matroids with no \( M(K_4) \)-minor. JAMES G. OXLEY, Louisiana State University, Baton Rouge (820-05-05)
2:15—2:35 (4) nth-line digraphs. Preliminary report. ROBERT L. HEMMINGER, Vanderbilt University (820-05-08)
2:45—3:05 (5) Quasigroups and graphs. C. C. LINDNER, Auburn University, Auburn (820-05-16)

Friday, May 3, 1985, 1:15 p.m.

Special Session on Analysis on Homogeneous Spaces, I
Learning Circle #4172
1:15—1:35 (7) Reciprocity theorems and branching laws. KENNETH I. GROSS, University of Wyoming (820-22-77)
1:45—2:05 (8) Addition and multiplication formulas for hypergeometric functions of matrix argument. DONALD ST. P. RICHARDS, University of North Carolina, Chapel Hill (820-33-27)
2:15—2:35 (9) The inverse Abel transform on complex Grassmann manifolds. CHRISTOPHER MEANEY, University of Texas, Austin (820-44-36)
2:45—3:05 (10) Nontangential convergence of Poisson integrals on compact groups. Preliminary report. BRIAN BLANK, Washington University (820-22-76)
3:15—3:35 (11) Convolution operators with conical singularities. ALLAN GREENLEAF, University of Rochester (820-42-14)
3:45—4:05 Discussion

Friday, May 3, 1985, 1:15 p.m.

Special Session on Algebraic Topology, I
Learning Circle #4171
1:15—1:35 (12) Upper triangular invariants. H. E. A. CAMPBELL, Queen's University, Ontario (820-55-60)
1:45—2:05 (13) On the growth of homotopy groups. HANS-WERNER HENN, Ohio State University, Columbus (820-55-28)
2:15—2:35 (14) Stable splittings of Stiefel manifolds. HAYNES MILLER, University of Washington (820-55-22)
3:15—3:35 (16) Bilinear forms versus Galois representations. Preliminary report. VICTOR SNAITH, University of Western Ontario (820-55-01)
3:45—4:05 (17) Flabby simplicial presheaves. Preliminary report. J. F. JARDINE, University of Western Ontario (820-55-06)
Friday, May 3, 1985, 1:15 p.m.

Special Session on Symbolic Dynamics and Ergodic Theory, I

Learning Circle #4168A


1:45– 2:05 (20) Smale diffeomorphisms of surfaces. Preliminary report. JOHN SMILLIE, Herbert H. Lehman College, City University of New York (820-58-80)

2:15– 2:35 (21) Factor maps which commute with a power of the shift. PAUL TROW, University of North Carolina, Chapel Hill (820-99-32) (Sponsored by Karl Petersen)

2:45– 3:05 (22) Topological conjugacy and transitivity for a class of piecewise monotone maps of the interval. LOUIS BLOCK, University of Florida, and ETHAN M. COVEN*, Wesleyan University (820-58-18)

3:15– 3:35 (23) Coding with almost sofic systems. KARL PETERSEN, University of North Carolina, Chapel Hill (820-28-02)

3:45– 4:05 (24) An analytic K-but not Bernoulli-map. DANIEL J. RUDOLPH, University of Maryland, College Park (820-99-82)


Friday, May 3, 1985, 1:30 p.m.

Special Session on Nonlinear Problems in Geometry, I

Learning Circle #4168B

1:30– 2:00 (26) On the first variation of a varifold with respect to general integrands. WILLIAM K. ALLARD, Duke University (820-49-46)

2:10– 2:40 (27) Conformal deformations of complete Riemannian manifolds with negative curvature. ROBERT C. MCOWEN, Northeastern University (820-58-31)


3:30– 4:00 (29) Self-dual Einstein metrics. Preliminary report. AL VITTER, Tulane University (820-53-53)

Friday, May 3, 1985, 4:45 p.m.

Invited Address

Conference Center

4:45– 5:45 (30) Short vectors in lattices and knapsack public key cryptosystems. JEFFREY LAGARIAS, AT&T Bell Laboratories, Murray Hill (820-68-73)

Saturday, May 4, 1985, 8:00 a.m.

Special Session on Nonlinear Problems in Geometry, II

Learning Circle #4168B

8:00– 8:30 (31) Critical associated metrics on symplectic manifolds. DAVID E. BLAIR*, Michigan State University, and STERE IANUS, University of Bucharest (820-53-09)

8:40– 9:10 (32) A variational formulation and solution of the problem of existence of a closed convex hypersurface in $\mathbb{R}^{n+1}$ with prescribed Gaussian curvature. Preliminary report. VLADIMIR OLKER, Emory University (820-53-30)

9:20– 9:50 (33) On the least growth of harmonic functions and the boundary behavior of Riemann mappings. FANG-HUA LIN and WEI-MING NI*, University of Minnesota, Minneapolis (820-53-33)

10:00–10:30 (34) Minimal surfaces of bounded topological type in three manifolds. Preliminary report. JON PITTS*, Texas A&M University, College Station, and J. H. RUBINSTEIN, University of Melbourne, Australia (820-49-64)


Saturday, May 4, 1985, 8:30 a.m.

Special Session on Number Theory and Its Applications, I

Learning Circle #4172


9:00– 9:20 (37) Periodicity of $p$-adic continued fraction expansions. ALICE A. DEANIN, Villanova University (820-11-11)

9:30– 9:50 (38) On the number of false witnesses for a composite number. PAUL ERDÖS, Mathematical Institute of the Hungarian Academy of Sciences, and CARL POMERANCE*, University of Georgia, Athens, and Bell Communications Research (820-11-37)

10:00–10:20 (39) Small differences between prime numbers. Preliminary report. HELMUT MAIER, University of Georgia, Athens (820-11-52) (Sponsored by Jeffery Lagarias)
Convolution powers of the Dickman function and applications to number theory. DOUGLAS HENSLEY, Texas A&M University, College Station (820-11-54)

Approximation of values of E and G functions. Preliminary report. CHARLES F. OSGOOD, Naval Research Laboratory (820-11-10)

Saturday, May 4, 1985, 8:30 a.m.

Special Session on Combinatorics and Graph Theory, II

8:30- 8:50 (42) The slope problem. ROBERT E. JAMISON, Clemson University (820-05-25) (Sponsored by James A. Reneke)

9:00- 9:20 Discussion

9:30- 9:50 (43) The maximum number of vertices in a regular graph not containing an induced 2K2. Preliminary report. MADELEINE PAOLI and WILLIAM T. TROTTER, Jr.*, University of South Carolina, Columbia, and G. W. PECK, Massachusetts Institute of Technology (820-05-84)

10:00-10:20 Discussion

10:30-10:50 (44) Applications of edge colorings of multigraphs to vertex colorings of graphs. Preliminary report. HENRY A. KIERSTEAD*, University of South Carolina, Columbia, and JAMES H. SCHMERL, University of Connecticut, Storrs (820-05-83)

Saturday, May 4, 1985, 8:30 a.m.

Special Session on Symbolic Dynamics and Ergodic Theory, II

8:30- 8:50 (45) Markov partitions and K2. J. B. WAGONER, University of California, Berkeley (820-99-20)


10:00-10:20 (48) Finite rank flows. Preliminary report. J. AUSLANDER and N. MARKLEY*, University of Maryland, College Park (820-54-48)

10:30-10:50 (49) Covers of sofic systems. Preliminary report. SUSAN WILLIAMS, University of South Alabama (820-28-49)

11:00-11:20 (50) The automorphism group of a subshift of finite type. Preliminary report. DOUGLAS LIND, University of Washington (820-94-66)

Saturday, May 4, 1985, 9:30 a.m.

Session for Contributed Papers

9:30- 9:40 (51) Products with pseudo-arcs as factors. Preliminary report. JUDY A. KENNEDY, Auburn University, Auburn (820-54-74)

9:45- 9:55 (52) A characterization of spaces that are the continuous image of an arc. L. B. TREYBIG, Texas A&M University, College Station (820-54-17)

10:00-10:10 (53) Computability of homotopy groups of nilpotent complexes. KATHRYN WELD, Baruch College, City University of New York (820-55-56)

10:15-10:25 (54) On w*-continuous cosine operator functions. SEN-YEN SHAW, National Central University, Chung-Li, Taiwan (820-47-21)

10:30-10:40 (55) Regular involution groupoids. Preliminary report. KRISHNAN V. SANKRITHI, Temple University (820-20-26)

10:45-10:55 (56) Finding generators for numerical semigroup ring idelas. Preliminary report. CHARLES G. FLEMING* and JUDY D. HALCHIN, Auburn University, Auburn (820-14-19)

Saturday, May 4, 1985, 11:30 a.m.

Invited Address

11:30-12:30 (57) Loop spaces and classical homotopy theory. F. R. COHEN, University of Kentucky (820-55-71)

Saturday, May 4, 1985, 1:30 p.m.

Invited Address

1:30- 2:30 (58) Invariant differential operators in harmonic analysis. JOHN GILBERT, University of Texas, Austin (820-42-40)
Saturday, May 4, 1985, 2:45 p.m.

Special Session on Analysis on Homogeneous Spaces, II

2:45–3:05 (59) Matrix coefficients of admissible representations. Preliminary report. ERNEST THIELEKER, University of South Florida (820-22-41)


3:45–4:05 (61) Joint eigenfunctions of some completely-integrable quantum-mechanical systems. Preliminary report. ROE GOODMAN* and NOLAN R. WALLACH, Rutgers University, New Brunswick (820-35-44)

4:15–4:35 (62) Fourier transform of orbital measures on the tangent space of a symmetric space. JEAN-LOUIS CLERC, Washington University (820-99-81) (Sponsored by Guido L. Weiss)

Saturday, May 4, 1985, 2:45 p.m.

Special Session on Algebraic Topology, II

2:45–3:05 (64) Splitting the n-fold smash product. Preliminary report. JEFFREY H. SMITH, Northwestern University (820-55-61)

3:15–3:35 (65) Unstable projectives and stable Ext: An application. PAUL G. GOERSS, University of Chicago (820-55-29) (Sponsored by Joe Neisendorfer)

3:45–4:05 (66) Stable naturality of Dyer-Lashof structure maps. STEWART B. PRIDDY, Northwestern University (820-55-45)

4:15–4:35 (67) Category and group rings in homotopy theory. WILLIAM RALPH, University of Western Ontario (820-55-62)

4:45–5:05 (68) Diophantine equations and undecidable spaces. DAVID J. ANICK, Massachusetts Institute of Technology (820-55-15)

Saturday, May 4, 1985, 2:45 p.m.

Special Session on Number Theory and Its Applications, II

2:45–3:05 (70) Use of a computer scan to prove $Q(2 + 2^{1/2})^{1/2}$ and $Q(3 + 2^{1/2})^{1/2}$ are Euclidean. HARVEY COHN*, City College, City University of New York, and JESSE DEUTSCH, Graduate School and University Center, City University of New York (820-12-03)


3:45–4:05 (72) A necessary condition for the integral equivalence of indefinite binary quadratic forms. RANDY TULER, University of Georgia, Athens (820-11-43)


4:45–5:05 (74) Running times of the Schnorr-Lenstra factoring method. Preliminary report. DUNCAN A. BUELL, Louisiana State University, Baton Rouge (820-11-51)

5:15–5:35 (75) Irreducibility criteria for polynomials with non-negative coefficients. MICHAEL FILASETA, University of South Carolina, Columbia (820-11-35)

5:45–6:05 (76) Phenomena related to the distribution of cubic and higher power residues. RICHARD H. HUDSON, University of South Carolina, Columbia (820-11-34)

Saturday, May 4, 1985, 2:45 p.m.

Special Session on Combinatorics and Graph Theory, III

2:45–3:05 (77) Continuing development of the matching structure of graphs. MICHAEL D. PLUMMER, Vanderbilt University (820-05-13)

3:15–3:35 (78) Flagged Schur functions, Schubert polynomials, and symmetrizing operators. MICHELLE L. WACHS, University of Miami (820-05-70)

3:45–4:05 (79) A pruning theorem for the counting matroids. NEIL WHITE, University of Florida (820-05-47)


4:45–5:05 (81) On weakly symmetric graphs of order twice a prime. YING CHENG* and JAMES OXLEY, Louisiana State University, Baton Rouge (820-05-04)
Saturday, May 4, 1985, 2:45 p.m.

Special Session on Nonlinear Problems in Geometry, III

Learning Circle #1468B

2:45– 3:15 (82) The Laplace spectra versus the length spectra of Riemannian manifolds. Preliminary report. CAROLYN S. GORDON, Washington University (820-53-50)


4:05– 4:35 (84) Gauss maps for codimension two immersed manifolds. Preliminary report. STEVEN WILKINSON, University ofNorth Carolina, Chapel Hill (820-53-38)

4:45– 5:15 Discussion

Presenters of Papers

Numbers following the names indicate the speakers’ positions on the program.
•Invited one-hour lecturer  •Special session speaker

*Allard, W. K., 26  •Gilbert, J., 58  •McOwen, R. C., 27
*Anick, D. J., 68  •Goerss, P. G., 65  •Meany, C., 9
*Baker, K. A., 47  •Goodman, R., 61  •Miller, H., 14
*Baldes, A., 28  •Gordon, C. S., 82  •Moore, J. C., 15
*Blair, D. E., 31  •Greenleaf, A., 11  •Ni, W.-M., 33
*Blank, B., 10  •Cross, K. L., 7  •Oliker, V., 32
*Brickell, E., 36  •Hemminger, R. L., 4  •Osgood, C. F., 41
*Brylawski, T. H., 2  •Henn, H.-W., 13  •Oxley, J. G., 3
*Buell, D. A., 74  •Hensley, D., 40  •Peele, R., 6
*Campbell, H. E. A., 12  •Hudson, R. H., 76  •Petersen, K., 23
*Cheng, Y., 81  •Jamison, R. E., 42  •Pitts, J., 34
*Clerc, J.-L., 63  •Jardine, J. F., 17  •Plummer, M. D., 77
*Cohen, F. R., 57  •Johnson, K. D., 60  •Pomerance, C., 38
*Cohn, H., 70  •Kennedy, J. A., 51  •Prasad, V. S., 25
*Coifman, R., 62  •Kierstead, H. A., 44  •Priddy, S. B., 66
*Coven, E. M., 22  •Knill, R. J., 83  •Ralph, W., 67
*Deanin, A. A., 37  •Lagarias, J., 30  •Richards, D. St. P., 8
*DeTurck, D. M., 1  •Lind, D., 50  •Richman, D. R., 73
*Foudree, R., 80  •Lindner, C. C., 5  •Roush, F. W., 46
*Filaseta, M., 75  •Maier, H., 39  •Rudolph, D. J., 24
Fleming, C. G., 56  •Markley, N., 48  •Sankriti, K. V., 55

*Selick, P., 18  •Shaw, S.-Y., 54
*Hemminger, R. L., 4  •Smith, J. H., 64
*Goodman, R., 61  •Snaith, V., 16
*Greenleaf, A., 11  •Stasheff, J., 69
*Coifman, R., 62  •Thiekeker, E., 59
*Gilbert, J., 58  •Trebybig, L. B., 52
*Goerss, P. G., 65  •Trotter, W. T., Jr., 43
*McOwen, R. C., 27  •Trow, P., 21
*Meaney, C., 9  •Tuler, R., 72
*Miller, H., 14  •Vaughan, T. P., 71
*Moore, J. C., 15  •Veech, W. A., 19
*Ni, W.-M., 33  •Vitter, A., 29
*Oliker, V., 32  •Wachs, M. L., 78
*Osgood, C. F., 41  •Wagoner, J. B., 45
*Oxley, J. G., 3  •Weld, K., 53
*Peele, R., 6  •White, N., 79
*Petersen, K., 23  •Wilkinson, S., 84
*Pitts, J., 34  •Williams, S., 49
*Plummer, M. D., 77  •Yang, D., 35

Frank T. Birtel
Associate Secretary
The August 1985 Joint Mathematics Meetings, including the 89th Summer Meeting of the AMS, the 65th Summer Meeting of the Mathematical Association of America, and the 1985 Annual Meeting of Pi Mu Epsilon, will be held August 12-15, 1985 (Monday–Thursday), at the University of Wyoming, Laramie. The meetings will be preceded by the AMS Short Course on August 10 and 11 (Saturday and Sunday), 1985. Sessions will take place on the campus of the University of Wyoming, Laramie.

The members of the Local Arrangements Committee are Sandy H. Adams, Myron B. Allen (chairman), Lois Kline, William J. LeVeque (ex-officio), Melfried Olson (publicity director), and Kenneth A. Ross (ex-officio).

89th Summer Meeting of the AMS
August 12–15, 1985

Colloquium Lectures
There will be a series of four Colloquium Lectures presented by Karen K. Uhlenbeck of the University of Chicago. The title of this lecture series is \textit{Mathematical gauge field theory}. The lectures will be given at 1:00 p.m. daily, Monday–Thursday, August 12–15.

Prize Session
The 1985 LeRoy P. Steele Prizes and the Norbert Wiener Prize in Applied Mathematics will be awarded at a session at 4:30 p.m. on Wednesday, August 14.

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

- \textbf{Stuart S. Antman}, University of Maryland, College Park, \textit{Global bifurcation problems from mechanics}, 2:15 p.m. Wednesday;
- \textbf{Richard E. Block}, University of California, Riverside, \textit{Simple Lie algebras of prime characteristic}, 3:30 p.m. Thursday;
- \textbf{Robert L. Bryant}, Rice University, \textit{Surfaces in conformal geometry}, 8:30 a.m. Wednesday;
- \textbf{David B. MacQueen}, AT&T Bell Laboratories, Theory of types in programming languages, 8:30 a.m. Monday;
- \textbf{Dennis W. Stanton}, University of Minnesota, Minneapolis, Orthogonal polynomials and association schemes, 3:20 p.m. Tuesday;
- \textbf{Ronald J. Stern}, University of Utah, Gauge theories and the topology of 4-manifolds, 11:00 a.m. Monday;
- \textbf{Jerrold B. Tunnell}, Rutgers University, Elliptic curves and diophantine problems, 2:15 p.m. Thursday; and,
- \textbf{Lai Sang Young}, Michigan State University, Hyperbolicity in dynamical systems, 3:20 p.m. Monday.

Special Sessions
By invitation of the same committee, there will be seven special sessions of selected twenty-minute papers. The topics of these special sessions, the names and affiliations of the mathematicians arranging them, and dates and times are as follows:

- \textit{Special functions and combinatorics}, Richard A. Askey, University of Wisconsin, Madison, 1:00 p.m. Wednesday and 8:00 a.m. Thursday.
- \textit{Dynamical systems and ergodic theory}, Marcy Barge, University of Wyoming and Robert F.
Preregistration and Housing

Preregistration. Preregistration for these meetings must be completed by June 14, 1985. All those wishing to preregister must complete the form which appears at the back of this issue and submit it along with the appropriate preregistration fee(s) to the Mathematics Meetings Housing Bureau in Providence by June 14.

Please provide your nickname if you wish this information to be printed on your badge.

Preregistration for the meeting and full payment of room/board charges is a requirement in order to obtain confirmed residence hall accommodations at Laramie through the Mathematics Meetings Housing Bureau.

Checks for preregistration fee(s), housing payments and fees for social events should be made payable to the AMS. Canadian checks must be marked for payment “in U.S. funds”. Those who preregister for the AMS Short Course and/or Joint Mathematics Meetings pay fees which are 30 percent lower than those who register at the meetings. The preregistration fees are as follows:

**AMS Short Course**

- Student/Unemployed: $5
- All Others: $25

**Joint Mathematics Meetings**

- Member of AMS, MAA, IUME: $55
- Emeritus Member of AMS, MAA: $14
- Nonmember: $84
- Student/Unemployed: $14

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. Preregistration forms received well before the deadline of June 14 which are not accompanied by correct payment will be returned to the participant with a request for resubmission with full payment.

A 50 percent refund of the preregistration fee(s) will be made for all cancellations received in Providence no later than August 9, 1985. No refunds will be granted for cancellations received after that date, or to persons who do not attend the meetings.

The only exception to this rule is someone who preregisters for the Joint Mathematics Meetings only in order to attend an MAA Minicourse, and is too late to obtain a slot in the Minicourse. In this case, full refund will be made of the Joint Mathematics Meetings preregistration fee, provided the preregistrant has checked the box on the Minicourse Preregistration Form that this was his or her intent. Individuals who preregister for both the Joint Meetings and a Minicourse and who intend to attend the Joint Meetings, even if the Minicourse is not available, should, of course, not check the box on the Minicourse Preregistration Form. In this case, the Joint Meetings preregistration will be processed and will be subject to the 50 percent refund rule.

Full refunds will be made of MAA 25-Year Banquet tickets if notification of cancellation is received prior to July 25; after that date, a 50 percent refund will apply.

Housing. The use of the services offered by the Mathematics Meetings Housing Bureau requires preregistration for the meetings. Persons desiring confirmed residence hall accommodations should complete the preregistration/housing form, or a reasonable facsimile, and send it with payment in full to the Mathematics Meetings Housing Bureau, Post Office Box 6887, Providence, Rhode Island 02940-6887, so that it will arrive no later than June 14, 1985. (See Housing section of preregistration/housing form.)

Please read carefully the section on University Housing before completing the form. Forms sent to the wrong address and thus incurring delay in delivery to the Housing Bureau until after the deadline cannot be accepted. All residence halls reservations with full prepayment for room/board will be confirmed by the Housing Bureau. All reservation requests must be received in writing and be processed through the Housing Bureau in Providence. Please do not contact the university directly. Telephone requests will not be accepted.

Housing assignments are made on a first-come, first-served basis, so participants desiring specific types of accommodations are urged to get their housing requests in as early as possible. Housing requests received after the deadline of June 14 most surely cannot be honored.

Participants who are able to do so are urged to share a room whenever possible. This procedure can be economically beneficial. The housing form should be fully completed to ensure proper assignment of rooms. Participants planning to share accommodations should provide the name of the person with whom they plan to occupy a room. Each participant should, however, complete a separate preregistration/housing form. Parties planning to share rooms should send their forms together in the same envelope, if possible.

Changes/Cancellations

Please make all changes to or cancellations of residence hall reservations with the Housing Bureau in Providence before July 25, 1985 in order to receive full refund of housing payment. After that date, cancellations should be made with the Housing Bureau in Providence up until Friday, August 9, 1985, at which time a partial refund (amount paid minus one night’s room/board) will be made and 50 percent of preregistration fee(s) will be allowed. No cancellations can be made between 5:00 p.m. on Friday, August 9, and 4:00 p.m. on Sunday, August 11, after which changes or cancellations may be called in to Mary Coccoli at the Telephone Message Center number in Laramie. Changes in reservations may be made at any time by notifying the Housing Bureau in Providence.
American Mathematical Society Short Course Series

Introductory Survey Lectures on Actuarial Mathematics
Laramie, Wyoming, August 10–11, 1985

The American Mathematical Society, in conjunction with its eighty-ninth Summer Meeting, will present a one and one-half day short course entitled Actuarial Mathematics on Saturday and Sunday, August 10 and 11, at the University of Wyoming, Laramie. Cecil J. Nesbit of the University of Michigan, James C. Hickman of the University of Wisconsin, and Elias Shiu of the University of Manitoba will serve as organizers of the course. Six lectures are planned, and it is anticipated that proceedings will be published in the series Proceedings of Symposia in Applied Mathematics.

A number of forces have been shaping actuarial mathematics in the latter part of the twentieth century. Clearly, the on-going developments of computers have had a major influence. At the same time, the clarification of concepts of probability and statistical theory have provided a much richer foundation for actuarial theory. These concepts apply in related fields such as biostatistics, demography, economics and reliability engineering. Life tables are no longer simply actuarial tools but have been explored and utilized in those other fields. The mathematical theory of risk has flourished with the concurrent development of stochastic processes. Still more recently, developments in the theory of finance may eventually be assimilated into actuarial mathematics.

A basic textbook in preparation for the Society of Actuaries co-ordinates risk theory and classical actuarial mathematics. J. C. Hickman will introduce the audience to some ideas from this book. H. H. Panjer will follow with a lecture on models in risk theory pertaining to aggregate insurance losses, while Stuart Klugman will discuss distributions of individual losses. Credibility theory is devoted to models for combining information from several sources in determining insurance premiums. P. M. Kahn, who has co-chaired two Berkeley conferences on credibility theory, will present a survey of that topic. Graduation, the process of constructing a smoothed version of data, is an important topic in actuarial mathematics. Reflecting the influence of the work of T. N. E. Greville, E. S. Shiu will give a survey of graduation theory. A new emphasis in actuarial practice is on actuarial projections of insurance and annuity funds. J. A. Beekman will address this topic by giving an overview of the array of processes used in actuarial projections for U.S. Social Security.

The course will conclude with a general discussion which may include comments by C. J. Nesbitt on the 1960-1982 experience under TIAA-CREF annuities and the studies being undertaken by the recently formed Commission on College Retirement. Synopses of the talks and accompanying reading lists appear in this issue of the Notices.

The mathematics involved will be at the undergraduate and early graduate level. Some background in probability, statistics and computing will be helpful. Actuarial mathematics deals with a wide diversity of complex applications and a short course thereon will necessarily be only an overview.

The short course is open to all who wish to participate upon payment of the registration fee. There are reduced fees for students and unemployed individuals. Please refer to the sections entitled Preregistration, Housing, and Registration at the Meetings for details.

The short course was recommended by the Society's Committee on Employment and Educational Policy, whose members are Lida K. Barrett, Stefan A. Burr, Philip C. Curtis, Jr., Lisi Novak Gaal, Gerald J. Janusz, and Donald C. Rung (chairman). The short course series is under the direction of the CEEP Short Course Subcommittee, whose members are Stefan A. Burr (chairman), Lisi Novak Gaal, Gerald J. Janusz, Barbara L. Osofsky, and Philip D. Straffin, Jr.
Contributed Papers

There will be sessions for contributed papers on Monday afternoon, Tuesday morning and afternoon, Wednesday afternoon, and Thursday morning and afternoon. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to Abstracts, Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940. Each abstract must be accompanied by payment in the amount of $15 to cover processing costs. Please refer to the article on page 484 of the August 1984 issue of the Notices. In addition, a charge of $12 is imposed for retyping abstracts that are not in camera-ready form.

Late papers will not be accepted.

Other AMS Sessions

AMS Committee on Employment and Educational Policy

CEEP will sponsor a fact-finding panel discussion at 7:00 p.m. on Wednesday, August 14, moderated by Donald C. Rung, Pennsylvania State University on Computer science in mathematics departments—What are the problems? Opening remarks on Forming a separate department of computer science will be given by Barnet M. Weinstock, University of North Carolina, Charlotte.

Council Meeting

The Council of the Society will meet at 5:00 p.m. on Sunday, August 11.

Business Meeting

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

Committee on the Agenda for Business Meetings

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

(a) doing nothing;
(b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting;
(c) recommending and planning a format for debate to suggest to a Business Meeting;
(d) recommending referral to a committee;
(e) recommending debate followed by referral to a committee.

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

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

In order that a motion for the Business Meeting of August 14, 1985, receive the service offered by the committee in the most effective manner, it should have been in the hands of the secretary by July 15, 1985.

Everett Pitcher, Secretary
65th Summer Meeting of the MAA
August 12–15, 1985

Hedrick Lectures

The 34th Earle Raymond Hedrick Lectures will be given by ARTHUR M. JAFFE of Harvard University. These lectures will be given at 11:00 a.m. on Tuesday, Wednesday, and Thursday, August 13–15.

Invited Addresses

There will be invited fifty-minute addresses. A partial list of speakers and their affiliations follow:

JEANNE LADUKI, DePaul University;
HENRY P. MIRANDA, DePaul University;
Hugh L. Montgomery, University of Michigan;
Michael Sachs, Bell Communications Research.

Minicourses

Five Minicourses are being offered by MAA. The names and affiliations of the organizers and the topics follow:

Minicourse #1: Geometry for college teachers is being organized by BRANKO GRUNBAUM, University of Washington;
Minicourse #2: Applied mathematics via classroom experiments is being organized by HERBERT R. BAILEY, Rose-Hulman Institute of Technology;
Minicourse #3: Teaching experiential applied mathematics, (TEAM) is being organized by JAMES R. CHOKES, Oklahoma State University;
Minicourse #4: Computing in undergraduate linear algebra is being organized by EUGENE A. HERMAN, Grinnell College;
Minicourse #5: Microcomputer software in mathematics instruction is being organized by ROY E. MYERS, Pennsylvania State University, Kensington.

Please note the new procedure for registering for Minicourses. Participants interested in attending any of the Minicourses should complete the Minicourse Preregistration Form located at the back of this issue and send it directly to the MAA Office at the address given on the form so as arrive prior to the June 14 deadline. DO NOT SEND THIS FORM TO PROVIDENCE.

Please note that prepayment is now 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 Minicourses are open only to persons who have registered for the Joint Mathematics Meetings and paid the Joint Meetings registration fee.

If the only reason for registering for the Joint Meetings is to gain admission to a Minicourse, this should be indicated by checking the appropriate box on the Minicourse Preregistration Form.

Then, if the Minicourse is fully subscribed, full refund can be made of the Joint Mathematics Meetings preregistration fee(s). Otherwise, the Joint Meetings preregistration will be processed, and then be subject to the 50 percent refund rule.

The registration fee for Minicourses #1, #2, and #3 is $25 each. The registration fee for Minicourses #4 and #5 is $35 each. This fee entitles the registrant to attend all sessions of the Minicourse for which he/she has registered. Participants are limited to two Minicourses each. It is advised that alternate choices be given in the event the first and/or second choice Minicourse(s) are full.

Contributed Papers

Papers are being accepted on four topics in collegiate mathematics for presentation in contributed paper sessions at the MAA Summer Meeting in Laramie. These sessions will be held on Monday morning and afternoon, and Tuesday and Wednesday mornings. The topics are:

- The role of the history of mathematics in the undergraduate curriculum (Duane D. Blumberg, University of Southwestern Louisiana)
- What’s happening in college geometry courses? What should? (Lester H. Lange, San Jose State University)
- Experience with innovation in solving the discrete/continuous mathematics dilemma (Michael G. Murphy and Nancy T. Rich, University of Houston–Downtown)
- What’s new in teaching statistics? (Ann E. Watkins, Los Angeles Pierce College)

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes.

Individuals wishing to submit papers for any of these sessions in Laramie should send the following information to the MAA Washington office (1529 Eighteenth Street, NW, Washington, DC 20036) before May 28.

1. Title
2. Intended session
3. A one-paragraph abstract (for distribution at the meeting)
4. A one-page outline of the presentation
5. A list of special equipment required for the presentation (e.g., slide or film projector).

Late papers will not be accepted.

This information will be sent to session leaders who will arrange for refereeing. Selection of papers will be announced by June 15.

Other MAA Sessions

The MAA Film Program will take place on Monday, August 12 at 7:00 p.m.

Business Meeting

The Business Meeting of the MAA will take place at 4:35 p.m. on Tuesday, August 13 at which the 1985 Carl B. Allendoerfer, Lester R.
and George Pólya Awards for expository writing will be presented. Awards of Certificates for Meritorious Service will be announced. This meeting is open to all members of the Association.

**Board of Governors**

The MAA Board of Governors' will meet at 9:00 a.m. on Sunday, August 11. This meeting is open to all members of the Association.

**Section Officers**

There will be a Section Officers' Meeting at 3:30 p.m. on Monday, August 12.

**Banquet for 25-year Members**

The MAA is planning its tenth annual banquet for individuals who have been members of the Association for twenty-five years or more. The banquet will take place at 6:15 p.m. on Wednesday evening, August 14. Dinner will be served at 7:00 p.m. The menu includes fresh fruit cup, Western cut of prime rib of beef, salad, vegetable, potato, rolls, dessert, coffee, tea, Sanka, iced tea. Dinner will be preceded by a cash bar reception.

Please note that all tickets for this banquet must be purchased through preregistration, since a guarantee must be given to the caterer. Tickets (which include gratuities) are $17.25 each. For those who are residing in the residence halls and are subject to the three-meal plan, the price of the banquet ticket is an additional $12.75 since a credit of $4.50 will be allowed. Interested participants should complete the appropriate section of the preregistration form. In the event of cancellations, a full refund of the amount paid for the ticket will be refunded if notification is received in Providence prior to July 25. After that date, only a 50 percent refund will be given.

**Joint AMS-MAA Sessions**

By invitation of the AMS-MAA Joint Program Committee (Jeanne L. Agnew, George E. Andrews, Paul F. Baum, and William P. Ziemer), the following speakers will address the joint meeting of the AMS and MAA on the history and development of mathematics. The names of some of the speakers, their affiliations, and some of their titles are:

- **Richard A. Askey**, University of Wisconsin, Madison, The Bieberbach conjecture, now de Branges's theorem;
- **Saunders Mac Lane**, University of Chicago.

**ACTIVITIES OF OTHER ORGANIZATIONS**

**Association for Women in Mathematics (AWM)**

The AWM will sponsor a panel discussion on the history and development of mathematics. The names of some of the speakers, their affiliations, and some of their titles are:

- **Andrews**, Paul F. Baum, and William P. Ziemer),

A full refund of the amount paid for the ticket and 14. The Journal of the speakers, their affiliations, and some of their titles are:

- **Pi Mu Epsilon (IIME)** will hold its annual meeting on Tuesday and Wednesday, August 13 and 14. The J. Sutherland Frame Lecture will take place at 8:30 p.m., on Wednesday, August 14. There will also be sessions for contributed papers on Tuesday afternoon and Wednesday morning.

**OTHER EVENTS OF INTEREST**

**National Meeting of Department Heads**

The Joint Policy Board for Mathematics (JPBM) has created a new committee, the Committee for Mathematics Department Heads. This committee is organizing a National Meeting of Department Heads on Monday, August 12, at 7:00 p.m. There will be two one-hour sessions. The first is titled Preliminary report from the AMS-MAA-SIAM Joint Committee on the Status of the Profession. The second one-hour session is titled On management and leadership in the mathematics department.

**Book Sales**

Books published by the AMS and MAA will be sold for cash prices somewhat below the usual prices when these same books are sold by mail. These discounts will be available only to registered participants wearing the official meeting badge. Visa and MASTERCARD credit cards will be accepted for book sale purchases at the meeting. The book sales will be open the same days and hours as the exhibits.

**Exhibits**

The book and educational media exhibits will be open from 1:00 to 5:00 p.m. on Monday, August 12 and from 8:30 a.m. to 4:30 p.m. on Tuesday and Wednesday, August 13 and 14. All participants are encouraged to visit the exhibits during the meeting.

**MATHSCI**

MATHSCI (formerly MATHFILE) will be demonstrated in the exhibit area during regular exhibit hours.

MATHSCI now contains three new components in addition to Mathematical Reviews: Current Mathematical Publications (CMP), Current Index to Statistics (CIS), and the Tukey Index to Statistics and Probability. The MR component of MATHSCI has also been increased with the addition of 200,000 author and title entries from MR 1959-72, bringing the size of MATHSCI to approximately 700,000 references.

CMP provides information on new articles and books within two months of their publication. The Current Index to Statistics, published jointly by the American Statistical Association and the Institute of Mathematical Statistics, brings to MATHSCI works which were not reviewed in MR. The Tukey Index covers the statistics literature from 1902 to 1968.

MATHSCI now makes it possible to search simultaneously four printed publications: MR (back to 1959), the current issues of CMP, CIS (back to 1975) and the Tukey Index (1902-1968).

**Summer List of Applicants**

At the direction of the AMS-MAA-SIAM Committee on Employment Opportunities, which
Petition Table

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

Signs of moderate size may be displayed at the table, but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven (7) days in advance of the meeting to the Meetings Department in Providence (telephone 401-272-9500). Since space is limited, it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

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

is charged with operation of the Employment Register and with the publication of Employment Information in the Mathematical Sciences, the Society will publish a Summer List of mathematical scientists seeking employment for distribution at the Laramie meeting.

Copies of the 1985 summer list of applicants will be available at the Transparencies section of the registration desk for $2. Following the meeting, they may be purchased from the AMS office in Providence for $3. This list should prove useful to employers who have last-minute openings in the latter part of the summer or in the fall.

The deadline for receipt of applicant forms to appear in this summer list is June 14. The applicant preregistration résumé and instructions on its completion can be found at the back of this issue.

Instead of an Employment Register at the Summer Meeting in Laramie, there will be an opportunity for posting of both applicant résumé forms and employers' announcements of open positions in or near the main meeting registration area. There will be no special room set aside for interviews. No provisions will be made by the Society for interviews: arrangements will be the responsibility of each employer and applicant. Messages may be left in the message box located in the registration area.

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

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

Accommodations

University Housing

Participants desiring confirmed reservations for on-campus housing must preregister and send payment in full for housing to the Mathematics Meetings Housing Bureau prior to the June 14, 1985 deadline. Participants in the Joint Mathematics Meetings may occupy residence halls at the University of Wyoming during the period August 9 to August 16 only. All must check out by August 16. A limited number of rooms on campus will be available for those participants who do not preregister but plan on attending the Laramie meeting and registering on site. All rooms on campus are offered only through a Room/Board Package that provides three meals.

Participants requesting housing on the University of Wyoming campus during the meetings will be assigned to the Washakie Complex residence halls. (Please refer to the section below titled Room and Board Rates.)

Families with children will be allowed to stay in the dormitories. Sleeping bags for children of any age will not be permitted; however, parents can bring portacribs for infants and small children. All children (other than those in portacribs) must occupy a bed in a room with a parent and pay the same rate as an adult. (See section on Motel Accommodations below for alternate housing for families.)

Dormitories at the University of Wyoming are not air-conditioned and windows do not have screens. There are elevators in each of the residence halls. Sleeping rooms are good sized, very well maintained, and contain two single beds, desks, chairs, closets (with a limited number of hangers), and overhead lights. There are no reading lamps; however, a few lamps are available on request at the check-in desk. Rooms will be prepared for occupancy in advance. In addition to bed linen, pillow and blanket, participants will receive one wash cloth, towel, hand towel, ashtray, soap and drinking glass. These may be replaced on request at the check-in desk. There is no daily maid service in the sleeping rooms.

There are two bathrooms with showers on each floor; one for each gender. Walls separate shower stalls and curtains screen the interiors. Hooks are placed on the outside of stall dividers where robes
may be hung. A changing area is located several feet from the showers.

No pets are allowed in the residence halls. Alcoholic beverages are permitted provided the 21 year age limit is observed. There will be no telephone service in any of the university accommodations; however, there are pay telephones and campus phones in the public areas. Participants will be held responsible for any room damage incurred.

Smoking is permitted in dormitory rooms; however, there are areas where it is restricted. There are fire code approved doors in the residence halls which are unlocked until 2:00 a.m. The university is tied into the city alarm system in the event of fire.

Check-In Locations and Times

A check-in desk will be maintained in the lobby of each residence hall assigned for our use in the Washakie Center which is located on 15th Street and Grand Avenue. These desks will be staffed from 7:00 a.m. to 2:00 a.m. daily. The closest parking lot to Washakie Center is located across from the residence halls on 15th Street; another is adjacent to the Wyoming Union.

At the time of check-in, participants will be required to fill out a card for university records which will enable them to receive a room key. Spouses desiring a room key must follow this procedure also. Please note that, although there is no deposit required for keys, a penalty of $20 will be imposed for each key lost or not returned. It is the responsibility of the Mathematics Meetings Housing Bureau to collect this penalty. Therefore, it is requested that proper caution be exercised to avoid this charge. At checkout, all keys must be returned to the main desk in the lobby. Should the clerk not be present, please ensure that your name is left with the key.

A computerized meal card will be issued to each person who has paid the required room and board fee(s). This card will entitle holders to breakfast, lunch, and dinner each day in the Washakie Cafeteria. Meals start with breakfast on the day following receipt of meal card.

Room and Board Rates

The following rates apply for residence hall accommodations at the University of Wyoming. Please note that there is no room or food tax applicable to these rates.

Rates for adults and children (other than those occupying a portacrib); including three meals, are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Singles</th>
<th>Doubles (two persons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>$ 25</td>
<td>$ 40</td>
</tr>
<tr>
<td>2 days</td>
<td>$ 50</td>
<td>$ 80</td>
</tr>
<tr>
<td>3 days</td>
<td>$ 75</td>
<td>$120</td>
</tr>
<tr>
<td>4 days</td>
<td>$ 90</td>
<td>$145</td>
</tr>
<tr>
<td>5 days</td>
<td>$104</td>
<td>$171</td>
</tr>
<tr>
<td>6 days</td>
<td>$117</td>
<td>$195</td>
</tr>
<tr>
<td>7 days</td>
<td>$130</td>
<td>$219</td>
</tr>
</tbody>
</table>

Food Services

All meals for those participants staying in the residence halls will be served in Washakie Cafeteria in Washakie Center. Dining hours are:

- Breakfast: 6:45 a.m. to 8:30 a.m.
- Lunch: 11:30 a.m. to 1:00 p.m.
- Dinner: 5:00 p.m. to 6:30 p.m.

Meals in the cafeteria are generous and well prepared. A typical breakfast would be fruit juices, fresh fruit, cold or hot cereals, eggs, sweet rolls, and assorted beverages. Lunch would be soup, a casserole, grilled sandwiches, salad bar with assorted dressings, desserts, fresh fruit and assorted beverages. Three entrees are offered for dinner together with vegetable, salad bar, fresh fruit, pies or cake, assorted rolls and beverages.

It will be possible for a limited number of participants not residing on campus to purchase a three-meal plan for $12.25 per day, if they wish. (This rate includes 3 percent tax.) These tickets may be purchased at the Housing Desk at the Joint Meetings Registration Desk in Washakie Center. In addition, tickets for individual meals in Washakie Cafeteria will be available for cash purchase at the Washakie Center Control Desk.

For those participants who wish to get their meals off-campus, please be advised that there are only a few restaurants within walking distance. Among these are a pizza parlor and a fast food place featuring hot dogs.

Motel Accommodations

Since most of the motels in Laramie are not within walking distance of the campus, it is recommended that participants planning to stay in a motel plan to provide their own transportation. There are fast food as well as other type restaurants in the motel areas.

The following is a partial list of motels and their approximate distance from the University of Wyoming campus. A 3 percent tax applies to room rates. Rates quoted are firm.

**WYO Motel** – 5 blocks
1720 Grand Avenue
Laramie, Wyoming 82070
Telephone: 307-742-6633

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$22.50 – 1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$25.20 – 1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$27.70 – 2 beds</td>
</tr>
<tr>
<td>Triple</td>
<td>$31.50 – 2 beds</td>
</tr>
<tr>
<td>Children 12 and under are free</td>
<td></td>
</tr>
</tbody>
</table>
Airconditioned, outdoor pool. AE, Visa and MC accepted

**Circle S** – 12 blocks
2440 Grand Avenue
Laramie, Wyoming 82070
Telephone: 307-745-4811

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$23.50 – 1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$28 – 1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$32 – 2 beds</td>
</tr>
</tbody>
</table>
All mathematicians who wish to attend sessions acknowledge received from the Mathematics Meetings Housing Bureau as proof of registration.

Badges are required to show their meeting badge, if so requested. If a preregistrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgment received from the Mathematics Meetings Housing Bureau as proof of registration.

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register, and should be prepared to show their meeting badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales, to cash a check with the meeting cashier, and to attend sessions scheduled in Room 127 in the Arts and Sciences Building. (If a preregistrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgment received from the Mathematics Meetings Housing Bureau as proof of registration.) The fees for Joint Meetings registration at the meeting (listed below) are 30 percent more than the preregistration fees.

**Joint Mathematics Meetings**

<table>
<thead>
<tr>
<th>Category</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member of AMS, MAA, TIMS</td>
<td>$72</td>
</tr>
<tr>
<td>Emeritus Member of AMS, MAA</td>
<td>$18</td>
</tr>
<tr>
<td>Nonmember</td>
<td>$109</td>
</tr>
<tr>
<td>Student/Unemployed</td>
<td>$18</td>
</tr>
</tbody>
</table>

**AMS Short Course**

<table>
<thead>
<tr>
<th>Category</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student/Unemployed</td>
<td>$10</td>
</tr>
<tr>
<td>All Other Participants</td>
<td>$30</td>
</tr>
</tbody>
</table>

**MAA Minicourses**

(if openings available)

- Minicourses #1, #2, and #3: $25 each
- Minicourses #4 and #5: $35 each

U.S. Treasury regulation §1.162-5 allows an income tax deduction for education expenses (registration fees, cost of travel, meals, and lodging) incurred to (i) maintain or improve skills in one's employment or other 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.

Registration fees may be paid at the meetings in cash, by personal or traveler's checks, or by Visa or MasterCard credit card. Canadian checks must be marked for payment in U.S. funds.

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

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

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

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

Nonmembers who register at the meetings and pay the $109 nonmember registration fee are entitled to a discount of the difference between the member registration fee of $72 and the nonmember registration fee of $109 as a $37 credit against dues in either the AMS or MAA or both, provided they apply for membership before September 15, 1985.

Nonmembers and nonmember students who thus qualify may apply for membership at the meetings, or by mail afterward up to the deadline.

**Registration Dates, Locations, and Times**

**AMS Short Course**

Outside Room 103, Classroom Building

**MAA Minicourses**

(if openings available)

- Minicourses #1, #2, and #3: $25 each
- Minicourses #4 and #5: $35 each

**TraveLodge**– 6 blocks

262 North Third Street

Laramie, Wyoming 82070

Telephone: 307-745-4853 or 800-255-3050

<table>
<thead>
<tr>
<th>Room</th>
<th>Type</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$32</td>
<td>1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$37</td>
<td>1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$48</td>
<td>2 beds</td>
</tr>
<tr>
<td>Children 17 and under</td>
<td>Free</td>
<td></td>
</tr>
</tbody>
</table>

Airconditioned, outdoor pool. AE, VISA, MC and Carte Blanche accepted.

**Holiday Inn**– 2 miles

South Third Street

Laramie, Wyoming 82070

Telephone: 307-742-6611

<table>
<thead>
<tr>
<th>Room</th>
<th>Type</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$38</td>
<td>(Double bed)</td>
</tr>
<tr>
<td>Double</td>
<td>$44</td>
<td>(Double bed)</td>
</tr>
<tr>
<td>Single</td>
<td>$42</td>
<td>(King bed)</td>
</tr>
<tr>
<td>Double</td>
<td>$46</td>
<td>(King bed)</td>
</tr>
</tbody>
</table>

Airconditioned, outdoor pool, restaurant, coffee shop, lounge. AE, VISA, MC, and Diner’s Club accepted.

**Ramada**– 2 miles

421 Boswell

Laramie, Wyoming 82070

Telephone: 307-742-3721

<table>
<thead>
<tr>
<th>Room</th>
<th>Type</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$36</td>
<td>1 bed</td>
</tr>
<tr>
<td>Double</td>
<td>$38</td>
<td>1 or 2 beds</td>
</tr>
</tbody>
</table>

Children 12 and under are free

Airconditioned, outdoor pool, coffee shop, dining room. AE, VISA, MC, and MC accepted.

**Registration Desk**

**Registration at the Meetings**

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register, and should be prepared to show their meeting badge, if so requested.
Joint Mathematics Meetings
[and MAA Minicourses (until filled)]
Wyoming Room, Washakie Center
Saturday, August 10 9:00 a.m. to 2:30 p.m.

Sunday, August 11 4:00 p.m. to 8:00 p.m.
Monday, August 12 8:00 a.m. to 4:30 p.m.
Tuesday, August 13, and 8:30 a.m. to 4:30 p.m.
Wednesday, August 14

Assistance and Information Desk
Outside Room 127, Arts & Sciences Building
Thursday, August 15 8:30 a.m. to 1:00 p.m.

Please note that the Joint Mathematics Meetings registration desk will not be open on Thursday, August 15, and that the telephone message center will not be in operation that day. Other services provided during the meeting at the registration desk will also no longer be available (see section below on Registration Desk Services). There will, however, be a small desk set up outside Room 127 in the Arts & Sciences Building, where local information will be available and where a staff member will provide limited assistance to participants. No registration or cash transactions will be possible at this desk.

Registration Desk Services

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

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

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

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

Rooms where special sessions and contributed paper sessions will be held will be equipped with an overhead projector, screen, and blackboard.

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

Baggage and Coat Check
Provision will be made for participants checking out of the residence halls or motels early to leave baggage in the meeting registration area while it is open.

Check Cashing
The meeting cashier will cash personal or travelers' checks up to $50, upon presentation of the official meeting registration badge, provided there is enough cash on hand. Due to the increased use of credit cards, cash availability may be lower than at other meetings. It is strongly advised that participants bring travelers' checks which are honored by banks and most restaurants. Canadian checks must be marked for payment in U.S. funds.

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

Lost and Found
See the meeting cashier during the meeting. After the meeting, all lost articles not claimed will be turned over to the Department of Mathematics.

Information Table
The information table at Joint Meetings of the AMS and MAA is set up in the registration area for the dissemination of information of a nonmathematical nature of possible interest to the members. The administration of the information table is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for such joint meetings. The following rules and procedures apply.

1. Announcements submitted by participants should ordinarily be limited to a single sheet no more than 8 1/2" × 14".
2. A copy of any announcement proposed for the table is to be sent to: H. Hope Daly, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940 to arrive at least one week before the first day of the scientific sessions.
3. The judgment on the suitability of an announcement for display rests with the Joint Meetings Committee. It will make its judgments on a case by case basis to establish precedents.
4. Announcements of events competing in time or place with the scheduled scientific program will not be accepted.
5. Copies of an accepted announcement for the table are to be provided by the proponent. Announcements are not to be distributed in any other way at the meeting (for example, not by posting or personal distribution of handbills).
6. It may be necessary to limit the number of events or the quantity of announcements distributed at a meeting.
7. At the close of registration, the table will be swept clean. A proponent who wishes the return of extra copies should remove them.
Mail

All mail and telegrams for persons attending the meetings should be addressed to the participant, c/o Joint Mathematics Meetings, Department of Mathematics, University of Wyoming, Laramie, Wyoming 82071. Mail and telegrams so addressed may be picked up at the mailbox in the registration area during the hours the registration desk is open. U.S. mail not picked up will be forwarded after the meeting to the mailing address given on the participant’s registration record.

Personal Messages

Participants wishing to exchange messages during the meeting should use the mailbox mentioned above. Message pads and pencils are provided. It is regretted that such messages left in the box cannot be forwarded to participants after the meeting is over.

Telephone Messages

A telephone message center will be located in the registration area to receive incoming calls for participants. The center will be open from August 11 through 14 only, during the hours that the Joint Mathematics Meetings 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. The telephone number of the message center will be announced later.

Transparencies

Speakers wishing to prepare transparencies in advance of their talk will find the necessary materials and copying machines at this section of the registration desk. A member of the staff will assist and advise speakers on the best procedures and methods for preparation of their material. There is a modest charge for these materials. Please note that this service will be not available on Thursday, August 15.

Visual Index

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

MISCELLANEOUS INFORMATION

Athletic Facilities

Half-Acre Gymnasium has lockers, weightroom, basketball courts, racquetball courts, and an indoor track. These will be open from 8:00 a.m. to 6:00 p.m. The university maintains quite a few tennis courts east of campus off of Willett Drive. Also east of campus are playing fields and a public golf course. Hours and access rules will be available before the meetings begin.

Participants and their families can use any of the athletic facilities provided they have a guest pass. This pass costs $2 per day or $10 per week, per person, including children. The pool will be open for public swimming from noon to 1:00 p.m. and from 4:00 p.m. to 6:00 p.m.

Book Store

The University of Wyoming Bookstore is located in the Wyoming Union. Business hours are Monday through Friday from 7:30 a.m. to 4:30 p.m. Other bookstores and novelty shops are located close to campus and downtown.

Camping and RV Facilities

K.O.A., Northwest of Laramie at Curtis and I-80 exit. 742-6553. Full hookups and other services available.

N & H Trailer Ranch, 1360 North Third Street, 742-3158.

Curt Gowdy State Park, approximately 25 miles east of Laramie off Happy Jack Road (take I-80 east from Laramie). There are several primitive campgrounds here, available for $2 per night on a first-come basis. For more information call the Wyoming Recreation Commission in Cheyenne. 307-777-7550.

U.S. Forest Camping Facilities, 7–8 miles east of Laramie off Happy Jack Road, Tie City, Pole Creek and Yellow Pines. All have drinking water and spaces for tents or small trailers. 71 spaces available. No reservations needed. There are also many campgrounds in the Medicine Bow National Forest roughly 30–40 miles west of Laramie. Maps and other information are available from the U.S. Forest Service, Skyline Drive, Laramie, WY 82070, 307-745-8971.

Child Care

There are several state-licensed day nurseries and child care facilities. Please make your own reservations by calling any of the following centers: ABC, 620 E. Fremont, 742-7272

Basic Beginnings, 1474 North 19th, 745-5755

Creative Childcare, 710 Garfield, 742-7502

Kids Connection, 506 South 21st, 742-0127

Sonshine House, 416 Hancock, 745-7985

Crib Rental

Portacribs can usually be rented directly from Taylor Rental Center, 1015 South Second, 745-3889. Some motels have rollaways for customer use upon request. Please note that no cots or cribs other than portacribs are allowed in the university residence halls.

Handicapped

Most (not all) university facilities are accessible to the handicapped. People with special requirements for campus housing should make these clear when submitting preregistration forms. People with special questions regarding handicapped access should contact Myron B. Allen, Mathematics Department, University of Wyoming, at 307-766-4221.

Libraries

Science Library (including mathematics): Biological Sciences Building
**TIMETABLE**

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

### SATURDAY, August 10

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 2:30 p.m.</td>
<td>REGISTRATION</td>
</tr>
<tr>
<td>2:00 p.m. - 3:15 p.m.</td>
<td>Updating actuarial mathematics</td>
</tr>
<tr>
<td>3:45 p.m. - 5:00 p.m.</td>
<td>Models in risk theory</td>
</tr>
</tbody>
</table>

### BUNDA Y, August 11

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 10:15 a.m.</td>
<td>Loss distributions</td>
</tr>
<tr>
<td>10:45 a.m. - noon</td>
<td>Overview of credibility theory</td>
</tr>
<tr>
<td>1:30 p.m. - 2:45 p.m.</td>
<td>A survey of graduation theory</td>
</tr>
<tr>
<td>3:15 p.m. - 4:30 p.m.</td>
<td>Actuarial assumptions and models for social security projections</td>
</tr>
<tr>
<td>4:30 p.m. - 5:15 p.m.</td>
<td>General Discussion</td>
</tr>
</tbody>
</table>

### AMERICAN MATHEMATICAL SOCIETY SHORT COURSE SERIES

**ACTUARIAL MATHEMATICS**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 2:30 p.m.</td>
<td>REGISTRATION</td>
</tr>
<tr>
<td>2:00 p.m. - 3:15 p.m.</td>
<td>Updating actuarial mathematics</td>
</tr>
<tr>
<td>3:45 p.m. - 5:00 p.m.</td>
<td>Models in risk theory</td>
</tr>
</tbody>
</table>

### SUNDAY, August 11

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 10:15 a.m.</td>
<td>Loss distributions</td>
</tr>
<tr>
<td>10:45 a.m. - noon</td>
<td>Overview of credibility theory</td>
</tr>
<tr>
<td>1:30 p.m. - 2:45 p.m.</td>
<td>A survey of graduation theory</td>
</tr>
<tr>
<td>3:15 p.m. - 4:30 p.m.</td>
<td>Actuarial assumptions and models for social security projections</td>
</tr>
<tr>
<td>4:30 p.m. - 5:15 p.m.</td>
<td>General Discussion</td>
</tr>
</tbody>
</table>

### JOINT MATHEMATICS MEETINGS

### SUNDAY, August 11

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 4:00 p.m.</td>
<td>Board of Governors' Meeting</td>
</tr>
<tr>
<td>4:00 p.m. - 8:00 p.m.</td>
<td>REGISTRATION</td>
</tr>
<tr>
<td>5:00 p.m. - 10:00 p.m.</td>
<td>Council Meeting</td>
</tr>
</tbody>
</table>

### MONDAY, August 12

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>morning</td>
<td>MAA - Contributed Paper Sessions</td>
</tr>
<tr>
<td>morning</td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td>8:00 a.m. - 4:30 p.m.</td>
<td>REGISTRATION</td>
</tr>
<tr>
<td>8:15 a.m. - 8:25 a.m.</td>
<td>WELCOME ADDRESS</td>
</tr>
<tr>
<td>8:30 a.m. - 9:30 a.m.</td>
<td>INVITED ADDRESS</td>
</tr>
<tr>
<td>9:00 a.m. - 10:15 a.m.</td>
<td>Theory of types in programming languages</td>
</tr>
<tr>
<td>11:00 a.m. - noon</td>
<td>INVITED ADDRESS</td>
</tr>
<tr>
<td>afternoon</td>
<td>MAA - Contributed Paper Sessions</td>
</tr>
<tr>
<td>afternoon</td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td>1:00 p.m. - 2:00 p.m.</td>
<td>COLLOQUIUM LECTURE I</td>
</tr>
<tr>
<td>1:00 p.m. - 5:00 p.m.</td>
<td>AMS BOOK SALE EXHIBITS</td>
</tr>
<tr>
<td>2:15 p.m.</td>
<td>MAA BOOK SALE</td>
</tr>
<tr>
<td>2:15 p.m. - 3:30 p.m.</td>
<td>SPECIAL SESSIONS</td>
</tr>
<tr>
<td>3:15 p.m. - 3:30 p.m.</td>
<td>MAA - INVITED ADDRESS</td>
</tr>
<tr>
<td>3:30 p.m. - 4:20 p.m.</td>
<td>Hyperbolicity in dynamical systems</td>
</tr>
<tr>
<td>3:30 p.m. - 5:30 p.m.</td>
<td>MAA - Section Officers' Meeting</td>
</tr>
<tr>
<td>evening</td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td>7:00 p.m. - 9:00 p.m.</td>
<td>MAA - Film Program</td>
</tr>
</tbody>
</table>

251
University Library: Coe Library
Geology Library: Knight Geology Building
Albany County Public Library: 310 S. 8th

Local Information

Laramie, with a population of about 25,000, is the third largest city (after Casper and Cheyenne) in Wyoming. Laramie sits at an elevation of 7,200 feet on a high, rolling prairie separating two mountain ranges. About 8–10 miles east of town are the Sherman Mountains of the Laramie Range, reaching 9,000 feet in elevation, and about 35 miles to the west rises the Snowy Range of the Medicine Bow Mountains, reaching 12,000 feet in elevation. The city began in 1868 when the first transcontinental railroad crossed the Laramie River, which afforded access to the railroad ties from forests in the Medicine Bow Mountains.

Because of its intermountain setting, Laramie is close to a wide range of outdoor activities. Within a 50-mile radius there is a remarkable variety of scenery: high, open plains; rocky, sage-covered foothills; densely forested mountains; alpine lakes, and many unusual geologic formations. The Happy Jack Road exit off I-80, about 10 miles east of Laramie, gives access to several hiking trails. Following Happy Jack Road about 12 miles leads to Curt Gowdy State Park, offering camping, hiking, and excellent fishing in Crystal and Granite Reservoirs. Further east along I-80, about 20 miles from Laramie, is the Vedawoo exit, giving access to Vedawoo Glen, a picnic area amidst huge, bizarre sub-rounded granite formations that challenge expert rock climbers. Across I-80 from Vedawoo is the Ames Monument, a stone pyramid commemorating the ghost town of Sherman, the highest point on the original transcontinental railroad.

West of Laramie, about 30 miles along Rte. 130, lies the small town of Centennial. Once a center for gold and platinum mining, Centennial today is largely a stopping place for hikers, fishermen, hunters, and skiers visiting the Medicine Bow Mountains. The hamlet boasts a small museum, several taverns, and a good restaurant (the Old Corral). Closer to Laramie along Rte. 130, near where it crosses the Little Laramie River, is the Vee-Bar Guest Ranch, offering horseback riding, ranch-style meals and accommodations. West of Centennial, Rte. 130 climbs into the Medicine Bow Mountains, giving access to several National Forest Service campgrounds, excellent hiking and fishing, and picnic grounds nestled among high mountain lakes beneath the sheer cliffs of the Snowy Range. Rte. 130 eventually leads to Saratoga, with its thermal springs.

North of Laramie, Route 287 leads about 40 miles to Como Bluffs, site of a large fossil bed that has yielded thousands of dinosaur bones. About 10 miles further along Rte. 287 is the town of Medicine Bow, setting for Owen Wister's novel, The Virginian. Today Medicine Bow is home of the Virginian Hotel, with its remarkable period furniture, and large wind turbines used to generate electricity. About 18 miles north of Laramie on Rte. 287 is the junction with Rte. 34, a cutoff leading northeast through Morton Pass and the rugged Sybille Canyon. About 40 miles from town is Wyoming's Game and Fish Experimental Station, where visitors can see elk, deer, moose, and bighorn sheep. Sharp navigators can find their way to Johnson Reservoir, north of Rte. 34 via dirt road, where there are campsites, fishing, and picnicking among the Laramie Hills.

To the south, about two-and-one-half hours' drive from Laramie, is Rocky Mountain National Park, some of whose peaks are visible from Laramie on clear days.

Within Laramie's city limits there are also many attractions. The block of Ivinson Avenue between First and Second Streets is a refurbished district with several specialty shops, a couple of restaurants, and a saloon. Further east on Ivinson Avenue is the Laramie Plains Museum, located in the home of one of Laramie's more prosperous early citizens. Upstairs in the museum is the Overland Trail Art Gallery. The university campus itself offers Geology, Anthropology, and Art Museums, along with the American Heritage Center, The Rocky Mountain Herbarium, containing over 300,000 plant specimens, and a planetarium.

Laramie has a public golf course, the Red Jacoby course on Willett at the eastern edge of town. There are 23 public tennis courts maintained by the university. There are several public parks, including Washington Park, three blocks south of campus off 15th; La Bonte Park, five blocks north of campus off of 9th, and Undine Park, 8 blocks southwest of campus off of 7th.

For further information about Laramie and environs, write to the Laramie Chamber of Commerce, 312 West Grand Avenue, Laramie, Wyoming 82070, or call 307-745-7339. For general information about Wyoming, write the Wyoming Travel Commission, I-25 at College Drive, Cheyenne, Wyoming 82002-0660, or call 307-777-7777. Further information on Laramie and surrounding areas will be available at the Local Information Section of the meeting registration desk.

Medical Services

Ivinson Memorial Hospital is located east of campus at 255 N. 30th; its telephone number is 742-2141.

Parking

The parking lot closest to Washakie Center is on 15th Street opposite the residence halls. There is additional parking adjacent to the Wyoming Union. Parking in these lots is free. No stickers are required.

Social Event

Plans are being made for a picnic on Tuesday evening, August 13. Further information will be available later.
<table>
<thead>
<tr>
<th>MONDAY, August 12</th>
<th>American Mathematical Society</th>
<th>Mathematical Association of America and Other Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 p.m. - 9:00 p.m.</td>
<td>NATIONAL MEETING OF DEPARTMENT HEADS</td>
<td>Preliminary report from the AMS-MAA-SIAM Joint Committee on the Status of the Profession On management and leadership in the mathematics department</td>
</tr>
<tr>
<td>7:00 p.m. - 10:00 p.m.</td>
<td>Pi Mu Epsilon - Reception</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TUESDAY, August 13</th>
<th>AMS</th>
<th>MAA and Other Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>morning</td>
<td>Sessions for Contributed Papers</td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td>morning</td>
<td></td>
<td>MAA - Contributed Paper Sessions</td>
</tr>
<tr>
<td>morning</td>
<td>SPECIAL SESSIONS</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Dynamical systems and ergodic theory I</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Commutative algebra and algebraic geometry II</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>The geometry of configurations II</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>REGISTRATION</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>AMS BOOK SALE</td>
<td>MAA BOOK SALE</td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>EXHIBITS</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 9:30 a.m.</td>
<td>Association for Women in Mathematics Panel Discussion</td>
<td></td>
</tr>
<tr>
<td>8:40 a.m. - 9:30 a.m.</td>
<td>MAA - INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td>9:30 a.m. - 10:45 a.m.</td>
<td>AWM - Membership Meeting</td>
<td></td>
</tr>
<tr>
<td>9:45 a.m. - 10:45 a.m.</td>
<td>AMS-MAA INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td>11:00 a.m. - noon</td>
<td></td>
<td>MAA - HEDRICK LECTURE I</td>
</tr>
<tr>
<td>noon - 1:00 p.m.</td>
<td></td>
<td>Title to be announced</td>
</tr>
<tr>
<td>afternoon</td>
<td></td>
<td>Arthur M. Jaffe</td>
</tr>
<tr>
<td>1:00 p.m. - 2:00 p.m.</td>
<td>COLLOQUIUM LECTURE II</td>
<td></td>
</tr>
<tr>
<td>afternoon</td>
<td>Mathematical gauge field theory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Karen K. Uhlenbeck</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sessions for Contributed Papers</td>
<td></td>
</tr>
<tr>
<td>2:15 p.m.</td>
<td>SPECIAL SESSIONS</td>
<td></td>
</tr>
<tr>
<td>2:15 p.m.</td>
<td>Dynamical systems and ergodic theory II</td>
<td></td>
</tr>
<tr>
<td>2:15 p.m. - 3:05 p.m.</td>
<td>Approximation theory and applications I</td>
<td></td>
</tr>
<tr>
<td>3:20 p.m. - 4:20 p.m.</td>
<td>INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Orthogonal polynomials and association schemes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dennis W. Stanton</td>
<td></td>
</tr>
<tr>
<td>4:35 p.m. - 5:35 p.m.</td>
<td>MAA - BUSINESS MEETING</td>
<td></td>
</tr>
<tr>
<td>evening</td>
<td>SOCIAL EVENT</td>
<td></td>
</tr>
<tr>
<td>8:30 p.m. - 10:30 p.m.</td>
<td>AWM - Party</td>
<td></td>
</tr>
<tr>
<td>evening</td>
<td>MAA - Minicourses</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WEDNESDAY, August 14</th>
<th>AMS</th>
<th>MAA and Other Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>morning</td>
<td>IMAE - Contributed Paper Session</td>
<td></td>
</tr>
<tr>
<td>morning</td>
<td>MAA - Minicourses</td>
<td></td>
</tr>
<tr>
<td>morning</td>
<td>MAA - Contributed Paper Sessions</td>
<td></td>
</tr>
<tr>
<td>8:00 a.m. - 9:00 a.m.</td>
<td></td>
<td>IMAE - Dutch Treat Breakfast</td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>REGISTRATION</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>AMS BOOK SALE</td>
<td>MAA BOOK SALE</td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>EXHIBITS</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 9:30 a.m.</td>
<td>INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surfaces in conformal geometry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Robert L. Bryant</td>
<td></td>
</tr>
<tr>
<td>9:45 a.m. - 10:45 a.m.</td>
<td>AMS-MAA INVITED ADDRESS</td>
<td></td>
</tr>
</tbody>
</table>
Laramie Meeting—SuperPhone Exclusive
800-556-6882

Save 25 Percent to 45 Percent
On Your Air Travel To The Joint Mathematics Meetings
August 10–15, 1985

SuperPhone exclusive does it again.... since flights are limited into Laramie, special discounts have been arranged with USAIR and United Airlines for flights going into Denver. In addition a special discount has been arranged with Alamo Rent A Car. It is suggested that auto rental is the least expensive and most efficient method to transfer from Denver to Laramie.

To be eligible for these discounts you must purchase your ticket 14 days prior to your travel*.

Sample Possible Fares to Denver Using SuperPhone **

<table>
<thead>
<tr>
<th>Originating City</th>
<th>Coach Fare</th>
<th>SuperPhone Fares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>$766</td>
<td>$300</td>
</tr>
<tr>
<td>Chicago</td>
<td>548</td>
<td>332</td>
</tr>
<tr>
<td>Dallas</td>
<td>484</td>
<td>323</td>
</tr>
<tr>
<td>Houston</td>
<td>530</td>
<td>334</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>530</td>
<td>334</td>
</tr>
<tr>
<td>New Orleans</td>
<td>610</td>
<td>384</td>
</tr>
<tr>
<td>New York City</td>
<td>698</td>
<td>250</td>
</tr>
</tbody>
</table>

Depending on circumstances, it may be possible for even lower fares than those above, but this must be determined on an individual basis.

- Seats are limited so the earlier you book the more likely you are to maximize your savings.
- If you are travelling from a city not serviced by USAIR or United, SuperPhone’s FARE CHECK SYSTEM will guarantee the lowest fare for your itinerary on any airline. Also, FARE CHECK automatically reviews your ticket purchase to insure that you have the lowest fare. You will be reticketed if a lower fare becomes available.
- Remember these special fares are available only through SuperPhone ***

* Additional restrictions may apply from Canada.
** Fares are quoted as of February 1, 1985 and are subject to change.
*** A $15 cancellation fee will be charged on all tickets returned and not reissued by SuperPhone.

Call Today Toll Free 800-556-6882 And Save

(In Rhode Island and outside the Continental U.S. call 401-884-9500.)

Hours of operation 9:00 a.m. to 7:00 p.m. EST.
Monday thru Thursday, Friday until 6:00 p.m.)
### TIMETABLE

<table>
<thead>
<tr>
<th>Wednesday, August 14</th>
<th>American Mathematical Society</th>
<th>Mathematical Association of America and Other Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 a.m. - noon</td>
<td></td>
<td>MAA - HEDRICK LECTURE II</td>
</tr>
<tr>
<td>afternoon</td>
<td></td>
<td>Title to be announced</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td></td>
<td>MAA - INVITED ADDRESS</td>
</tr>
<tr>
<td>1:00 p.m. - 1:50 p.m.</td>
<td></td>
<td>Special functions and combinatorics I</td>
</tr>
<tr>
<td>1:00 p.m. - 2:00 p.m.</td>
<td></td>
<td>COLLOQUIUM LECTURE III</td>
</tr>
<tr>
<td>2:15 p.m. - 3:15 p.m.</td>
<td></td>
<td>INVITED ADDRESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Global bifurcation problems from mechanics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stuart S. Antman</td>
</tr>
<tr>
<td>2:15 p.m. - 3:05 p.m.</td>
<td></td>
<td>MAA - INVITED ADDRESS</td>
</tr>
<tr>
<td>3:20 p.m. - 4:10 p.m.</td>
<td></td>
<td>MAA - INVITED ADDRESS</td>
</tr>
<tr>
<td>4:30 p.m. - 6:00 p.m.</td>
<td></td>
<td>PRIZE SESSION AND BUSINESS MEETING</td>
</tr>
<tr>
<td>6:15 p.m.</td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td>6:30 p.m. - 8:15 p.m.</td>
<td></td>
<td>IIME - Banquet</td>
</tr>
<tr>
<td>7:00 p.m.</td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Banquet for 25-Year Members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIME - J. Sutherland Frame Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAA - Minicourses</td>
</tr>
</tbody>
</table>

### Thursday, August 15

<table>
<thead>
<tr>
<th>Morning</th>
<th>AMS</th>
<th>MAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Mechanics and bifurcation theory I</td>
<td>MAA - HEDRICK LECTURE III</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Analysis of one complex variable I</td>
<td>Title to be announced</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Special functions and combinatorics II</td>
<td>Arthur M. Jaffe</td>
</tr>
<tr>
<td>8:30 a.m. - 1:00 p.m.</td>
<td>ASSISTANCE &amp; INFORMATION DESK</td>
<td></td>
</tr>
<tr>
<td>8:40 a.m. - 9:30 a.m.</td>
<td>MAA - INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td>9:45 a.m. - 10:45 a.m.</td>
<td>AMS-MAA INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td>11:00 a.m. - noon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Afternoon

| 1:00 p.m. | Mechanics and bifurcation theory II | MAA - INVITED ADDRESS |
| 1:00 p.m. | Analysis of one complex variable II | |
| 1:00 p.m. - 1:50 p.m. | | |
| 1:00 p.m. - 2:00 p.m. | COLLOQUIUM LECTURE IV | Mathematical gauge field theory |
| | Karen K. Uhlenbeck | |
| 2:15 p.m. - 3:15 p.m. | INVITED ADDRESS | Elliptic curves and diophantine problems |
| | Jerrold B. Tunnell | |
| 3:30 p.m. - 4:30 p.m. | INVITED ADDRESS | Simple Lie algebras of prime characteristic |
| | Richard E. Block | |
Travel

In August, Laramie is on Mountain Daylight Saving Time.

The local airport, Brees Field, is four miles west of the campus. At the moment, only Centennial Airlines offers jet service connecting Laramie to Denver’s Stapleton International Airport. (It is hoped that by the time of the meeting that another carrier will pick up the service recently eliminated when Frontier Airlines dropped their regularly scheduled flights.) There are, however, a very limited number of seats available on Centennial, and participants are urged to consider other means of transportation from Stapleton to Laramie, as outlined below.

If, however, one is fortunate enough to obtain a seat on Centennial, there is taxi service available at Brees Field. Also, Avis and National maintain car rental desks at the airport in Laramie.

There are several types of ground transportation available at Stapleton International Airport which will take one to Laramie, approximately 120 miles to the northwest. Participants should consider sharing a rental car. This is probably the most advantageous form of transportation since it will be available to the renters throughout the entire meeting period. (It is worth mentioning that many scenic attractions in the Laramie area require travel by car.) Avis, National, and Dollar maintain desks at Stapleton. Current rates being quoted for compact cars range from $139 to $235/week. However, Alamo Rent A Car is making a special offer to participants at the Laramie meeting where they will provide an economy-sized car for $21/day or $89/week. This includes unlimited mileage; there is an additional charge of $7.95 for insurance. Since Alamo does not have an office in Laramie, you must return the car to the Denver office. There is a courtesy van which will take one to and from Alamo’s Denver office and Stapleton. In order to take advantage of these special rates, participants must request Group Number 14651, and Plan Code G9 when making reservations. Reservations may be made by calling 800-732-3232, toll-free.

The shortest and most scenic route is I-25 north to Fort Collins, then Colorado 24 west to Route 287, which runs north alongside the Rockies into Laramie. Driving time is approximately two-and-one-half hours.

One can also take the Front Range Airporter (pickup in baggage area at airport) from Stapleton to Fort Collins, and connect with the Laramie Cab Corporation’s limousine service from there to Laramie. Passengers can request to be dropped off at their accommodations, whether on campus or in a nearby motel. The total cost is $36 one way, and reservations MUST be made in advance. Reservations for the entire trip can be made by calling Laramie Cab Corporation at 307-745-4840. The trip takes about three hours, and service is available from Stapleton at 9:30 a.m., 3:30 p.m., and 7:30 p.m. daily. Return service from Laramie is at 6:00 a.m., 10:00 a.m., and 4:00 p.m. Laramie Cab will pick participants up at their accommodations early enough to be on the road to Fort Collins at 6:00 a.m. Again, reservations are a must.

Greyhound offers four buses daily. The trip takes about two-and-one-half hours, and the present fare is $24 one way or $45.60 round trip.

Weather

In August, Laramie’s daytime highs average around 80°F; the average nighttime low is around 48°F. Laramie’s altitude (7,200 feet above sea level) makes hot weather fairly rare. Humidity is generally quite low; however, afternoon thunder-showers are common throughout the summer.

Robert M. Fossum

Urbana, Illinois

Associate Secretary
Actuarial Assumptions and Models for Social Security Projections (John A. Beekman). The lecture consists of seven sections. In the first section, population projections are considered. A social security area population projection starts with an estimate of the current population by age, sex, and marital status, and carries the estimate forward as far as 2080. A deterministic model, and a stochastic model for population projections will be presented.

The second section is concerned with projected life tables. This will include a discussion of life table functions, an analysis of mortality experience by cause of death as well as by age and sex, postulated annual improvement rates in mortality, and the estimation of probabilities of death.

Dependency ratios are described in the third section. These are ratios of retired versus working populations, youth versus working populations and youth plus retired versus working populations. This will include a discussion of the financial burden of a social security pension scheme in a country with a stationary population versus the financial burden in a country with a stable population with a specified growth rate.

In section four, the basic economic assumptions which the Office of the Actuary, Social Security Administration must make are described. These assumptions are made in order to examine the financial status of the Old-Age, Survivors and Disability Insurance (OASDI) system for various periods of time.

Several mathematical models used by the Office of the Actuary are included in section five. These involve linkages between productivity and average wages, increases in average wages as related to increases in productivity and other factors, and labor force participation rates by sex and age. These rates were projected to the year 2060, under four alternative sets of assumptions. Short-range projected GNP, including the concept of potential GNP, with mathematical models for potential GNP are considered.

Further actuarial assumptions and models are presented in section six. These include regression equations for covered worker rates, projected covered populations to the year 2060, relations between effective taxable payroll (ETP) and GNP, and historical analysis of linkages between ETP and GNP, with projections to 2060. Further topics which will be presented are disability incidence and termination rates, probabilities of death, recovery for disabled people, expected average duration of disability entitlement, and actuarial present values of monthly annuities payable to disabled workers.

The seventh section is concerned with long-range cost estimates for the OASDI system. This involves four ideas. The first is primary insurance amounts (PIA) and benefits (expressed through PIA) for various classes of beneficiaries through 2060. The second is the actuarial balance of the system. The third involves sensitivity analyses of actuarial balances as demographic, economic, and programmatic assumptions are varied. The fourth concept is that of projected average OASDI cost rates, income rates, and actuarial balances based on alternative sets of assumptions through 2060.


Updating Actuarial Mathematics (James C. Hickman). Actuarial mathematics is a collection of mathematical ideas found useful in designing and managing financial security systems. The basic mathematical model for life insurance and annuity systems is based on the assumption that time until death is a random variable with a distribution that depends only on the factors of time already lived and the growth of financial capital. The distribution of time until death for use in model building is fixed by selecting an appropriate life table. Choosing an interest rate completes the specification of the
Constructing a basic model for a life insurance or annuity system, based on separate contracts with individuals, is a four step process. (1) A loss variable, \( L = (\text{Present value of benefit payments}) - (\text{Present value of premium income}) \), a function of time until death, is formulated. (2) The premium is determined by requiring that the expected value of \( L \) be zero. (3) Reserves, liabilities of the insurance or annuity system, are defined as the expected value of the loss variable given survival to the time the liabilities are measured. (4) The variances of the loss variable provide a measure of the mortality risk assumed by the issuing organization. The variance of losses on individual policies can be used for making approximate probability statements about the present value of future losses for collections of policies. Earlier expositions of life contingencies omitted step (4) and stressed steps (2) and (3), premiums and reserves as expected values.

More elaborate versions of the basic model are made necessary by business practice and economic reality. Five of these extensions will be discussed. (1) Expenses and expense loadings on the premiums may be added to the loss variable. That is, \( L = (\text{Present value of benefits and expenses}) - (\text{Present value of expense loaded premiums}) \). (2) Different benefits may be paid, depending on the cause of decrement from the group of insured lives. For example, deaths due to accidental means may result in a larger benefit payment. In the U.S. the law specifies a minimum benefit for policy holders terminating voluntarily. These benefits require a multiple decrement model where both the time and cause of decrement are random variables. (3) The payment of benefits and premiums may depend on two or more time until death random variables. For example, a pension may be paid until the death of the last survivor of two lives. These extensions are called multiple life models. (4) Benefit amounts may depend on other economic variables. For example, pension benefits may depend in part on an individual’s salary record. Variable life insurance and annuities may pay benefits related to the value of an investment portfolio or a price index. In such cases it may be necessary to augment the basic model with a component submodel for the economic variables that determine benefit amounts. (5) The assumption of a fixed interest rate may be dropped. A stochastic model for future interest rates can be added to the model. As an alternative, interest rate paths deemed to be relatively extreme can be used in addition to a central set of rates to determine the sensitivity of premium and reserve values to interest rate variation.

In the lecture the basic model will be developed and the five extensions reviewed.


**Overview of Credibility Theory** (Paul M. Kahn). Synopsis and Reading List not available at time of publication.

**Loss Distributions** (Stuart Klugman). The risks assumed under an insurance contract center on three facets of a specified event. The first is whether or not the event takes place. If it does occur, the remaining two are the time of the occurrence and the amount of money paid under the insurance contract. In life insurance only the time is of interest, as death is certain, and the benefit is fixed. In property and liability insurances the time is usually short, but the other two factors are crucial. For this lecture, the emphasis will be on the amount of payment, given that one is to be made. Examples include the cost of repairing an automobile after an accident, and the settlement in a medical malpractice lawsuit.

The actuary’s objective is to find a probability model that adequately describes the distribution of losses. It is not sufficient to determine only the expected value. Questions such as the effects of inflation or a change in the deductible can only be answered if the complete distribution is known. We prefer parametric models, as they avoid inconsistencies.

The first step in such an analysis is to acquire an inventory of parametric distributions. For actuarial applications, we prefer that all positive real numbers be possible outcomes, and that the right tail of the distribution be heavy. Such an inventory will be provided, along with three general techniques for creating heavy tailed distributions.

The second step is to estimate the parameters. Five methods will be presented, ranging from percentile matching (usually easy but unreliable), to maximum likelihood (often requires a computer but is optimal in some senses). Some algorithms will be given, along with asymptotic theory for maximum likelihood estimators.

The final step is to use the fitted model to answer specific questions. A few of these will be discussed, including the effect of inflation on premiums in the presence of a deductible and the expected time between hurricanes that produce in excess of $1 billion in damages.

All of the above procedures will be illustrated with examples drawn from insurance company experience.


**Models in Risk Theory** (Harry H. Panjer). In many insurance contexts, the insurer is interested in modeling the effect of the total claims in the company or in some subset of the company. The modeling
of claims for an aggregate of risks will be reviewed in this lecture. Theoretical justification for the choice of models using concepts of mixed (compound) distributions and infinite divisibility. Numerical procedures for the evaluation of the distribution of total claims and related quantities, such as stop-loss premiums will be emphasized.

The lecture will reflect the author's own research interests. A forthcoming book by the author may be available in draft form at the time of the short course. Other references, readily available in most libraries are:


A Survey of Graduation Theory (Elias S. Shiu). The actuary is concerned with the contingencies of events such as death, disability, retirement, sickness or marriage. He must know the probabilities of such events in order to predict their future occurrence and to calculate premiums, reserves, annuities, etc., for insurance operations. Tables of these probabilities have to be constructed. Graduation is a key step in constructing such tables.

A set of observed mortality probabilities usually contains irregularities which we do not believe to be a feature of the true, underlying mortality probabilities. Graduation is the process of obtaining, from an irregular set of observed values, a corresponding smooth set of values consistent in a general way with the observed values. The purpose of this talk is to give a survey of various graduation methods used by actuaries. An excellent introduction to this subject is the article Graduation, written by T.N.E. Greville in Encyclopedia of Statistical Sciences, vol. 3 (1983), edited by S. Kotz and N. L. Johnson, and published by J. Wiley and Sons.

**Factorizations of** $b^n \pm 1$, $b = 2, 3, 5, 6, 7, 10, 11, 12$

**up to High Powers**

**John Brillhart, D. H. Lehmer, J. L. Selfridge, Bryant Tuckerman, and S. S. Wagstaff, Jr.**

"One characteristic that differentiates human beings from other animals is the ability to react with ebullience to an intellectual stimulus. Accordingly, the arrival of this book provided a welcome opportunity to reaffirm that I belong to the human race. Friends who share with me an interest in and curiosity about topics like the subject of this book have recounted how they, too, were 'turned on' when they turned its pages.

"We had good reason to feel the way we did. During the first quarter of this century, Allan Cunningham undertook the factoring of various numbers which captured his fancy. In particular, he and his associates published factorizations of $b^n \pm 1$ for the bases $b = 2, 3, 5, 6, 7, 10, 11, 12$, with $n$ going into several high values. Since then, sporadic additional factorizations within and beyond the original ranges have appeared. Much of the effort to supplement all this work with within the past two decades, with larger factors than Cunningham was able to compute, has been referred to as 'the Cunningham project'. Some of this work was funded, some was done privately on personal time, and some was done with the expressed or implied consent of the organization or institution for which the researcher worked. Much was done on 'free' machine time.

"Many different computational devices and computers were used. Indeed, the computational effort was both an effect and a cause of more research, improvements, and advancements in number theoretical theorems and techniques. Accounts of this effort, as well as descriptions and explanations of the research, along with references, are given in the textual parts of this book.

"The long-awaited initial product of 'the Cunningham project' is *Factorizations of* $b^n \pm 1$.*

— Samuel Yates

Contemporary Mathematics, 1983, 80 pages, softcover; List price $22, Institutional Member $18, Individual member $13. Order code CONM/22N

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air, 1st book $5, each add'l $3, max. $100 Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
The nineteenth annual Symposium on Some Mathematical Questions in Biology will be held on Monday, May 27, 1985, in the Garden East Room of the Los Angeles Hilton Hotel, in conjunction with the annual meeting of the American Association for the Advancement of Science. The symposium is sponsored by the American Mathematical Society, the Society for Industrial and Applied Mathematics, and Section A (Mathematics) of the American Association for the Advancement of Science. Cosponsors: Sections G (Biological Sciences) and O (Agriculture).

Details regarding registration, local arrangements, and program information for the AAAS meeting will appear in the March 8, 22 and April 5 issues of Science.

The program has been arranged by an Organizing Committee consisting of H. Thomas Banks (Brown University); Gail A. Carpenter, (Northeastern University); Joel E. Cohen (Rockefeller University); Joseph B. Keller (Stanford University); Robert M. Miura (University of British Columbia), chairman; Garrett M. Odell (Rensselaer Polytechnic Institute); Charles S. Peskin (Courant Institute, New York University); and John Rinzel (National Institutes of Health).

The theme of the symposium is Plant Biology. There will be two half-day sessions, each including three one-hour lectures.

**PROGRAM**

Chairman: Robert M. Miura

9:00 a.m.  
Some Mathematical Questions in Biology — Plant Biology
Presiding: Louis J. Gross, University of Tennessee, Knoxville

*Computer simulations of branching-patterns and their implications on the evolution of plants. Karl J. Niklas, Cornell University*

*Dynamics of stomate fields in leaves. Richard H. Rand, Cornell University*

*Modelling plant processes and crop growth. John H. M. Thornley, Grassland Research Institute*

2:30 p.m.  
Some Mathematical Questions in Biology — Plant Biology
Presiding: Richard H. Rand, Cornell University

*Photosynthetic dynamics and plant adaptation to environmental variability. Louis J. Gross, University of Tennessee, Knoxville*

*Life cycle models for plants. Hal Caswell, Woods Hole Oceanographic Institution*

*Models of population processes for plants. Jonathan Roughgarden, Stanford University*
The seventeenth AMS-SIAM Summer Seminar in Applied Mathematics will be held June 30–July 13, 1985, at Cornell University, Ithaca, New York. The seminar will be sponsored jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. It is anticipated that it will be supported by a grant from a federal agency. The topic Reacting Flows: Combustion and Chemical Reactors was selected by the AMS-SIAM Committee on Applied Mathematics whose members at the time were Roger W. Brockett, C. K. Chu, A. K. Konheim, Alan C. Newell (chairman), George C. Papanicolaou, and Robert F. Warming. The proceedings of the seminar will be published by the Society in the series Lectures in Applied Mathematics.

The seminar is the culmination of the Special Year 1984–85 on the same subject held at the Center for Applied Mathematics of Cornell University. The theory of reacting flows has finally blossomed as a mathematical science in the last decade, and an attempt will be made to synthesize it into a firm foundation for future large-scale computing. The seminar will not, however, be aimed at computational fluid mechanics as a whole, but only those parts peculiar to reacting flows.

A series of five lectures each will be given by Rutherford Aris (University of Minnesota, Minneapolis), G. S. S. Ludford (Cornell University), and Andrew Majda (University of California, Berkeley); shorter series will be presented by Harry Dwyer (University of California, Davis), and A. F. Ghoniem (Massachusetts Institute of Technology). There will also be lectures by John D. Buckmaster (University of Illinois, Urbana), Donald Cohen (California Institute of Technology), John Guckenheimer (University of California, Santa Cruz), Ingo Müller (Berlin), Basil Nicolaenko (Los Alamos National Laboratory), Herschel Rabitz (Princeton University), and Forman A. Williams (Princeton University). Together, these lectures will summarize the Cornell Special Year and sharpen the focus on computational questions.

The remaining speakers will be selected by the Organizing and Advisory Committees on the basis of abstracts submitted and commitments to a timely written version. The Organizing Committee consists of Donald Cohen, G. S. S. Ludford, (chairman), Andrew Majda, and Forman A. Williams; the members of the Advisory Committee are Rutherford Aris, John D. Buckmaster, H. Dwyer, John Guckenheimer, Ingo Müller, Basil Nicolaenko, and Herschel Rabitz. A list of topics at which abstracts should be aimed can be obtained from: Professor G. S. S. Ludford, Theoretical & Applied Mechanics, Thurston Hall, Cornell University, Ithaca, New York 14853.

In the early spring a brochure will be available from the AMS office which will include a description of the scientific program, information on the residence and dining hall facilities, firm room and board rates, local information, and a reservation form to be used to obtain accommodations on campus. Each participant will pay a social fee to cover the cost of refreshments served at breaks and for social events. There will also be a meeting registration fee. A copy of the proceedings will be available to registered participants as a privilege of participation in the seminar.

Application blanks for admission and/or financial assistance can be obtained from the Meetings Department, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940. An applicant should have completed at least one year of graduate school and will be asked to indicate his or her scientific background and interest. A graduate student's application must be accompanied by a letter from his or her faculty advisor concerning the applicant's ability and promise. Those who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are limited and individuals who can obtain support from other sources should do so.

Topics for AMS/SIAM Summer Seminar
(Reviews preferred)

Laminar Combustion
- Diffusion flame structure, extinction and spread
- Deflagration structure, stability and extinction
- Ignition and explosion development
- Detonation structure, initiation and failure
- Deflagration-to-detonation transition
- Multiple-step kinetics
- Fluid-dynamical effects

Turbulent Combustion
Reactors (stirred tank, tubular, countercurrent, two-phase)
- Fluidized and packed beds
- Control, multiplicity of states, oscillations, stability

Pyrolysis and Gasification
- Gas-solid reactions, autocatalysis, catalyst preparation
- Polymerization, mass-action kinetics

Mathematical Questions
- Existence, uniqueness and stability of combustion structures
- Ignition modeling
- Analysis of complex reactions
- Governing equations of reacting flows
- Sensitivity analysis
- Qualitative methods and transition to chaos in reactive systems

Computational Questions
- Laminar-flame structure
- Detonation-wave structure
- Transition to detonation
- Statistical calculations of turbulent flames
- Large-eddy simulations (vortex dynamics)
- Adaptive-mesh techniques
- Elliptic free-boundary problems
- Numerical bifurcation and instability in reactors and combustion
- Sensitivity analysis
The thirty-third Summer Research Institute sponsored by the American Mathematical Society will be devoted to algebraic geometry, and will take place at Bowdoin College in Brunswick, Maine, from July 8 to 26, 1985. Members of the Organizing Committee include Spencer Bloch, David Eisenbud (chairman), William Fulton, David Gieseker, Joe Harris, Robin Hartshorne, and Shigefumi Mori. It is anticipated that the institute will be partially supported by a grant from the National Science Foundation. Proceedings of the institute will be published in the AMS series *Proceedings of Symposia in Pure Mathematics*.

The topic was selected by the 1983 Committee on Summer Institutes, whose members were Michael Artin, Thomas H. Brylawski, Robert Osserman (chairman), George C. Papanicolaou, Harold M. Stark, and Stephen Wainger.

The field of algebraic geometry has undergone very intense development since the AMS Summer Research Institute took place in 1974. Since that time there has been a very substantial return to the hard special problems at the base of algebraic geometry and a corresponding wealth of special results and examples. It is anticipated that the institute will have a broad enough scope to encompass the important developments in recent years in what might be called “classical” algebraic geometry, centered around projective varieties in characteristic 0, allowing leeway for the representation of the most exciting new results from the whole field. Algebraic geometry has changed considerably in its emphasis and practices in the last ten years, and an amazing number of classical conjectures have been settled. The demography of the field has also changed substantially; many more algebraic geometers now work outside the great centers. For these reasons, an institute in which at least the classical side of algebraic geometry is “pulled together” is extremely desirable at this time.

It is anticipated that there will be a number of lecture series presenting topics from classical algebraic geometry such as enumerative geometry, moduli of curves, classification of varieties, and arithmetic theory, which have undergone very extensive recent development. There will also be a number of research level seminars on these and other topics which seem likely to play a major role in the subject in the years ahead.

Housing accommodations will be available in the campus residence halls for participants and their families, and cafeteria-style meals will be served daily in the adjacent dining hall. Residence and dining facilities, as well as rooms used for the scientific sessions at Bowdoin College, are accessible to the handicapped.

In the spring a brochure will be sent to all who are invited to attend the institute. It will include information about the scientific program, the residence and dining facilities, room and board rates, travel and local information, and a reservation form for on-campus housing accommodations. Each participant will pay a social fee of $25 to cover the cost of social events and refreshments served at breaks. There will also be a meeting registration fee. A copy of the proceedings will be available to registered participants as a privilege of participation in the institute. Unfortunately, funds for financial assistance will be limited and, therefore, it will be necessary for many participants to obtain their own funds. Anyone who wishes to receive an invitation to participate in the institute and/or be considered for financial assistance should write to Mrs. Dorothy Smith, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940 prior to April 12, 1985. The Organizing Committee will subsequently consider those requests and applicants will be informed at a later date if funds are granted to provide support.
Invited Speakers and Special Sessions

Invited Speakers at AMS Meetings

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

Laramie, August 1985
Stuart S. Antman
Richard E. Block
Robert L. Bryant
David B. MacQueen
Dennis Stanton
Ronald J. Stern
Jerrold Tunnell
Karen K. Uhlenbeck
Lai-Sang Young

Amherst, October 1985
Vaughan F. R. Jones
Andre Joyal
Ngaiming Mok
Robert T. Seeley

Columbia, November 1985
Eric Friedlander
Carlos Kenig
M. Talagrand

Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of the Notices went to the printer. The section below entitled Information for Organizers describes the timetable for announcing the existence of Special Sessions.

August 1985 Meeting in Laramie
Associate Secretary: Robert M. Fossum

Deadline for organizers: Expired
Deadline for consideration: May 7, 1985

Richard A. Askey, Special Functions and combinatorics
Marcy Barge and Robert F. Williams, Dynamical systems and ergodic theory
Frank R. DeMeyer and Rick Miranda, Commutative algebra and algebraic geometry
George B. Purdy, The geometry of configurations
V. M. Segal and S. P. Singh, Approximation theory and applications
Scott J. Spector, Mechanics and bifurcation theory
Chung-Chun Yang, Analysis of one complex variable

October 1985 Meeting in Amherst
Eastern Section
Deadline for organizers: April 15, 1985
Deadline for consideration: July 29, 1985

November 1985 Meeting in Columbia
Central Section
Deadline for organizers: April 15, 1985
Deadline for consideration: July 31, 1985

November 1985 Meeting in Claremont
Far Western Section
Deadline for organizers: April 15, 1985
Deadline for consideration: August 5, 1985

Fall 1985 Meeting
Southeastern Section
No meeting will be held

January 1986 Meeting in New Orleans
Associate Secretary: Frank T. Birtel
Deadline for organizers: April 15, 1985
Deadline for consideration: September 25, 1985

Spring 1986 Meeting
Eastern Section
Deadline for organizers: October 15, 1986
Deadline for consideration: To be announced

Spring 1986 Meeting
Central Section
Deadline for organizers: October 15, 1986
Deadline for consideration: To be announced

Spring 1986 Meeting
Far Western Section
Deadline for organizers: October 15, 1986
Deadline for consideration: To be announced

Spring 1986 Meeting
Southeastern Section
Deadline for organizers: October 15, 1986
Deadline for consideration: To be announced

Information for Organizers

Special Sessions at Annual and Summer meetings are held under the general supervision of the Program Committee. They are administered by the Associate Secretary in charge of the meeting with staff assistance from the Society office in Providence.

Some Special Sessions arise from an invitation to a proposed organizer issued through the Associate Secretary. Others are spontaneously proposed by interested organizers or participants. Such proposals are welcomed by the Associate Secretaries.

The number of Special Sessions at a Summer or Annual Meeting is limited to twelve. Proposals, invited or offered, which are received at least nine months prior to the meeting are screened for suitability of the topic and of the proposed list of speakers, and for possible overlap or conflict with other proposals (specific deadlines for requesting
approval for Special Sessions at national meetings are given above). If necessary, the numerical limitation is enforced.

Proposals for Special Sessions should be submitted directly to the Associate Secretary in charge of the meeting (at the address given in the accompanying box). If such proposals are sent to the Providence office, addressed to the Notices, or directed to anyone other than the Associate Secretary, they will have to be forwarded and may not be received before the quota is filled.

In accordance with an action of the Executive Committee of the Council, no Special Session may be arranged so late that it may not be announced in the Notices early enough to allow any member of the Society, who wishes to do so, to submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration.

Special Sessions are effective at Sectional Meetings and can usually be accommodated. They are arranged by the Associate Secretary under the supervision of the Committee to Select Hour Speakers for the section. The limitation on the number of sessions depends on the space and time available. The same restriction as for national meetings applies to the deadline for announcing Special Sessions at sectional meetings: no Special Session may be approved too late for its announcement to appear in time to allow a reasonable interval for members to prepare and submit their abstracts prior to the special early deadline set for consideration of papers for Special Sessions.

The Society reserves the right of first refusal for the publication of proceedings of any special session. These proceedings appear in the book series Contemporary Mathematics.

Information for Speakers

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, RI 02940) by the special deadline for Special Sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Send Proposals for Special Sessions to the Associate Secretaries

The programs of sectional meetings are arranged by the Associate Secretary for the section in question:

Far Western Section (Pacific and Mountain)
Hugo Rossi, Associate Secretary
Department of Mathematics
University of Utah
Salt Lake City, UT 84112
(Telephone 801-581-8159)

Central Section
Robert M. Fossum, Associate Secretary
Department of Mathematics
University of Illinois
1409 West Green Street
Urbana, IL 61801
(Telephone 217-333-3975)

Eastern Section
W. Wistar Comfort, Associate Secretary
Department of Mathematics
Wesleyan University
Middletown, CT 06457
(Telephone 203-347-9411)

Southeastern Section
Frank T. Birtel, Associate Secretary
Department of Mathematics
Tulane University
New Orleans, LA 70118
(Telephone 504-865-5646)

As a general rule, members who anticipate organizing Special Sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.
Call For Topics For 1987 Conferences

Suggestions are invited from mathematicians, either singly or in groups, for topics of the various conferences that will be organized by the Society in 1987. The deadlines for receipt of these suggestions, as well as some relevant information about each of the conferences are outlined below. An application form to be used when submitting suggested topic(s) for any of these conferences (except the Short Course Series) may be obtained by writing to the Meetings Department, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940, or telephoning 401-272-9500, extension 296.

Individuals willing to serve as organizers should be aware that the professional meeting staff in the Society’s Providence office will provide full support and assistance, before, during, and after each of these conferences. Organizers should also note that for all conferences except Summer Research Conferences, it is required that the proceedings be published by the Society, and that SRC’s are frequently published. A member of the Organizing Committee must be willing to serve as editor of the proceedings.

All suggestions must include (1) the names and affiliations of proposed members and chairman of the Organizing Committee; (2) a two- or three-page detailed outline of the subject(s) to be covered, including the importance, timeliness of the topic, and estimated attendance; (3) a list of the recent conferences in the same or closely related areas; (4) a tentative list of names and affiliations of the proposed principal speakers; (5) a list of likely candidates who would be invited to participate and their current affiliations; and (6) any other observations which may affect the size of the conference and the amount of support required. Any suggestions as to sites and dates should be made as early as possible in order to allow adequate time for planning. By action of the AMS Board of Trustees, the Meetings Department of the Society is responsible for the final selection of the site for each conference, and for all negotiations with the host institution. Individuals submitting suggestions for the conferences listed below are requested to recommend sites or geographic areas which would assist the Meetings Department in their search for an appropriate site. In the case of Joint Summer Research Conferences in the Mathematical Sciences, a one-, two-, or three-week conference may be proposed.

Refer to the box titled Topics of Current and Recent Conferences in this announcement for lists of topics.

Topics of Current and Recent Conferences

AMS-SIAM Symposium in Applied Mathematics

1980–Mathematical psychology and psychophysiology, organized by Stephen Grossberg of Boston University.

1983–Inverse problems, organized by D. W. McLaughlin of the University of Arizona.

AMS Summer Institute

1983–Nonlinear functional analysis and applications, organized by Felix Browder of the University of Chicago.


1985–Algebraic geometry, organized by David Eisenbud of Brandeis University.

1986–Representations of finite groups and related topics, organized by Jonathan L. Alperin of the University of Chicago.

AMS-SIAM Symposium on Some Mathematical Questions in Biology

1983–Muscle physiology, organized by Robert M. Miura of the University of British Columbia.

1984–DNA sequence analysis, organized by Robert M. Miura of the University of British Columbia.

1985–Plant biology, organized by Robert M. Miura of the University of British Columbia.

1986–Modeling circadian rhythms, organized by Gail A. Carpenter of Northeastern University.

AMS-SIAM Summer Seminar

1983–Large scale computations in fluid mechanics, organized by Richard C. J. Somerville, Scripps Institution of Oceanography


1987 AMS-SIAM Symposium In Applied Mathematics

This two-day symposium in applied mathematics will henceforth take place in every odd-numbered year, alternating with a symposium in pure mathematics in even-numbered years. The next regularly scheduled symposium is scheduled to be held during the two days preceding the 1987 spring AMS sectional meeting at a site that has not yet been selected. Proceedings are published by the Society as volumes in the series SIAM-AMS Proceedings.

Deadline For Suggestions: August 15, 1985

1987 AMS-SIAM Symposium
Some Mathematical Questions in Biology

This one-day symposium is usually held in conjunction with the Annual Meeting of the AAAS in May. Papers from the symposia are published by the Society as volumes in the series Lectures on Mathematics in the Life Sciences.

Deadline For Suggestions: April 1, 1985

1987 AMS-SIAM Summer Seminar

The goal of the summer seminar is to provide an environment and program in applied mathematics in which experts can exchange the latest ideas and newcomers can learn about the field. Proceedings are published by the Society as volumes in the series Lectures in Applied Mathematics.

Deadline For Suggestions: August 15, 1985

1987 Joint AMS-IMS-SIAM Summer Research Conferences in the Mathematical Sciences

These conferences are similar in structure to those held at Oberwolfach, and represent diverse areas of mathematical activity, with emphasis on areas currently especially active. Careful attention is paid to subjects in which there is important interdisciplinary activity at present. Topics for the fourth series of one-week conferences, being held in 1985, are Brown-Gitler spectra and applications, Applications of Lie groups in differential geometry, Numerical simulations of fluid flow, Multiparameter bifurcation theory, Harmonic analysis in R^n, Function estimates, Applications of mathematical logic to finite combinatorics, Combinatorics and ordered sets, Current trends in arithmetical algebraic geometry, and Computational number theory. If proceedings are published by the Society, they will appear as volumes in the series Contemporary Mathematics.

Deadline For Suggestions: February 1, 1986

Call for Topics for 1987 AMS Short Course Series

The AMS Short Courses consist of a series of introductory survey lectures and discussions ordinarily extending over a period of one and one-half days immediately prior to the Joint Mathematics Meetings held in January and August each year. Each of the courses is devoted to a specific area of applied mathematics or to areas of mathematics used in the study of a specific subject or collection of problems in one of the physical, biological, or social sciences. Topics in recent years have been Fair Allocation (January 1985), Environmental and Natural Resource Mathematics (August 1984), Mathematics of Information Processing (January 1984), Population Biology (August 1983), and Computer Communications (January 1983). Proceedings are published by the Society as volumes in the series Proceedings of Symposia in Applied Mathematics, with the approval of the Editorial Committee.

Deadline for Suggestions: July 1, 1985 for January 1987 course, and December 1, 1985 for August 1987 course.

Submit suggestions to: Professor Stefan A. Burr, Chairman, AMS Short Course Subcommittee, Department of Computer Sciences, CUNY, City College, New York, New York 10031.
THIS SECTION contains announcements of meetings of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in the Notices if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year and page of the issue in which the complete information appeared.

IN GENERAL, announcements of meetings held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. All communications on special meetings should be sent to the Editor of the Notices, care of the American Mathematical Society in Providence.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the Notices prior to the meeting in question. To achieve this, listings should be sent in Providence SIX MONTHS prior to the scheduled date of the meeting.


1984–1985. Special Year Devoted to Minimal Surfaces and their Applications to Low-Dimensional Topology, Department of Mathematics, University of California, Santa Barbara, California. (October 1984, p. 690)


1984–1985. Special Year in Mathematical Logic and Theoretical Computer Science, University of Maryland, College Park, Maryland.

Support: Some financial support is available for other participants. Priority will be given to graduate students and junior faculty.


Information: K. Lopez-Escobar, Department of Mathematics, University of Maryland, College Park, Maryland 20742. Alternatively, contact any other member of the organizing committee.

March 1985


April


1985. European Mechanics Colloquia, Various locations. (October 1984, p. 690)


MARCH 1985


Information: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, 612-373-0355.

11–15. Symposium on the Occasion of the Proof of the Bieberbach Conjecture, Purdue University, West Lafayette, Indiana. (January 1985, p. 90)

18–22. Short Course on Numerical Methods for Partial Differential Equations, University of Tennessee Space Institute, Tullahoma, Tennessee. (October 1984, p. 692)

18–22. NSF-CBMS Regional Conference on Mathematical Ecology, University of California, Davis, California. (October 1984, p. 692)


22–23. Mathematical Ecology Conference, University of Georgia, Athens, Georgia.

Program: 25-minute contributed talks and discussion sessions.

Participants: D. DeAngelis (Oak Ridge National Laboratory), T. Hallam (University of Tennessee), R. Lassiter (U.S. Environmental Protection Agency), B. Patten (University of Georgia), R. Wiegent (University of Georgia).

Information: Thomas C. Gard, Department of Mathematics, University of Georgia, Athens, Georgia 30602.

22–24. Conference on Automorphic Forms and L-Functions, Purdue University, West Lafayette, Indiana. (October 1984, p. 692)

Information: David Maier, Department of Computer Science, Oregon Graduate Center, 19600 N.W. Walker Road, Beaverton, Oregon 97006, 503-845-1121, Ext. 241.

25–29. Conference on Chaotic Dynamics, Georgia Institute of Technology, Atlanta, Georgia. (October 1984, p. 692)


29–30. Midwest Several Complex Variables Conference, University of Toronto, Toronto, Canada.

Support: It is expected that funds will be available to cover accommodation.

Information: Thomas Bloom or Ian Graham, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1.

APRIL 1985

1–3. EUROCAL '85: European Conference on Computer Algebra (Symbolic and Algebraic Computation), Linz, Austria. (October 1984, p. 692)

1–5. Workshop on Oscillation Theory, Computation, and Methods of Compensated Compactness, University of Minnesota, Minneapolis, Minnesota.

Information: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, 612-373-0355.


Principal Speakers: D. Zagier (Bonn), C. L. Feffermann (Princeton), and M. Groenov (Paris). There will be 15 speakers from the United Kingdom as well.

Program: Addresses, a discussion of mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, 612-373-0355.

4–6. Second Chico Topology Conference, California State University, Chico, California.

Program: Edward Tymchatyn will give two 1-hour talks. There will be 20-minute talks on recent and current research; the emphasis will be on continuum theory but there will be some talks on other aspects of general topology.

Deadline for Abstracts: Abstracts (not to exceed one double spaced typewritten page) should be submitted by March 10, 1985.

Support: A limited amount of support will be available.

Information: Eldon J. Vought, Mathematics Department, California State University, Chico, California 95929.


8–19. International Seminar on Algebraic and Topological Graph Theory, Dubrovnik, Yugoslavia. (November 1984, p. 801)


Topics: The theory of complete partial orders and continuous lattices; topological and categorical aspects to semantics; formal and descriptive aspects of semantic notations.

Speakers: D. Scott (Carnegie-Mellon University), H. Herrlich (University of Bremen, West Germany), G. Strecker (Kansas State University), A. Tang (University of Kansas), S. Brooks (Carnegie-Mellon University), C. Gunter (Carnegie-Mellon University).


Information: Austin Melton, Department of Computer Science, Kansas State University, Manhattan, Kansas 66506, 913-532-6350.


12–13. Workshop on Numerical Fluid Dynamics, Georgia Institute of Technology, Atlanta, Georgia. (October 1984, p. 692)


22–May 2. NATO-Advanced Study Institute: Nonlinear Functional Analysis and Fixed Point Theorems, Maratea, Italy.

Program: The Institute will cover recent advances in nonlinear functional analysis and its applications in differential equations, partial differential equations, and other areas.


Support: Limited support is available from NATO.

Participation: Participation is limited to fifty.

Information: S. P. Singh, Department of Mathematics, Memorial University of Newfoundland, St. John's, Newfoundland, Canada, A1C 5S7, 709-737-8799.


25–27. Midwest Dynamical Systems Seminar, University of Cincinnati, Cincinnati, Ohio.

Information: Ken Meyer, Department of Mathematics, University of Cincinnati, Cincinnati, Ohio 45221.


MAY 1985


Call for Papers: Papers solicited in the following areas: sensitivity and stability analysis; solution methods for problems involving implicitly defined problem functions, and for problems involving deterministic or stochastic parameter changes; solution approximation techniques and error analysis.


Information: J. B. Hiriart-Urruty, Université Paul Sabatier, 118 route de Narbonne, 21062 Toulouse Cedex, France.

6–10. Workshop on Metastability and Incompletely Posed Problems, University of Minnesota, Minneapolis, Minnesota.

Information: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, 612-373-0355.

13–15. Great Plains Operator Theory Seminar, Texas A&M University, College Station, Texas.

Principal Speakers: M. D. Choi and P. Jorgensen.

Information: R. R. Smith, J. D. Ward, or D. P. Williams, Texas A&M University, Department of Mathematics, College Station, Texas 77843-3368, 409-845-3261.

13–17. Australian Mathematics Convention, University of New South Wales, Kensington, Australia. (January 1985, p. 91)


Program: There will be approximately eight invited lectures as well as several sessions of contributed short papers. Prior to the conference, there will be two one-week workshops (May 6–11). The workshop topics will be computer-oriented management and algorithms.

Organizers: Department of Mathematics, University of Malaya; Centre of Quantitative Studies, National University of Malaysia; Southeast Asian Mathematical Society.

Information: K. P. Chew, Department of Mathematics, University of Malaya, Kuala Lumpur, Malaysia.


16–18. Multiple Stochastic Integration, Polynomial Chaos and their Applications, Case Western Reserve University, Cleveland, Ohio.

Speakers: C. Borell (Chalmers, Goteborg and CWRU), A. Jaffé (Harvard), S. Kwapień (Warsaw University and CWRU), R. Vitale (Claremont Graduate School), and J. Zinn (Texas A&M).

Information: John Chao, Cleveland State University, Cleveland, Ohio 44115, 216-687-4698; or Wojbor A. Woyczynski, Case Western Reserve University, Cleveland, Ohio 44106, 216-368-2880.


20–23. International Conference on Theory and Applications of Differential Equations, Pan American University, Edinburg, Texas. (January 1985, p. 91)


Information: Ph. Tassi et Ensa, 3 av. Pierre Larousse, 92241 Malakoff Cedex, France.


Information: S. Gossel or M. Guilleltoeau, INRIA, Service des Relations Extérieures, BP 105, 78153 Le Chesnay Cedex, France. Telephone: 33 (3) 954.90.20 poste 3600. Telex: 697 033F.


26–31. American Association for the Advancement of Science (AAA8), Los Angeles, California.


28–30. 15th Annual Symposium on Multiple-Value Logic, Queen’s University, Ontario, Canada.

Information: H. T. Mulfah, Department of Electrical Engineering, Queen’s University, Kingston, Ontario K7L 2N6, Canada.

28–June 1. Colloque de Combinatoire Énumérative, Montréal, Québec, Canada. (October 1984, p. 693)

JUNE 1985


3–7. Workshop on Dynamical Problems in Continuum Physics, University of Minnesota, Minneapolis, Minnesota.

Information: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, 612-373-0355.


Program: Most lectures will be of half-hour duration plus a short time for immediate discussion. There will be nine one-hour survey talks on the main topics. A limited number of contributed papers are welcome.

Main Topics: Optimal stochastic control, filtering, stochastic analysis, stochastic mechanics, and applications.


4–6. 7th Symposium on Computer Arithmetic, University of Illinois, Urbana, Illinois.

Information: Daniel G. Gajski, Department of Computer Science, University of Illinois, Urbana, Illinois 61801.


6-8. Canadian Mathematical Society Annual Summer Meeting, Université Laval, Québec, Canada.


Special Sessions: Algebraic and geometric topology, classical analysis, combinatorics, harmonic analysis on groups and representation theory, Lie and Jordan algebras, mathematical physics, numerical methods.

Contributed Papers: 15-minute talks are invited.

Information: L. Lacroix, Département de Mathématiques, Université Laval, Québec G1K 7P4, Canada.


10-14. Ninth International Conference on Transport Theory, Montecatini Terme, Italy.

Program: This biennial series of conferences is devoted to mathematical and computational aspects of transport theory. Most papers will be invited but there will be a limited number of contributed papers.

Support: Travel support from the National Science Foundation is anticipated for a few United States participants.

Information: Paul Nelson, Department of Mathematics, P. O. Box 4319, Texas Tech University, Lubbock, Texas 79409, 806-742-2566; or Vinicio Boffi, Laboratorio Ingegneria Nucleare di Montecucuolino, Università degli Studi di Bologna, 40136 Bologna, Italy.

10-14. Short Course on Numerical Grid Generation, Mississippi State University, Mississippi State, Mississippi.

Topics: Generation and use of grids in numerical solution of partial differential equations; code development and application techniques in computational fluid dynamics, heat transfer, and other areas.

Information: Joe Thompson, Drawer A, Mississippi State, Mississippi 37962, 601-325-3623.


Call for Papers: Submission of papers as well as proposals for symposia and workshops is invited. Deadline is March 15, 1985.

Information: P. A. Wagner, Director, Institute for Logic and Cognitive Studies, University of Houston-Clear Lake, Box 269, Houston, Texas 77058.

17-21. Lecture Series on Combinatorial Aspects of Matrix Analysis, Johns Hopkins University, Baltimore, Maryland.

Program: Ten research-level lectures by C. R. Johnson of Clemson University, additional speakers, and small group discussions.

Support: Limited travel and subsistence funds available.

Information: Alan F. Karr, Department of Mathematical Sciences, The Johns Hopkins University, Baltimore, Maryland 21218, 301-338-7214.

17-29. Canadian Mathematical Society Seminar on Number Theory, Concordia University, Montréal, Québec, Canada.


Information: H. Kisilevsky, Department of Mathematics, Concordia University, 1455 de Maisonneuve Boulevard W., Montréal, Québec H3G 1M8, Canada.


Information: B. Trung Van, CNES/DTI/MN, 18 av. E. Belin, 31062 Toulouse Cedex, France.


20-July 5. Third Workshop on Nonlinear Evolution Equations and Dynamical Systems, Lecco, Italy. (October 1984, p. 693)


Information: J. Cougnard, Université de Franche-Comté, Route de Gray, 25030 Besançon Cedex, France.


Information: V. Statulavicius, Director, Institute of Mathematics and Cybernetics, 54 K Poezoes Str., Vilnius 252600, U.S.S.R.


Information: Secrétariat des Ecoles d’Eté, 1, avenue du Général-de-Gaulle, 92141 Clamart, France. Tél.: (1) 65.42.13; Téléc. 270 400 F.


Purpose: This international congress is organized to honor Hermann Weyl on the occasion of his 100th birthday.


Contributed Papers: 15-minute papers are to be submitted as free contributions no later than April 15, 1985.

Information: Hermann-Weyl-Congress Office, Kiel University, Olshausenstr. Haus N 50b, Zi. 416, 2400 Kiel 1, Federal Republic of Germany. Tel.: 0431-880-2239.


Information: Organising Committee, CDE-111, Mathematics Center, Technical University, BG-7004, Ruse, Bulgaria.

JULY 1985

1-5. International Conference on Classical and Categorical Algebra, University of Natal, Durban, Republic of South Africa. (October 1984, p. 693)

1-6. First International Fuzzy Systems Association Congress, Palma de Mallorca, Balearic Islands, Spain. (October 1984, p. 693)

1-12. Problèmes Inverses Pour l’Analyse Numérique, Clamart Cedex, France.

Information: Secrétariat des Ecoles d’Eté, 1, avenue du Général-de-Gaulle, 92141 Clamart, France.


7-13. Logic Colloquium 85: European Summer Meeting of the Association for Symbolic Logic, University of Paris XI, Orsay, France. (October 1984, p. 693)
Information: L. Bican, Charles University, MFF, Sokolovská 83, 18600 Praha 8, Czechoslovakia.

Program: The first week consists of a summer school; the second week will be an Association for Symbolic Logic meeting including invited lectures, symposia, and sessions for contributed papers.
Topics: Situational semantics, PROLOG, denotational semantics, types and ML, complexity theory, abstract data types, the theory of algorithms, generalised quantifiers, LISP, and foundations of intensional logic.
Information: Ingrid Devil, Center for the Study of Language and Information, Ventura Hall, Stanford University, Stanford, California 94305.

11-13. Journées Remoises d'Analyse de Problèmes Décisionnels dans un Environnement Incertain et Imprécis, Reims, France.
Information: Herman Akdag, Groupe Recherche, C. F. Picard, Université de Paris-6, Tour 45, 4 place Jussieu, 75230 Paris Cedex 05, France.
Registration: Advance registration material will be available in May 1985.
15-19. Conference on Algorithms for the Approximation of Function and Data, Shriver, United Kingdom. (January 1985, p. 92)
Speakers: G. T. Herman, K. J. Langenberg, P. C. Sabatier.
Information: Secrétariat des Ecoles d’Été, 1, avenue du Général-de-Gaulle, 92141 Clamart, France. Tel.: (1) 765.42.13; Téléx: 270 400 F.
21-26. Workshop on Homotopical Algebra and Its Applications, University College of North Wales, Bangor, United Kingdom.
Topics: Talks at the workshop will be restricted to these main themes: algebraic homotopy theory, algebraic models of homotopy types, rational homotopy theory, homotopy coherence, cohomological methods, topos and sheaf theory. It is expected that discussions will take place on the extensive manuscript of Grothendieck.
Support: Partial support is expected from the London Mathematical Society.
Information: T. Porter, Department of Pure Mathematics, University College of North Wales, Bangor, Gwynedd LL57 2UW, United Kingdom.
22-25. SLU-GTE Conference on Sequence Spaces, St. Lawrence University, Canton, New York. (January 1985, p. 92)
22-26. Tenth British Combinatorial Conference, Glasgow, Scotland, United Kingdom. (October 1984, p. 893)
28-August 10. Conference on Banach Spaces and Classical Analysis, Kent State University, Kent, Ohio. (November 1984, p. 802)
29-31. 5th International Conference on Mathematical Modelling, Milano, Italy.
Information: F. Celentano, Dipartimento Biologia, 26 Via Celerio, 2-10133 Milano, Italy.
29-August 16. NATO Advanced Study Institute: Non-linear Dynamical Systems; Integrability and Qualitative Behavior, Université de Montréal, Montréal, Canada. (January 1985, p. 92)

AUGUST 1985

Information: Massachusetts Institute of Technology, Operations Research Center, Room E40-164, Cambridge, Massachusetts 02139.
5-16. Georgia Topology Conference, University of Georgia, Athens, Georgia. (October 1984, p. 694)
Information: ISI Permanent Office, 428 Princes Beatirixzaan, P.O. Box 950, NL-2270 AZ Voorburg, The Netherlands.
12-16. Workshop/Conference on Hydrocodes and Other Codes on Parallel Processors, Michigan Technological University, Houghton, Michigan. (October 1984, p. 694)
18-22. CRYPTO ’85, Santa Barbara, California.
Topic: Cryptology.
Information: Ernest F. Brickell, Org. 1641, Sandia National Laboratories, Albuquerque, New Mexico 87185, 505-844-5949.
Information: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, Minnesota 55455, 612-373-3355.
Information: W. Albers, Department of Medical Information and Statistics, University Limburg, P.O. Box 616, NL-6200, MD Maastricht, The Netherlands.

271
Topics: Probability, stochastic processes, statistics, entropy, ergodic theory, coding theory, fuzzy sets, game theory, pattern recognition, artificial intelligence, genetics, and related areas.
Information: M. Behara or I. Z. Chorneyko, McMaster University, Department of Mathematical Sciences, Hamilton, Ontario, Canada, L8S 4K1, 416-525-9140.


Information: EQUADIFF 6, J. E. Purkyň University, Department of Mathematics, 2a Janackovo CS-66295 Brno, Czechoslovakia.


SEPTEMBER 1985

2–12. NATO Advanced Study Institute: Advances in Microlocal Analysis, II Ciocco, Castelvecchio-Pascoli, Italy. (August 1984, p. 525)

9–12. International Symposium on Computational Fluid Dynamics, Tokyo, Japan. (January 1985, p. 93)

Information: M. Bernadou, INRIA, B.P. 105, 78153 Le Chenay Cedex, France.

Information: J. W. Searl, Department of Mathematics, The University, James Clerk Maxwell Building, The King’s Building, Maryfield Road, Edinburgh EH9 3J2 Great Britain.


OCTOBER 1985

Information: Harold Benzinger or John D’Angelo, Department of Mathematics, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801.


Topics: Problems arising in gas and fluid dynamics, combustion, elasticity, theoretical physics, geometry, and others.

Information: Gladys Moran, Conference Secretary, Mathematics Research Center, 610 Walnut Street, WARF Building, Madison, Wisconsin 53705.


Program: Invited addresses and contributed papers.
Principal Speakers: T. Hallam (University of Tennessee), M. Hirsch (University of California), P. Waltman (Emory University).
Information: Calvin Ahlbrandt or Carmen Chicone, Department of Mathematics, University of Missouri, Columbia, Missouri 65211.

NOVEMBER 1985


DECEMBER 1985

Program Objective: To focus attention on some of the emerging areas in approximation theory and its applications; recent researches are to be highlighted.
Topics: Approximate solutions of operator equations including eigenvalue problems; approximation by positive maps; spline theory and applications; convex analysis and best approximation; optimal estimation, n-widths; interpolation and complex approximation.
Program: One-hour and half-hour talks, group discussions and problem sessions on topics related to the conference theme.
Information: D. V. Pai, Indian Institute of Technology, Bombay, Powai, Bombay 400 076, India; or C. M. Mitchell, IBM, Thomas J. Watson Research Center, Box 218, Yorktown Heights, New York 10598; or B. V. Limaye, L’Institut Mathématiques Appliquées de Grenoble, Tour des Mathématiques, BP 68, 38402, St. Martin d’Hères Cedex, France.

*****

MAY 1986


AUGUST 1986

3–11. International Congress of Mathematicians, Berkeley, California. (February 1984, p. 159)

Recursion Theory
Anil Nerode and Richard A. Shore, Editors
(Proceedings of Symposia in Pure Mathematics. Volume 42)

This Proceedings of the 1982 AMS Summer Research Institute in Recursion Theory, co-sponsored by the Association for Symbolic Logic at Cornell University, June 28 to July 17, represents the largest and broadest meeting ever devoted to recursion theory. It should be a landmark in the subject, as was the AMS Institute at Cornell in 1957.

Anyone from graduate students to active researchers with interests in any aspects of recursion theory, including its interactions with set theory, model theory, constructive mathematics, foundations of mathematics and computer science, will be interested in this book. The background required varies with the papers; some require a basic course in logic or recursion theory only, others advanced research.

The book contains major surveys with expository papers as well as important new research in the general area of recursion theory. From the survey and expository articles a reader can get a general view of recent progress in the various areas of recursion theory, an introduction to current techniques and an idea of some of the important problems still to be solved. One should also get some picture of how recursion theory has interacted with other areas of logic, mathematics and computer science.

The organizers' intention was to consider recursion theory in the broadest sense. This is reflected in the lists of participants and lectures as well as in the contents of the book. The hour talks were roughly grouped around seven short courses—two in Classical Recursion Theory and one each in Generalized Recursion Theory, Fine Structure of L, Descriptive Set Theory, Effective Mathematics, and Complexity Theory (Computer Sciences). These series correspond to the sections of this volume except that two set-theoretic subjects have been grouped into one section and the papers on the foundational topics have been combined with those on computer science. Both of these are natural alignments since the talks in

Descriptive Set Theory dealt mainly with the structure of L(R) and the papers in complexity theory are strongly related to classical undecidability and incompleteness results.

The major research articles include the following.

Carl J. Jockusch, Jr. and Richard A. Shore on the minimal cover problem—a key to recent results on the degrees of unsolvability.

Wolfgang Maas on automorphisms of the lattice of r.e. sets.

Gerald Sacks and Theodore A. Slaman on the r.e. degrees in E-recursion theory (Post Problem and density, respectively).

H. D. Donder, R. B. Jensen and L. J. Stanley on combinatorial principles in L.

Jean-Yves Girard and Jean Pierre Ressayre on $\Pi^1_2$ logic—a major paper on a subject newly developed by Girard and others which while at its root is proof theoretic seems to have important implications for and applications to generalized recursion theory, descriptive set theory and other areas.

Expository and survey articles include

Robert I. Soare, the first article presenting an accessible approach to the 0' priority method introduced by Lachlan and currently being extensively exploited by Harrington and others to settle many important questions about the r.e. sets and degrees.

Richard A. Shore, a survey of recent work on the structure of the degrees of unsolvability.

Anil Nerode and J. Remmel, an encyclopedic survey of the lattice of r.e. substructures of effectively presented mathematical systems.

Papers by Kenneth McAloon, Stephen S. Simpson and Paul Young on the connections between logic and recursion theory on the one hand and strength of axiom systems and low level complexity of computation on the other.

Sy D. Friedman, an introduction to the fine structure of L from a recursion theoretic viewpoint with some new applications.

1980 Mathematics Subject Classifications: 03D25, 03D30, 03D45, 03D55, and others
ISO 5-9218-1447-6, LC 84-18525
ISSN 0082-0717
vii + 528 pages (hardcover), March 1985
List price $60, Institutional member $48,
Individual member $36
Shipping and handling charges must be added
To order, please specify PSPUM/42N

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard
Four-Manifold Theory
Cameron Gordon
and Robion C. Kirby, Editors
(Contemporary Mathematics, Volume 35)

These are the proceedings of the Summer Research Conference on 4-manifolds held at Durham, New Hampshire, July 1982, under the auspices of the AMS and National Science Foundation.

The conference was highlighted by the breakthroughs of Michael Freedman and S. K. Donaldson, and Frank Quinn's completion at the conference of the proof of the annulus conjecture (We commend the AMS committee, particularly Julius Shaneson, who had the foresight in spring 1981 to choose the subject, 4-manifolds, in which such remarkable activity was imminent.) Freedman and several others spoke on his work: some of their talks are represented by papers in this volume. Donaldson and Clifford H. Taubes gave surveys of their work on gauge theory and 4-manifolds and their papers are also included herein. There were a variety of other lectures, including Quinn's surprise, and a couple of problem sessions which led to the problem list.

A background of basic differential topology is adequate for potential readers.

Contents
I. R. Aitchison and J. H. Rubinstein, Fibered knots and involutions on homotopy spheres
Selman Akbulut, A fake 4-manifold
Frederic D. Ancel, Approximating cell-like maps of $S^4$ by homeomorphisms
Sylvain E. Cappell and Julius L. Shaneson, Linking numbers in branched covers
Andrew Casson and Michael Freedman, Atomic surgery problems
S. K. Donaldson, Smooth 4-manifolds with definite intersection form
Robert D. Edwards, The solution of the 4-dimensional annulus conjecture (after Frank Quinn)
Ronald Fintushel and Ronald J. Stern, A $\mu$-invariant one homology 3-sphere that bounds an orientable rational ball
Ronald Fintushel and Ronald J. Stern, Another construction of an exotic $S^1 \times S^3 \# S^2 \times S^2$
Robert E. Gompf and Sukhjit Singh, On Freedman's reimbedding theorems
John Harer, The homology of the mapping class group and its connection to surface bundles over surfaces
Akio Kawuchi, Rochlin invariant and $\alpha$-invariant
R. A. Litherland, Cobordism of satellite knots

Richard Mandelbaum, Complex structures on 4-manifolds
Yukio Matsumoto, Good torus fibrations
Paul Melvin, 4-dimensional oriented bordism
Richard T. Miller, A new proof of the homology torus and annulus theorem
Steven P. Plotnick, Fibered knots in $S^4$-twisting, spinning, rolling, surgery, and branching
Frank Quinn, The embedding theorem for towers
Frank Quinn, Smooth structures on 4-manifolds
Daniel Ruberman, Concordance of links in $S^4$
Lee Rudolph, Constructions of quasipositive knots and links, II
Clifford Henry Taubes, An introduction to self-dual connections

Robion Kirby, 4-manifold problems

Group Actions on Manifolds
Reinhard Schultz, Editor
(Contemporary Mathematics, Volume 36)

The articles in this book are mainly based upon lectures at the 1983 AMS-IMS-SIAM Joint Summer Research Conference on Group Actions on Manifolds held at the University of Colorado. A major objective was to provide an overall account of current knowledge in transformation groups; a number of survey articles describe the present state of the subject from several complementary perspectives. The book also contains some research articles, generally dealing with results presented at the conference. Finally, there is a discussion of current problems on group actions and an acknowledgment of the work and influence of D. Montgomery on the subject.

The book will be accessible to advanced graduate students who have had the equivalent of three semesters of graduate courses in topology; some previous acquaintance with the fundamentals of transformation groups is also highly desirable. Readers can obtain an overall understanding of the sorts of problems one studies in group actions and the methods used to study such problems. This book is not merely an account of new results, but also a guide to motivation behind present work and potentially future developments.

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard

274
Contents

F. Raymond and R. Schultz. The work and influence of Deane Montgomery
Bibliography of Deane Montgomery
Homotopy-Theoretic Techniques and Applications:
R. Schultz. Homotopy invariants and G-manifolds: A look at the past fifteen years
R. Dotzel. Splitting semifree group actions on homotopy spheres into solid tori
S. Illman. Equivariant Whitehead torsion and actions of compact Lie groups
Homological Methods and Machinery:
C. Allday. A family of unusual torus group actions
J.-P. Haeberly. For $G = S^3$ there is no $G$-Chern character
P. Löffler and R. Schultz. Equivariant frameability of homotopy linear $S^3$ actions on spheres
B. M. Mann and E. Y. Miller. Action maps on equivariant function spaces and applications to PL bordism
A. Necochea. Borsuk-Ulam theorems for prime periodic transformation groups
D. Randall. On equivariant maps of Stiefel manifolds
Applications of Surgery and Geometric Topology:
S. Cappel and J. Shaneson. Representations at fixed points
K. H. Dovermann, T. Petrie and R. Schultz. Transformation groups and fixed point data
M. Masuda and T. Petrie. Lectures on transformation groups and Smith equivalence
R. Schultz. Transformation groups and exotic spheres
S. Weinberger. Constructions of group actions: A survey of recent developments
A. Assadi. Concordance of group actions on spheres
E. C. Cho and D. Y. Suh. Induction in equivariant K-theory and s-Smith equivalence of representations
E. C. Cho. Smith equivalent representations of generalized quaternion groups
D. Y. Suh. s-Smith equivalent representations for finite abelian groups
Y. D. Tsai. Isotropy representations of nonabelian finite group actions
Low-dimensional Topology and Transformation Groups:
A. Edmonds. Transformation groups and low-dimensional manifolds
Homogeneous Spaces and Seifert Fiberings:
K. B. Lee and F. Raymond. The role of Seifert fiber spaces in transformation groups
D. Fried and R. Lee. Realizing group automorphisms
R. Lee and S. Weintraub. Cohomology of a Siegel modular variety of degree two
Transformation Groups and Differential Geometry:
Problems:
R. Schultz (ed.). Problems submitted to the AMS Summer Research Conference on Group Actions

Conference on Algebraic Topology in Honor of Peter Hilton
Renzo Piccinini and Denis Sjerve, Editors
(Contemporary Mathematics, Volume 37)

This book contains 18 papers in algebraic topology and homological algebra by collaborators and associates of Peter Hilton. It is dedicated to Peter Hilton on the occasion of his 60th birthday. The various topics covered are homotopy theory, $H$-spaces, group cohomology, localization, classifying spaces, and Eckmann-Hilton duality.

Students and researchers in algebraic topology will gain an appreciation for Peter Hilton’s impact upon mathematics from reading this book.

Contents

J. F. Adams. The fundamental representations of $E_8$
Israel Berstein. On covering spaces and Lie group actions
A. K. Bousfield. On the homotopy classification of $K$-theoretic spectra and infinite loop spaces
William Browder. $S^1$-actions on open manifolds
F. R. Cohen. An analogue of “Hopf invariant one”
W. G. Dwyer and D. M. Kan. Reducing equivariant homotopy theory to the theory of fibrations
Beno Eckmann. Surface groups and Poincaré duality
Leonard Evens and Stewart Priddy. The cohomology of the semi-dihedral group
Richard Kane. Finite $H$-spaces and the $U(M)$ property

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard

275
Kee Yuen Lam. *On stable Hopf invariant one elements in RP*\(^{2n}\)

Charles A. McGibbon and Joseph A. Neisendorfer. *Various applications of Haynes Miller's theorem*

Ib Madsen and Jan-Alve Svensson. *Induction in unstable equivariant homotopy theory and non-invariance of Whitehead torsion*

Mark Mahowald. *Lin's theorem and the EHP sequence*

J. P. May. *Stable maps between classifying spaces*

Joseph Roitberg. *Residually finite, Hopfian and co-Hopfian spaces*

Victor Snaith. *On the classifying spaces of Galois groups*

James Stasheff. *Hilton-Eckmann duality revisited*

K. Varadarajan. *Projective and free approximations*

**Topics in Complex Analysis**

Dorothy B. Shaffer, Editor

(Contemporary Mathematics, Volume 38)

Most of the mathematical ideas presented in this volume are based on papers given at an AMS meeting held at Fairfield University in October 1983. The unifying theme of the talks was Geometric Function Theory.

Papers in this volume generally represent extended versions of the talks presented by the authors. In addition, the proceedings contain several papers that could not be given in person. A few of the papers have been expanded to include further research results obtained in the time between the conference and submission of manuscripts. In most cases, an expository section or history of recent research has been added. The authors' new research results are incorporated into this more general framework. The collection represents a survey of research carried out in recent years in a variety of topics.

The paper by Y. J. Leung deals with the Loewner equation, classical results on coefficient bodies and modern optimal control theory. Glenn Schober writes about the class \(\Sigma\), its support points and extremal configurations. Peter Duren deals with support points for the class \(S\), Loewner chains and the process of truncation.

A very complete survey about the role of polynomials and their limits in class \(S\) is contributed by T. J. Suffridge.

A generalization of the univalence criterion due to Nehari and its relation to the hyperbolic metric is contained in the paper by David Minda. The omitted area problem for functions in class \(S\) is solved in the paper by Roger Barnard. New results on angular derivatives and domains are represented in the paper by Burton Rodin and Stefan E. Warschawski, while estimates on the radial growth of the derivative of univalent functions are given by Thom McGregor.

In the paper by B. Bshouty and W. Hengartner a conjecture of Bombieri is proved for some cases. Other interesting problems for special subclasses are solved by B. A. Case and J. R. Quine; M. O. Reade, H. Silverman and P. G. Todorov; H. Silverman and E. M. Silvia.

New univalence criteria for integral transforms are given by Edward Merkes. Potential theoretic results are represented in the paper by Jack Quine with new results on the Star Function and by David Tepper with free boundary problems in the flow around an obstacle. Approximation by functions which are the solutions of more general elliptic equations are treated by A. Dufresnoy, P. M. Gauthier and W. H. Ow.

At the time of preparation of these manuscripts, nothing was known about the proof of the Bieberbach conjecture. Many of the authors of this volume and other experts in the field were recently interviewed by the editor regarding the effect of the proof of the conjecture. Their ideas regarding future trends in research in complex analysis are presented in the epilogue by Dorothy Shaffer.

A graduate level course in complex analysis provides adequate background for the enjoyment of this book.

**Errett Bishop: Reflections on Him and His Research**

Murray Rosenblatt, Editor

(Contemporary Mathematics, Volume 39)

This book is the proceedings of the Memorial Meeting for Errett Bishop held at the University of California, San Diego. September 24, 1983.

Errett Bishop was distinguished for his mathematical work on function algebras and
the foundations of mathematics. His research on function algebras and complex analysis was universally recognized. The research on foundations which came later was also remarkable. As is well known, many people have very strong opinions concerning foundations. The object here is to present a view of Errett Bishop as an individual, a colleague to many of us, and as a mathematician. A vita of Bishop is first given with a listing of his mathematical papers. This is followed by a paper of Bishop's titled "Schizophrenia in contemporary mathematics." This paper was distributed in conjunction with the Colloquium Lectures he delivered in 1973 at the Seventy-Eighth Summer Meeting of the American Mathematical Society.

People with an interest in function algebras, the foundations of mathematics, or Bishop himself will be pleased with this book. They will gain an understanding of the contributions of Bishop to research on function algebras and foundations, and their novelty and continuing impact on these fields.

Contents

Vita of Errett Bishop
Publications of Errett Bishop
Errett Bishop, Schizophrenia in contemporary mathematics
Stefan Warschawski, Errett Bishop—In memoriam
John Wermer, The work of Errett Bishop in several complex variables
John Kelley, Recollections
Halsey Royden, Aspects of constructive analysis
Irving Glicksberg, The work of Errett Bishop and uniform algebras
Anil Nerode, George Metakides and Robert Constable, Remembrances of Errett Bishop
G. Metakides, A. Nerode and R. A. Shore, On Bishop's Hahn-Banach Theorem

Prescribing the Curvature of a Riemannian Manifold
Jerry L. Kazdan

(CBMS Regional Conference Series. Number 57)

These notes were the basis for a series of ten lectures given from January 6–10, 1984 at Polytechnic Institute of New York under the sponsorship of the Conference Board of the Mathematical Sciences and the National Science Foundation. The lectures were aimed at mathematicians who knew either some differential geometry or partial differential equations, although others could hopefully understand the lectures.

Author's Summary: Given a Riemannian Manifold \((M, g)\) one can compute the sectional, Ricci, and Scalar curvatures. In other special circumstances one also has mean curvatures, holomorphic curvatures, etc. The inverse problem is, given a candidate for some curvature, to determine if there is some metric \(g\) with that as its curvature. One may also restrict ones attention to a special class of metrics, such as Kähler or conformal metrics, or those coming from an embedding. These problems lead one to (try to) solve nonlinear partial differential equations. However, there may be topological or analytic obstructions to solving these equations. A discussion of these problems thus requires a balanced understanding between various existence and non-existence results.

The intent of this volume is to give an up-to-date survey of these questions, including enough background, so that the current research literature is accessible to mathematicians who are not necessarily experts in PDE or Differential Geometry.

The intended audience is mathematicians and graduate students who know either PDE or differential geometry at roughly the level of an intermediate graduate course.

Contents

I. Gaussian Curvature
1. Surfaces in \(\mathbb{R}^3\)
2. Prescribing the curvature form on a surface
3. Prescribing the Gaussian curvature on a surface
   (a) Compact surfaces
   (b) Noncompact surfaces
II. Scalar Curvature
1. Topological obstructions
2. Pointwise conformal deformations and the Yamabe problem
   (a) \(M^n\) compact
   (b) \(M^n\) noncompact
3. Prescribing scalar curvature
4. Cauchy–Riemann manifold
III. Ricci Curvature
1. Local solvability of \(\text{Ric}(g) = R_{ij}\)
2. Local smoothness of metrics
3. Global topological obstructions
4. Uniqueness. nonexistence
5. Einstein metrics on 3-manifolds
6. Kähler manifolds
   (a) Kähler geometry
   (b) Calabi's problem and Kähler–Einstein metrics

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard
(c) Another variational problem
IV. Boundary Value Problems
1. Surfaces with constant mean curvature
   (a) Rellich’s problem
2. Some other boundary value problems
   (a) Graphs with prescribed mean curvature
   (b) Graphs with prescribed Gauss curvature
3. The $C^{2+\alpha}$ estimate at the boundary
   Some Open Problems

Kazdan received the Ph.D. in 1963 from the Courant Institute of Mathematical Sciences. After that, he was a Peirce Instructor at Harvard University. Since 1966 he has been at the University of Pennsylvania.

Visiting Professorships: Harvard, UC Berkeley, University of Paris, École Polytechnique, Bonn University, Max Planck Institute (Bonn), Australian National University, Tokyo University, RIMS (Kyoto).

Research interests: Nonlinear Partial differential equations and differential geometry.

1980 Mathematics Subject Classifications: 35Jxx, 53Cxx
ISBN 0-8218-0707-2, LC 84-28274
ISSN 0160-7642
64 estimated pages (softcover), July 1985
List price $12, all individuals $7
Shipping and handling charges must be added
To order, please specify CBMS/57N

Dual Algebras
with Applications
to Invariant Subspaces
and Dilation Theory
Hari Bercovici, Ciprian Foiaș
and Carl Pearcy
(CBMS Regional Conference Series, Number 56)

This book is a slightly expanded and revised version of the lecture notes from the NSF/CBMS Regional Conference held in Tempe, Arizona in May 1984, at which the third author was the principal lecturer. In the book the authors have tried to summarize some of the voluminous progress that has been made in the theory of dual algebras since the appearance in 1978 of Scott Brown’s pioneering paper which clearly showed the utility of this concept for studying the structure theory of bounded linear operators on Hilbert space. The aim of the book is to present an approach for studying (non-self-adjoint) dual algebras that allows one, in particular, to obtain results on invariant subspaces and dilation theory.

The book is put together as follows. Chapter I contains facts of a general nature about dual algebras. Chapters II and III describe a general method for proving structure theorems concerning the preduals of operator algebras. Several instances in which these general structure theorems for preduals can be applied are studied in Chapters VI, VII and IX. Chapter IX, for example, contains a very general reflexivity theorem for operator algebras. The remaining chapters are dedicated to the study of singly generated algebras, with special emphasis on a new dilation theory (Chapter V). Chapters VIII and X contain applications to special classes of operators, like weighted shifts and subnormal operators.

This book may serve as an introduction to this area of research for those not already familiar with it. Results in this area are scattered throughout the literature and, sometimes, unpublished. The book provides a unified approach to developments following Scott Brown’s invariant subspace theorem for subnormal operators.

A background in basic functional analysis and operator theory on Hilbert space will prepare the reader. Some knowledge of canonical models for contractions will also be helpful, especially for Chapter VIII.

1980 Mathematics Subject Classifications: 47A, 47C, 47D; 46H, 46J
ISBN 0-8218-0706-4, LC 84-24528
ISSN 0610-7642
estimated 112 pages (softcover), May 1985
List price $16, all individuals $10
Shipping and handling charges must be added
To order, please specify CBMS/56N

Selected Tables
in Mathematical Statistics,
Volume 8

These volumes of mathematical tables have been prepared under the aegis of the Institute of Mathematical Statistics, which is a professional society for mathematically-oriented statisticians. The purpose of the Institute is to encourage the development, dissemination, and application of mathematical statistics. The Committee on Mathematical Tables of the Institute of Mathematical Statistics is responsible for preparing and editing these series of tables.

The tables included in the present volume were checked at the University of Victoria. Dr. R. F. Odeh arranged for, and directed this checking with the assistance of Mr. Bruce Wilson.

Contents
B. J. Trawinski. Expected sizes of a selected subset in paired comparison experiments
Robert E. Bechhofer and Ajit C. Tamhane. Tables of admissible and optimal balanced treatment incomplete block (BTIB) designs for comparing treatments with a control

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard

278
M. L. Tiku and S. Kumra. Expected values and variances and covariances of order statistics for a family of symmetric distributions (student's t)

1980 Mathematics Subject Classifications:
62Q05, 62C15, 62E30, 62F07, 62G30 and others
ISBN 0-8218-1907-7, LC 74-6283
ISSN 0094-8837
x + 270 pages (hardcover), April 1985
List price $30, Institutional member $24,
Individual member $18
Shipping and handling charges must be added
To order, please specify TABLES/8N

Dirichlet Integrals of Type 2 and Their Applications
Milton Sobel, V. R. R. Uppuluri and K. Frankowski
(Selected Tables in Mathematical Statistics, Volume 9)

Abstract
This volume deals with incomplete Dirichlet integrals of type 2 and is a companion book to Volume 4 of this series (by the same authors) which deals with incomplete Dirichlet integrals of type 1. As in the previous volume
1) there are several new contributions present, some of which concern the development of new algorithms that made these tables possible.
2) there are many examples given to illustrate the use of the tables,
3) applications of these integrals are given to two types of problems: some that would be classified as being in the area of probability and also to some that are primarily statistical in nature,
4) there is already evidence that these tables and the associated write-up will serve as a catalytic agent for further research.
5) the probabilistic interpretation of the Dirichlet integral plays a major role in the direction we take and in the development of tables.

An important area of application of these integrals is to ranking and selection problems dealing with the multinomial distribution, especially when the statistic of major interest is related to the minimum or maximum frequency among the cells and the stopping rule is of the type used in inverse sampling. In the tables most attention is to the homogeneous multinomial; however much of the analysis attempts to get away from homogeneity.

1980 Mathematics Subject Classifications:
62Q05, 65E15, 62H10
ISSN 0094-8837
pages (hardcover), May 1985
List price $40, Institutional member $32,
Individual member $24
Shipping and handling charges must be added
To order, please specify TABLES/9N

Seven Papers in Applied Mathematics
(American Mathematical Society Translations. Series 2, Volume 125)

The papers in this book are translated from the Russian.

Contents
D. V. Anosov. Smooth dynamical systems
V. S. Bondarchuk. A periodic problem in the calculus of variations and deformations of Hamiltonian systems
V. G. Babskiï and A. D. Myshkis. The monotonicity of the change in the first eigenvalue for a class of nonselfadjoint boundary value problems in the theory of hydrodynamical stability
A. V. Kazhikhov and V. B. Nikolaev. On the correctness of boundary value problems for the equations of a viscous gas with nonmonotone state function
Yu. A. Eremnin, E. V. Zakharov and N. I. Nesmeyanov. The method of fundamental solutions in problems of diffraction of electromagnetic waves by bodies of revolution

1980 Mathematics Subject Classifications:
58, 35, 34, 76, 78, 70, 82, 83, 49, 85
ISBN 0-8218-3087-2, LC 84-21681
ISSN 0065-9290
vi + 130 pages (hardcover), April 1985
List price $45, Institutional member $36,
Individual member $27
Shipping and handling charges must be added
To order, please specify TRANS2/125N

Selected Translations in Mathematical Statistics
and Probability, Volume 16

These translations from the Russian papers are selected by a joint committee of the Institute for Mathematical Statistics and the American Mathematical Society.

Contents
I. B. Klebanov and S. T. Mkrtchyan. Estimating the proximity of distributions in terms of coinciding moments
I. V. Ostrovskii. On an infinitely divisible factorization

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard

279
L. A. Yanovich. On quadrature formulas for stochastic integrals of nonrandom functions

A. G. Nakonechnyi. Approximation of random functions by positive operators

S. E. Kuznetsov. Construction of a regular split process (random interval)

S. E. Kuznetsov. Regularity criteria for Markov processes

S. E. Kuznetsov. Transformation of a Markov process with the help of excessive functions

N. I. Mashina and Yu. N. Shul'ga. On the question of optimizing the operation of a volume network with mobile servers

V. V. Anisimov and V. N. Sityuk. Asymptotic analysis of nonhomogeneous Markov systems with "rare" semi-Markov failures

Z. M. Landsman. Asymptotic behavior of the Fisher information in the case of a family with location and scale parameters

A. A. Zinger and R. V. Januškevičius. On a theorem of characterization by identical distribution of statistics, and its stability

È. A. Nadaraya. On some tests based on "kernel" type estimators of a probability density

Yu. M. Lin'kov. Asymptotic normality of the logarithm of the likelihood ratio, and hypothesis testing for nonhomogeneous Poisson processes

A. K. Kelmans. On the analysis and synthesis of probabilistic networks

1980 Mathematics Subject Classifications: 62
ISBN 0-8218-1468-0, LC 63-9803
ISSN 0065-9274
vi + 138 pages (hardcover), March 1985
List price $56, Institutional member $45,
Individual member $34
Shipping and handling charges must be added
To order, please specify STAPRO/16N

Attractors Representing Turbulent Flows
Peter S. Constantin, Ciprian Foiaș and Roger Temam
(Memoirs of the AMS. Number 314)

The aim of this monograph is to fill some part of the gap existing between two classical approaches to turbulence, on one hand the conventional statistical theory and the well-known results of Kolmogorov, on the other hand the more recent point of view based on the concept of attractors and chaos, following in particular the ideas of Smale and Ruelle-Takens. By using the mathematical theory of the Navier-Stokes equations, refined estimates on the Lyapunov numbers of the system are given and the connection is made between the concept of number of degrees of freedom of a turbulent flow and the dimension of the attractor associated to the flow.

1980 Mathematics Subject Classifications: 76D05, 76F90
ISBN 0-8218-2315-9, LC 84-24623
ISSN 0065-9266
vi + 67 pages (softcover), January 1985
List price $11, Institutional member $9,
Individual member $7
Shipping and handling charges must be added
To order, please specify MEMO/314N

Chapter 16 of Ramanujan's Second Notebook: Theta-functions and q-series
Chandrashker Adiga, Bruce C. Berndt, S. Bhargava and George N. Watson
(Memoirs of the AMS. Number 315)

Chapter 16 of Ramanujan's second notebook provides an introduction to his further work on q-series and elliptic functions found in later chapters of his second notebook and in his "lost notebook." The purpose of this Memoir is to give proofs of all of the 135 identities stated in 39 sections of Chapter 16. Some of the results on q-series are classical basic hypergeometric transformations due to Cauchy, Euler, and Heine. However, many of the identities, including certain q-continued fraction expansions, are originally due to Ramanujan and are proved for the first time in this Memoir. Ramanujan also develops in this chapter the classical theory of theta-functions from which Ramanujan derives original theorems not heretofore proved in print.

1980 Mathematics Subject Classifications: 11B37, 33A90
ISBN 0-8218-2317-5, LC 84-24283
ISSN 0065-9266
vi + 85 pages (softcover), January 1985
List price $20, Institutional member $10,
Individual member $7
Shipping and handling charges must be added
To order, please specify MEMO/315N

Galvin's "Racing Pawns" Game and a Well-Ordering of Trees
Stephen B. Grantham
(Memoirs of the AMS. Number 316)

The combinatorial game considered here was formulated by Fred Galvin during the mid-seventies; though unpublished, his proof by "infinitary strategy-stealing" that the game is always a win for the first player has become known for its elegance. Galvin also was able to construct an
explicit strategy for the case in which the trees involved in the game are finite.

In this paper the author presents Galvin’s results and then goes on to construct the elaborate machinery needed to give the explicit strategy in the general (infinite) case. At the same time he uses Galvin’s game to define a well-ordering on the class of branch-finite trees and applies his machinery to determine the order types of many subsets of this class under that well-ordering.

1980 Mathematics Subject Classifications: 04A10, 03E10, 05C05, 06A05, 90D05
ISBN 0-8218-2317-5, LC 84-24613
ISSN 0065-9266
iv + 63 pages (softcover), January 1985
List price $11, Institutional member $9,
Individual member $7
Shipping and handling charges must be added
To order, please specify MEMO/316N

Spectral Sequence Constructors in Algebra and Topology
Donald W. Barnes
(Memoirs of the AMS. Number 317)

Spectral sequence constructors are a special type of functor to filtered chain complexes. They provide a means of comparing the various constructions which have been given for certain spectral sequences, for example, the spectral sequence of a group extension. In this book, the theory of spectral sequence constructors is developed, the four main constructions of the spectral sequence of a Hopf algebra extension are discussed and compared, and a uniqueness theorem for the spectral sequence is proved. A similar study is made of the spectral sequence of a fibration, and its uniqueness is also established.

1980 Mathematics Subject Classifications: 18G40, 55F40; 18H05, 55T10
ISBN 0-8218-2319-1, LC 84-24622
ISSN 0065-9266
iv + 82 pages (softcover), January 1985
List price $11, Institutional member $9,
Individual member $7
Shipping and handling charges must be added
To order, please specify MEMO/318N

Embedding and Multiplier Theorems for \( H^p(\mathbb{R}^n) \)
Albert Baernstein II
and Eric T. Sawyer
(Memoirs of the AMS. Number 318)

This paper is about the real variable Hardy spaces \( H^p(\mathbb{R}^n) \), \( 0 < p \leq 1 \). We prove two main theorems. The first is a sufficient condition involving the “size” of \( f \in S' \) which implies that \( f \in H^p \), and the second a sufficient condition on \( m \in L^\infty(\mathbb{R}^n) \) for \( m \) to be a Fourier multiplier of \( H^p \). These conditions are phrased in terms of certain function spaces introduced by Herz, and within these spaces the conditions are sharp. The embedding theorem sharpens results of Taibleson and Weiss involving “molecules” and implies a sharp Fourier embedding theorem of the Bernstein-Taibleson-Herz type, while the multiplier theorem sharpens results of Calderón and Torchinsky. The paper also contains three other theorems about Fourier transforms of \( H^p \) distributions.

1980 Mathematics Subject Classifications: 42B30, 42B15
ISBN 0-8218-2318-3, LC 84-24294
ISSN 0065-9266
iv + 63 pages (softcover), January 1985
List price $11, Institutional member $9,
Individual member $7
Shipping and handling charges must be added
To order, please specify MEMO/315N

Some Basic Hypergeometric Orthogonal Polynomials that Generalize Jacobi Polynomials
Richard Askey and James Wilson
(Memoirs of the AMS. Number 319)

The classical orthogonal polynomials include those of Hermite, Laguerre, Jacobi and discrete analogues found by Chebyshev, Charlier, Meixner and Hahn. In an earlier paper the authors found the most general set of classical orthogonal polynomials whose weight function is discrete. The same polynomials with different choices of parameters have an absolutely continuous weight function. The explicit orthogonality relation is obtained, many special cases are considered, and a few facts about these polynomials are discovered. These include quadratic transformations for some basic hypergeometric series, a solution of the connection coefficient problem which gives Watson’s extension of the Rogers-Ramanujan identities, inequalities for the polynomials on the spectral interval, a divided difference equation and a Rodrigues type formula. All of the paper rests on a new extension of the beta integral which has four rather than two free parameters in addition to the \( q \) associated with basic hypergeometric series.

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard
1979 Mathematics Subject Classification: 05A17
ISBN 0-8218-2321-3, LC 84-28117
ISSN 0065-9266
iv + 56 pages (softcover), March 1985
List price $10, Institutional member $6,
Individual member $6
Shipping and handling charges must be added
To order, please specify MEMO/319N

Positive Polynomials and Product Type Actions of Compact Groups
David Handelman
(Memoirs of the AMS, Number 320)

In computing $K_0$ of fixed point $C^*$-algebras under special actions of compact groups, one is lead to the following type of problem (in the case of the $d$-torus). Let $f$ be a polynomial in $d$ real variables. Decide if there exists a polynomial $Q$ such that $Qf$ has only non-negative coefficients. The answer to this decision question is given. completing results of Poincaré (1883), Meissner (1911), and Polyà (1928). Similar questions with characters of compact Lie groups replacing polynomials are considered, and the foundations are laid for further work on this sort of “eventual positivity” problem. The author also goes back to describe the maximal ideal structure of the original fixed point algebras, using the techniques from ordered $K_0$-theory developed above.

1980 Mathematics Subject Classification: 46L05
ISBN 0-8218-2322-1, LC 84-28463
ISSN 0065-9266
xii + 80 pages (softcover), March 1985
List price $12, Institutional member $10,
Individual member $7
Shipping and handling charges must be added
To order, please specify MEMO/320N

Conditional Stability and Real Analytic Pseudo-Anosov Maps
Marlies Gerber
(Memoirs of the AMS, Number 321)

The author shows that the smooth pseudo-Anosov diffeomorphisms constructed by Gerber and Katok satisfy a “conditional structural stability” property, i.e. structural stability with respect to $C^1$ perturbations which preserve some finite number of jets at a given finite collection of points. As a corollary, she obtains real analytic diffeomorphisms which are Bernoulli with respect to a smooth invariant measure and which are conjugate to Thurston’s pseudo-Anosov homeomorphisms. These results also hold for generalized pseudo-Anosov diffeomorphisms. In particular, this proves the existence of real-analytic Bernoulli diffeomorphisms on the two-dimensional disk which preserve Lebesgue measure.

1980 Mathematics Subject Classification: 58F15, 58F30, 58F11
ISBN 0-8218-2320-5, LC 84-29008
ISSN 0065-9266
iv + 124 pages (softcover), March 1985
List price $13, Institutional member $10,
Individual member $8
Shipping and handling charges must be added
To order, please specify MEMO/321N

Banach Spaces with a Unique Unconditional Basis, Up to Permutation
Jean Bourgain, Peter G. Casazza, Joram Lindenstrauss and Lior Tzafriri
(Memoirs of the AMS, Number 322)

This Memoir is a contribution to the study of the following question: What are the Banach spaces $X$ which have up to equivalence and permutation a unique normalized unconditional basis? It is proved that the class of such spaces $X$ includes some infinite direct sums of classical sequence spaces as well as spaces with more complicated structure (the $2$-convexified Tsirelson space). The Memoir contains a detailed study of the structure of the important but difficult to handle space $(\sum \ell_1)_0$. In particular all the complemented subspaces of this space are classified. As far as uniqueness of bases is concerned this space exhibits a behavior which is surprising. A normalized $K$-unconditional basis in $(\sum \ell_1)_0$ is $e^{\alpha K}$ equivalent to a permutation of the unit vector basis for some $\alpha > 0$. In this statement $e^{\alpha K}$ cannot be replaced by a function which grows like a polynomial in $K$ (as is usually the case in similar problems in Banach space theory).

1970 Mathematics Subject Classifications: 46A99, 46E99, 46F99, 47B55
ISSN 0065-9266
iv + 112 pages (softcover), March 1985
List price $13, Institutional member $10,
Individual member $8
Shipping and handling charges must be added
To order, please specify MEMO/322N

Restricted Orbit Equivalence
Daniel J. Rudolph
(Memoirs of the AMS, Number 323)

These notes develop a theory of restricted orbit equivalence which has as particular examples

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard

282
Ornstein’s isomorphism theorem for Bernoulli processes. Dye’s orbit equivalence theorem for ergodic processes and the theory of Kakutani equivalence developed by Feldman, Ornstein, Weiss and Katok. Other examples are also given. A number of results from the Bernoulli theory are shown to be true for any restricted orbit equivalence.

1980 Mathematics Subject Classifications: 28D05, 28D20
ISBN 0-8218-2324-3, LC 84-28119
ISSN 0065-9266
vi + 150 pages (softcover), March 1985
List price $18, Institutional member $14,
Individual member $11.
Shipping and handling charges must be added
To order, please specify MEMO/323N

A Dirichlet Problem for Distributions and Specifications for Random Fields
Michael Röckner
(Memoirs of the AMS, Number 324)

Consistent conditional distributions for a large class of Gaussian measures defined on the space of (tempered) distributions on a domain $D$ in $\mathbb{R}^d$ are constructed explicitly. The conditional distributions are with respect to an (uncountable) family of $\sigma$-fields associated with the complements of the (relatively compact) open subsets of $D$. The construction involves solving a Dirichlet problem whose “boundary data” is given by a distribution. Furthermore, the associated set of Gibbs states is studied. The extreme Gibbs states are characterized and it is proved that they have the global Markov property. Based on the Dirichlet solution for distributions it is shown that any Gibbs state can be represented in terms of extreme Gibbs states.

1980 Mathematics Subject Classification: 60G60
ISBN 0-8218-2325-6, LC 84-29009
ISSN 0065-9266
vi + 76 pages (softcover), March 1985
List price $11, Institutional member $9,
Individual member $7.
Shipping and handling charges must be added
To order, please specify MEMO/324N

SOCIÉTÉ MATHÉMATIQUE DE FRANCE.
ASTÉRISQUE

The AMS distributes Astérisque in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF, B.P. 126-05, 75226 Paris Cedex 05, France, or to OFFILIB, 48 rue Gay-Lussac, 75240 Paris Cedex 05. France.

Individual members of either AMS or SMF are entitled to the member price.

Séminaire Bourbaki,
1983/1984, exposés
615–632
(Astérisque. Numbers 121–122)

Comme les précédents volumes de ce séminaire, celui-ci contient 18 exposés de synthèse sur des sujets d’actualité: six de géométrie différentielle, cinq d’arithmétique ou de géométrie algébrique, deux d’algèbre, deux de physique statistique, un d’analyse complexe, un de logique, un d’informatique.

Entre autres, on y trouve la démonstration des conjectures de Tate, de Shafarevitch et de Mordell, on y fait le point sur la construction du Monstre, l’homologie cyclique, la reconstruction des phases en cristallographie, le calcul des primitives.

ISSN 0303-1179
List price $25, Individual member $18
Shipping and handling charges must be added
To order, please specify AST/121/122N

Discrete Lax Equations and Differential-difference Calculus
B. A. Kupershmidt
(Astérisque. Number 123)

This is the first detailed introduction into the theory of discrete infinite integrable systems and associated mathematical ideas. It covers constructions of the basic, modified, specialized, and deformed equations, their conservation laws and Hamiltonian structures, canonical maps between various equations, continuous limits, formal eigenfunctions of Lax operators, and a $\tau$-function representation. The basic language of the theory is the discrete Calculus of Variations which behaves naturally under the continuous limit. An extensive exposition is given of the abstract Hamiltonian formalism and of the formalism of the dual spaces of Lie algebras over function rings.

The text is useful to mathematicians and physicists interested in “soliton” science and modern Hamiltonian formalism, and is suitable for graduate students.

ISSN 0303-1179
List price $15, Individual member $11
Shipping and handling charges must be added
To order, please specify AST/123N

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard
Homologie, Groupes $\text{Ext}^n$, Représentations de Longueur Finie des Groupes de Lie

(Astérisque. Numbers 124–125)

Le présent numéro d'Astérisque contient divers travaux récents portant sur les trois sujets d’actualité mentionnés dans le titre. En homologie des groupes de Lie on trouvera notamment des démonstrations du lemme de Shapiro et du théorème de réduction. En ce qui concerne les espaces $\text{Ext}^n$ et les représentations de longueur finie, un travail est consacré aux groupes semi-simples réels. dans le cadre classique des $(g, K)$-modules, un autre aux groupes nilpotents et aux espaces de vecteurs $C^\infty$ des représentations unitaires irréductibles. les deux derniers portant sur certains produits semidirects, pour lesquels on étudie une théorie de réduction à la Mackey.

ISSN 0363-1179
List price $18, Individual member $13
Shipping and handling charges must be added
To order, please specify AST/124/125N

To order use the order form in this issue or call 800-556-7774 to use VISA or MasterCard

PROCEEDINGS OF SYMPOSIA IN PURE MATHEMATICS
Complex Analysis of Several Variables
Yum-Tong Siu, Editor

These proceedings contain a collection of papers presented at the Symposium on Several Complex Variables held in Madison, Wisconsin from April 12 to April 15, 1982. At the Symposium there were one-hour survey talks by H. Grauert, J. J. Kohn, M. Schneider, H. Skoda, and S. T. Yau on major areas of important recent developments. In addition, there were more than forty specialized half-hour talks by other participants. Quite a number of talks are not included in these proceedings because detailed papers containing the results presented at the Symposium have already appeared elsewhere. On the other hand, included in these proceedings are some papers submitted by invited speakers who were unable to attend the Symposium.

Contents

Steve Bell, Local boundary behavior of proper holomorphic mappings
Thomas Bloom, Polynomial interpolation for entire functions on $\mathbb{C}^n$
A. Boggess, The first and second Levi forms and CR extension
David W. Catlin, Global regularity of the $\overline{\partial}$-Neumann problem
John D'Angelo, Intersection theory and the $\overline{\partial}$-Neumann problem
K. Diederich, J. E. Fornaess and G. Herbort, Boundary behavior of the Bergman metric
John Erik Fornaess and Berit Stens"ønes Henriksen, Peak sets for $A^\theta(D)$
Robert E. Greene and Steven G. Krantz, Stability of the Carathéodory and Kobayashi metrics and applications to biholomorphic mappings
Gary A. Harris, Function theory and geometry of real submanifolds of $\mathbb{C}^n$ near a CR singularity
F. R. Harvey and J. C. Polking, The $\overline{\partial}$-Neumann kernel in the ball in $\mathbb{C}^n$

J. J. Kohn, A survey of the $\overline{\partial}$-Neumann problem
László Lempert, Intrinsic metrics
Ngaiming Mok, A survey on complete noncompact Kähler manifolds of positive curvature
Michael Schneider, On the number of equations needed to describe a variety
H. Skoda, A survey of the theory of closed, positive currents
Yue Lin Tong, Special cycles, harmonic forms and invariant theory
S. M. Webster, Analytic discs and the regularity of $C^R$ mappings of real submanifolds in $\mathbb{C}^n$
R. O. Wells, Jr., Extensions of holomorphic vector bundles and coupled cohomology equations
B. Wong, A class of compact complex manifolds with negative tangent bundles
Pli-Mann Wong, On umbilical hypersurfaces and uniformization of circular domains
H. Wu, On certain Kähler manifolds which are q-complete
P. Yang, Geometry of tube domains
Shing Tung Yau, A survey of Kähler-Einstein manifolds
Stephen S.-T. Yau, Criteria for right-left equivalence and right equivalence of holomorphic functions with isolated critical points


Proceedings of Symposia in Pure Mathematics
Volume 41, xiv + 298 pages
List price $50, institutional member $40,
individual member $30
ISBN 0-8218-1446-X; LC 83-25734
Publication date: April 1984
To order, please specify PSPUM/41N

284
Personal Items

James C. Becker of Purdue University has been appointed chairman of the Department of Mathematics and Statistics at the University of Vermont, effective September 1985.

Nicholaas H. Kuiper, retiring director of the Institut des Hautes Études Scientifiques, received an honorary degree of Doctor of Science, Honoris Causa, from Brown University on the occasion of the symposium “Visualizing Higher Dimensions” in October 1984.

Eugene H. Lehman, formerly retired, has been appointed to Professor of Mathematics at Dawson College, Montreal.

Emmanuel O. Okoronkwo, of Northern Illinois University, has been appointed Assistant Professor at that university.

Deaths

Charles C. Conley of the University of Wisconsin died on November 20, 1984, at the age of 51. He was a member of the Society for 25 years.

Max Deuring of the University of Göttingen, Federal Republic of Germany, died on December 20, 1984, at the age of 77. He was a member of the Society for 51 years.

Paul Dirac died on October 20, 1984, at the age of 82. Professor Dirac received the Nobel Prize in Physics in 1933 for his fundamental work in establishing the principles of quantum mechanics.

James Dugundji of the University of Southern California died on January 8, 1985, at the age of 65. He was a member of the Society for 38 years.

Andre Gleyzal, of Boca Raton, Florida, died on October 21, 1984, at the age of 76. He was a member of the Society for 38 years.

Palmer H. Graham of Burlingame, California, died on September 17, 1984, at the age of 96. He was a member of the Society for 57 years.

William L. Hart of La Jolla, California, died on December 16, 1984, at the age of 92. He was a member of the Society for 68 years.

Demetrios A. Kappos of Athens, Greece, died on January 8, 1985, at the age of 80. He was a member of the Society for 24 years.

Cyril A. Nelson of Pt. Haywood, Virginia, died on July 27, 1984, at the age of 90. He was a member of the Society for 65 years.

Louis E. Perrin of Reims, France, died on October 9, 1984, at the age of 74. He was a member of the Society for 21 years.

Visiting Mathematicians

(Supplementary List)

Mathematicians visiting other institutions during the 1984-1985 academic year have been listed in recent issues of the Notices: June 1984, pages 403–405; August 1984, pages 536-537; October 1984, pages 708-709; November 1984, page 806; and January 1985, page 97. The list below gives the name and home country, the host institution, period of visit, and field of special interest of additional visiting mathematicians.

Janos Bognar (Hungary), University of Calgary, September 1984 to April 1985, indefinite inner spaces.

Philip Laird (Australia), University of Calgary, January 1985 to April 1985, mean periodic functions, mean value properties in potential theory.

William J. Spratt (Scotland), University of Calgary, October 1984 to April 1985, integral transforms, fractional calculus, multipliers and distribution theory.

Juan L. Vázquez (Spain), Institute for Mathematics and its Applications, Minneapolis, and University of Chicago, March 1985 to July 1985, partial differential equations.

Reciprocity Agreements

The listing below updates the report published in the Notices, August 1984 (pages 527–532).

Europe

Société de Mathématiques Appliquées et Industrielles

Apply to: Société de Mathématiques Appliquées et Industrielles, Laboratoire de Mathématiques Appliquées, Ecole Polytechnique, 91128 Palaiseau, France.

Dues: 100 francs (US $11); payable to Société de Mathématiques Appliquées et Industrielles, Laboratoire de Mathématiques Appliquées.

Privileges: Right to receive the membership list and the newsletter; right to participate at SMAI sponsored meetings and workshops with a reduced fee.

Officers: R. Temam (President), J. P. Boujot, N. Elkaroui, J. Periaux (Vice-Presidents), J. P. Puel (Treasurer), P. Lasaux (Secretary).
Backlog of Mathematics Research Journals

**Backlog.** Information on the backlog of papers for research journals, primarily those published in North America, is reported to the Providence Office by those editorial boards which elect to participate. The figures are an estimate of the number of printed pages which have been accepted, but are in excess of the number required to maintain copy editing and printing schedules.

**Observed Waiting Time.** The quartiles give a measure of normal dispersion. They do not include extremes which may be misleading. Waiting times are measured in months from receipt of manuscript in final form to publication of the issue. When a paper is revised, the waiting time between an editor's receipt of the final revision and its publication may be much shorter than is the case otherwise, so these figures are low to that extent.

The observations are made from the latest issue published before the deadline for this issue of the *Notices* from journals that have actually been received by a subscriber in the Providence, Rhode Island, area; in some cases this may be two months later than publication abroad. If the waiting time as defined above is not given in the journal, if no new issue has been received since the last survey, or if the latest issue is for some reason obviously not typical, no times are given in this report and such cases are marked NA (not available or not applicable).

<table>
<thead>
<tr>
<th>Journal</th>
<th>Number Issues per Year</th>
<th>Number Pages per Year</th>
<th>Backlog of Printed Pages 12/15/84</th>
<th>Backlog of Printed Pages 5/31/84</th>
<th>Editor's Estimated Time for Paper Submitted Currently to be Published (in Months)</th>
<th>Observed Waiting Time in Latest Published Issue (in Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acta. Inform.</td>
<td>6</td>
<td>720</td>
<td>0 0</td>
<td>5</td>
<td>5 6 6</td>
<td>NA</td>
</tr>
<tr>
<td>Aequationes Math.</td>
<td>6</td>
<td>640</td>
<td>137 133</td>
<td>12</td>
<td>10 12 13</td>
<td></td>
</tr>
<tr>
<td>Amer. J. Math.</td>
<td>6</td>
<td>1500</td>
<td>2014 1350</td>
<td>16</td>
<td>19 23 27</td>
<td></td>
</tr>
<tr>
<td>Ann. of Math.</td>
<td>6</td>
<td>1200</td>
<td>300 300</td>
<td>12</td>
<td>9 12 15</td>
<td></td>
</tr>
<tr>
<td>Ann. Probab.</td>
<td>4</td>
<td>1300</td>
<td>NR 150</td>
<td>15</td>
<td>8 10 12</td>
<td></td>
</tr>
<tr>
<td>Ann. Sci. Ecole Norm. Sup.</td>
<td>4</td>
<td>600</td>
<td>NR NR</td>
<td>NR</td>
<td>14 16 18</td>
<td></td>
</tr>
<tr>
<td>Ann. Statist.</td>
<td>4</td>
<td>1650</td>
<td>0 0</td>
<td>6</td>
<td>6 8 9</td>
<td></td>
</tr>
<tr>
<td>Appl. Math. Optim.</td>
<td>6</td>
<td>576</td>
<td>150 250</td>
<td>3</td>
<td>6 7 9</td>
<td></td>
</tr>
<tr>
<td>Applicable Anal.</td>
<td>8</td>
<td>800</td>
<td>NR NR</td>
<td>NR</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Arch. Hist. Exact Sci.</td>
<td>12</td>
<td>1200</td>
<td>0 0</td>
<td>13</td>
<td>10 11 11</td>
<td></td>
</tr>
<tr>
<td>Arch. Rational Mech. Anal.</td>
<td>16</td>
<td>1600</td>
<td>0 0</td>
<td>11-12</td>
<td>9 9 10</td>
<td></td>
</tr>
<tr>
<td>Bull. Austral. Math. Soc.</td>
<td>6</td>
<td>960</td>
<td>0 **</td>
<td>5-6</td>
<td>9 9 10</td>
<td></td>
</tr>
<tr>
<td>Canad. J. Math.</td>
<td>6</td>
<td>1152</td>
<td>300 100</td>
<td>15</td>
<td>14 16 19</td>
<td></td>
</tr>
<tr>
<td>Canad. Math. Bull.</td>
<td>4</td>
<td>512</td>
<td>256 192</td>
<td>18</td>
<td>12 15 17</td>
<td></td>
</tr>
<tr>
<td>Comm. Algebra</td>
<td>12</td>
<td>3120</td>
<td>1239 1797</td>
<td>9</td>
<td>10 14 15</td>
<td></td>
</tr>
<tr>
<td>Comm. Math. Phys.</td>
<td>20</td>
<td>3040</td>
<td>0 0</td>
<td>5</td>
<td>7 7 9</td>
<td></td>
</tr>
<tr>
<td>Comm. Partial Diff. Equations</td>
<td>12</td>
<td>1400</td>
<td>350 500</td>
<td>9</td>
<td>4 5 8</td>
<td></td>
</tr>
<tr>
<td>Computing</td>
<td>8</td>
<td>768</td>
<td>0 0</td>
<td>7</td>
<td>7 9 12</td>
<td></td>
</tr>
<tr>
<td>Duke Math. J.</td>
<td>4</td>
<td>1100</td>
<td>0 0</td>
<td>9</td>
<td>10 11 15</td>
<td></td>
</tr>
<tr>
<td>Houston J. Math.</td>
<td>4</td>
<td>600</td>
<td>150 150</td>
<td>15</td>
<td>16 20 21</td>
<td></td>
</tr>
<tr>
<td>Illinois J. Math.</td>
<td>4</td>
<td>704</td>
<td>713 NR</td>
<td>21</td>
<td>31 31 32</td>
<td></td>
</tr>
<tr>
<td>Indiana Univ. Math. J.</td>
<td>4</td>
<td>928</td>
<td>100 200</td>
<td>15</td>
<td>18 19 20</td>
<td></td>
</tr>
<tr>
<td>Internat. J. Math. Math. Sci.</td>
<td>4</td>
<td>832</td>
<td>200 NR</td>
<td>6-7</td>
<td>8 14 18</td>
<td></td>
</tr>
<tr>
<td>Invent. Math.</td>
<td>12</td>
<td>2304</td>
<td>0 0</td>
<td>7</td>
<td>7 8 9</td>
<td></td>
</tr>
<tr>
<td>Israel J. Math.</td>
<td>12</td>
<td>1200</td>
<td>300 100</td>
<td>12</td>
<td>7 8 11</td>
<td></td>
</tr>
<tr>
<td>J. Algorithms</td>
<td>4</td>
<td>600</td>
<td>500 **</td>
<td>12</td>
<td>18 20 27</td>
<td></td>
</tr>
<tr>
<td>J. Amer. Statist. Assoc.</td>
<td>4</td>
<td>1100</td>
<td>150 NR</td>
<td>9</td>
<td>7 8 8</td>
<td></td>
</tr>
<tr>
<td>J. Assoc. Comput. Mach.</td>
<td>4</td>
<td>1000</td>
<td>0 NR</td>
<td>9-12</td>
<td>7 8 8</td>
<td></td>
</tr>
<tr>
<td>J. Comput. System Sci.</td>
<td>6</td>
<td>900</td>
<td>100 600</td>
<td>12</td>
<td>6 7 14</td>
<td></td>
</tr>
<tr>
<td>J. Differential Geom.</td>
<td>4</td>
<td>1200</td>
<td>600 900</td>
<td>9</td>
<td>8 11 12</td>
<td></td>
</tr>
<tr>
<td>J. Math. Biol.</td>
<td>7</td>
<td>896</td>
<td>0 0</td>
<td>7</td>
<td>7 7 9</td>
<td></td>
</tr>
<tr>
<td>J. Math. Phys.</td>
<td>12</td>
<td>3600</td>
<td>200 390</td>
<td>5-6</td>
<td>10 11*** 16</td>
<td></td>
</tr>
<tr>
<td>J. Math. Sociol.</td>
<td>4</td>
<td>400</td>
<td>120 NA</td>
<td>6</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>J. Nigerian Math. Soc.</td>
<td>1</td>
<td>100</td>
<td>0 0</td>
<td>10-12</td>
<td>17 32 34</td>
<td></td>
</tr>
<tr>
<td>J. Operator Theory</td>
<td>4</td>
<td>800</td>
<td>NR 400</td>
<td>NR</td>
<td>14 17 19</td>
<td></td>
</tr>
<tr>
<td>J. Symbolic Logic</td>
<td>4</td>
<td>1152</td>
<td>100 200</td>
<td>16</td>
<td>18 20 22</td>
<td></td>
</tr>
</tbody>
</table>

286
<table>
<thead>
<tr>
<th>Journal</th>
<th>Number Issues per Year</th>
<th>Number Pages per Year</th>
<th>Backlog of Printed Pages 12/15/84</th>
<th>5/31/84</th>
<th>Editor's Estimated Time for Paper Submitted Currently to be Published (in Months)</th>
<th>Observed Waiting Time in Latest Published Issue (in Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Algebra Appl.</td>
<td>9</td>
<td>2700</td>
<td>500</td>
<td>300</td>
<td>12-15</td>
<td>Q1: 13, M: 14, Q3: 15</td>
</tr>
<tr>
<td>Linear and Multilinear Algebra</td>
<td>6</td>
<td>540</td>
<td>300</td>
<td>400</td>
<td>9</td>
<td>Q1: 9, M: 13, Q3: 15</td>
</tr>
<tr>
<td>Manuscripta Math.</td>
<td>12</td>
<td>1200</td>
<td>NR</td>
<td>0</td>
<td>NR</td>
<td>Q1: 8, M: 9, Q3: 10</td>
</tr>
<tr>
<td>Math. Ann.</td>
<td>12</td>
<td>1920</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>Q1: 8, M: 11, Q3: 14</td>
</tr>
<tr>
<td>Math. Biosci.</td>
<td>10</td>
<td>1500</td>
<td>NR</td>
<td>100</td>
<td>NR</td>
<td>Q1: 6, M: 6, Q3: 7</td>
</tr>
<tr>
<td>Math. Comp</td>
<td>4</td>
<td>1300</td>
<td>50</td>
<td>80</td>
<td>12</td>
<td>Q1: 11, M: 14, Q3: 16</td>
</tr>
<tr>
<td>Math. Oper. Res.</td>
<td>4</td>
<td>704</td>
<td>350</td>
<td>590</td>
<td>18</td>
<td>Q1: 17, M: 19, Q3: 21</td>
</tr>
<tr>
<td>Math. Programming</td>
<td>9</td>
<td>1080</td>
<td>120</td>
<td>NR</td>
<td>15</td>
<td>Q1: 7, M: 10, Q3: 15</td>
</tr>
<tr>
<td>Math. Systems Theory</td>
<td>4</td>
<td>384</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Q1: 8, M: 10, Q3: 12</td>
</tr>
<tr>
<td>Math. Z.</td>
<td>12</td>
<td>1820</td>
<td>0</td>
<td>0</td>
<td>8-9</td>
<td>Q1: 7, M: 8, Q3: 11</td>
</tr>
<tr>
<td>Mem. Amer. Math. Soc.</td>
<td>6</td>
<td>2800</td>
<td>0</td>
<td>256</td>
<td>9</td>
<td>Q1: 6, M: 15, Q3: 22</td>
</tr>
<tr>
<td>Michigan Math. J.</td>
<td>3</td>
<td>384</td>
<td>150</td>
<td>125</td>
<td>10-14</td>
<td>Q1: 5, M: 7, Q3: 8</td>
</tr>
<tr>
<td>Monatsh. Math.</td>
<td>8</td>
<td>704</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>Q1: 6, M: 7, Q3: 8</td>
</tr>
<tr>
<td>Numer. Funct. Anal. Optim.</td>
<td>6</td>
<td>700</td>
<td>150</td>
<td>0</td>
<td>9</td>
<td>Q1: 3, M: 4, Q3: 7</td>
</tr>
<tr>
<td>Numer. Math.</td>
<td>8</td>
<td>1280</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>Q1: 7, M: 9, Q3: 10</td>
</tr>
<tr>
<td>Oper. Res.</td>
<td>6</td>
<td>1300</td>
<td>NR</td>
<td>700</td>
<td>NR</td>
<td>Q1: 28, M: 30, Q3: 41</td>
</tr>
<tr>
<td>Pacific J. Math.</td>
<td>10</td>
<td>2500</td>
<td>NR</td>
<td>NR</td>
<td>13</td>
<td>Q1: 19, M: 20, Q3: 21</td>
</tr>
<tr>
<td>Proc. Amer. Math. Soc.</td>
<td>12</td>
<td>2200</td>
<td>50</td>
<td>150</td>
<td>9</td>
<td>Q1: 13, M: 13, Q3: 16</td>
</tr>
<tr>
<td>Quart. Appl. Math.</td>
<td>4</td>
<td>512</td>
<td>128</td>
<td>128</td>
<td>15</td>
<td>Q1: 15, M: 17, Q3: 18</td>
</tr>
<tr>
<td>Resultate Math.</td>
<td>2</td>
<td>220</td>
<td>140</td>
<td>0</td>
<td>12</td>
<td>Q1: 21, M: 23, Q3: 26</td>
</tr>
<tr>
<td>Rocky Mountain J. Math.</td>
<td>4</td>
<td>768</td>
<td>750</td>
<td>750</td>
<td>27</td>
<td>Q1: 14, M: 17, Q3: 19</td>
</tr>
<tr>
<td>Semigroup Forum</td>
<td>9</td>
<td>1150</td>
<td>0</td>
<td>128</td>
<td>7</td>
<td>Q1: 5, M: 6, Q3: 11</td>
</tr>
<tr>
<td>SIAM J. Algebraic Discrete Methods</td>
<td>4</td>
<td>700</td>
<td>269</td>
<td>509</td>
<td>14</td>
<td>Q1: 15, M: 17, Q3: 17</td>
</tr>
<tr>
<td>SIAM J. Appl. Math.</td>
<td>6</td>
<td>1050</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>Q1: 8, M: 9, Q3: 11</td>
</tr>
<tr>
<td>SIAM J. Comput.</td>
<td>4</td>
<td>1000</td>
<td>394</td>
<td>538</td>
<td>14</td>
<td>Q1: 15, M: 16, Q3: 17</td>
</tr>
<tr>
<td>SIAM J. Control Optim.</td>
<td>6</td>
<td>975</td>
<td>356</td>
<td>106</td>
<td>13</td>
<td>Q1: 13, M: 14, Q3: 16</td>
</tr>
<tr>
<td>SIAM J. Math. Anal.</td>
<td>6</td>
<td>1345</td>
<td>958</td>
<td>796</td>
<td>17</td>
<td>Q1: 16, M: 18, Q3: 19</td>
</tr>
<tr>
<td>SIAM Rev.</td>
<td>4</td>
<td>560</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>Q1: 4, M: 6, Q3: 10</td>
</tr>
<tr>
<td>Stochastics</td>
<td>Varies</td>
<td>Varies</td>
<td>NR</td>
<td>NA</td>
<td>3</td>
<td>Q1: 6, M: 7, Q3: 7</td>
</tr>
<tr>
<td>Topology Appl.</td>
<td>6</td>
<td>990</td>
<td>715</td>
<td>260</td>
<td>9</td>
<td>Q1: 16, M: 16, Q3: 17</td>
</tr>
<tr>
<td>Trans. Amer. Math. Soc.</td>
<td>12</td>
<td>5000</td>
<td>0</td>
<td>100</td>
<td>9</td>
<td>Q1: 13, M: 14, Q3: 20</td>
</tr>
<tr>
<td>Z. Wahrsch. Verw. Gebiete</td>
<td>12</td>
<td>1920</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>Q1: 9, M: 12, Q3: 19</td>
</tr>
</tbody>
</table>

NR means no response received.
NA means not available or not applicable.
* From date of acceptance (this journal does not give the received date).
** This journal is new to the listing; backlog as of 5/31/84 not known.
*** From date of first receipt of manuscript (this journal does not give dates of revisions).
Mathematical Sciences Assistantships and Fellowships

for Graduate Study at Universities in 1985–1986, Supplementary List

The entries below supplement the December 1984 Special Issue of the Notices.

The number following “Faculty” is the number of faculty members in the department who are full time employees in the institution and at least half-time in the department; the number following “Published” is the number of those reported who have published a technical paper or book in the last three years.

The section on “Graduate Students” refers to the number of graduate students in the department who are full-time (including teaching assistants), full-time first year, and part-time. Information not supplied in any of these categories is indicated by a dash.

Under the DEGREES AWARDED column the following terms have been used:

Bachelor's by inst. . . . Number of bachelor's degrees awarded by the institution
Bachelor's by dept. . . . Number of bachelor's degrees awarded by the department
Master's by dept. . . . Number of master's degrees awarded by the department

Abbreviations used

ANT . . . Algebra or Number Theory
AF . . . Analysis or Functional Analysis
GT . . . Geometry or Topology
L . . . . Logic
P . . . . Probability
S . . . . Statistics
CS . . . Computer Science
OR . . . Operations Research
AM . . . Applied Mathematics
ME . . . Mathematics Education

Under the SERVICE REQUIRED column, hours per week section, “c” denotes contact hours.

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
<th>DEGREES AWARDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(number anticipated 1985-1986)</td>
<td>paid to student</td>
<td>paid by student ($)</td>
<td>hours per week</td>
<td>type of service</td>
</tr>
<tr>
<td>Alabama A&amp;M University, Normal 35762</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATHMATICS</td>
<td>Applications due: 4/15/85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jerry R. Shipman, Chairman</td>
<td>Faculty 12; Published 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (1)</td>
<td>4250</td>
<td>9</td>
<td>20 Teaching</td>
<td>Bachelor’s by inst. 375</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bachelor’s by dept. 2</td>
</tr>
</tbody>
</table>

University of Alaska, Fairbanks 99701

MATHMATICAL SCIENCES | Faculty 21; Published 6 | Bachelor’s by inst. 338 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ronald W. Gatterdam, Chairman</td>
<td>Graduate Students: full-time 8; full-time first year 4; part-time 0</td>
<td>Bachelor’s by dept. 15</td>
</tr>
<tr>
<td>Teaching Assistantship (12-15)</td>
<td>7207-7607</td>
<td>9</td>
</tr>
<tr>
<td>Research Assistantship (2)</td>
<td>9784-13144</td>
<td>12</td>
</tr>
</tbody>
</table>

Alaska
<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
<th>DEGREES AWARDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(number anticipated 1985-1986)</td>
<td>paid to student dollars</td>
<td>paid by student ($)</td>
<td>hours per week</td>
<td>type</td>
</tr>
<tr>
<td>California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claremont Graduate School, Claremont 91711</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>Applications due: 2/15/85*</td>
<td>Master's by dept.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Robert Williamson, Chairman</td>
<td>Faculty 4**, Published 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 13; full-time first year 3; part-time 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship (4)</td>
<td>1000-3000</td>
<td>9</td>
<td>Waived</td>
<td></td>
</tr>
<tr>
<td>Scholarship Merit (3)</td>
<td>4000</td>
<td>9</td>
<td>Waived</td>
<td></td>
</tr>
<tr>
<td>Tuition Waivers (6)</td>
<td>4000</td>
<td>9</td>
<td>Waived</td>
<td></td>
</tr>
<tr>
<td>Clinic Team Leader (4)</td>
<td>5600-9200</td>
<td>9</td>
<td>275/unit</td>
<td></td>
</tr>
<tr>
<td>*Late applications invited. **Claremont Graduate School is the graduate school of the Claremont Colleges; the total graduate faculty is 35.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Diego State University, San Diego 92182</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematical Sciences</td>
<td>Applications due: 4/15/85</td>
<td>Bachelor's by inst.</td>
<td>2136</td>
<td></td>
</tr>
<tr>
<td>David H. Carlson, Chair</td>
<td>Faculty 60; Published 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 24; full-time first year 24; part-time 183</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (20)</td>
<td>2600-2900</td>
<td>9</td>
<td>348.50</td>
<td></td>
</tr>
<tr>
<td>Stanford University, Stanford 94305</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistics</td>
<td>Applications due: 1/1/85</td>
<td>Bachelor's by inst.</td>
<td>1645</td>
<td></td>
</tr>
<tr>
<td>David Siegmund, Chairman</td>
<td>Faculty 16; Published 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 40; full-time first year 9; part-time 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (10)</td>
<td>5800</td>
<td>9</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of California, Santa Cruz 95064</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>Applications</td>
<td>Faculty 17; Published 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geoffrey Mason, Chairman</td>
<td>Graduate Students: full-time 30; full-time first year 15; part-time 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship (3)</td>
<td>6000</td>
<td>9</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (25)</td>
<td>8250</td>
<td>9</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>California Teaching Fellowship (2)</td>
<td>8250</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Delaware, Newark 19716</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematical Sciences</td>
<td>Applications due: 3/1/85</td>
<td>Bachelor's by inst.</td>
<td>1317</td>
<td></td>
</tr>
<tr>
<td>Ivar Stakgold, Chairman</td>
<td>Faculty 38; Published 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 39; full-time first year 14; part-time 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship (2)</td>
<td>6360-7035</td>
<td>9</td>
<td>420/sem.*</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (29)</td>
<td>6360-7035</td>
<td>9</td>
<td>12-15</td>
<td></td>
</tr>
<tr>
<td>Scholarship (1)</td>
<td>6360-7035</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internship (2)</td>
<td>14000-16000</td>
<td>12</td>
<td>3400</td>
<td></td>
</tr>
<tr>
<td>*Connecticut resident.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florida</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Florida, Gainesville 32611</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial and Systems Engineering</td>
<td>Applications due: 4/15/85</td>
<td>Bachelor's by inst.</td>
<td>3680</td>
<td></td>
</tr>
<tr>
<td>D. J. Elzinga, Chairman</td>
<td>Faculty 15; Published 14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 38; full-time first year 16; part-time 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship (1)</td>
<td>7000</td>
<td>9</td>
<td>50.50/hr.</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (15)</td>
<td>5600-8400</td>
<td>9</td>
<td>50.50/hr.</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (6)</td>
<td>5600-8400</td>
<td>9</td>
<td>50.50/hr.</td>
<td></td>
</tr>
<tr>
<td>University of Florida, Gainesville 32611</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial and Systems Engineering</td>
<td>Applications due: 4/15/85</td>
<td>Bachelor's by inst.</td>
<td>3680</td>
<td></td>
</tr>
<tr>
<td>D. J. Elzinga, Chairman</td>
<td>Faculty 15; Published 14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 38; full-time first year 16; part-time 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship (1)</td>
<td>7000</td>
<td>9</td>
<td>50.50/hr.</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (15)</td>
<td>5600-8400</td>
<td>9</td>
<td>50.50/hr.</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (6)</td>
<td>5600-8400</td>
<td>9</td>
<td>50.50/hr.</td>
<td></td>
</tr>
</tbody>
</table>
Georgia

Georgia State University, Atlanta 30303

MATHEMATICS AND COMPUTER SCIENCE

Applications due: 7/1/85

Fred A. Massey, Chairman

Faculty 25; Published 11

Graduate Students: full-time 13; full-time first year 3; part-time 0

Research Assistantship (6)

4500–5000

12

10–13

Hawaii

University of Hawaii, Honolulu 96822

MATHEMATICS

Applications due: 3/1/85

William A. Lampe, Chairman

Faculty 35; Published 34

Graduate Students: full-time 15; full-time first year 8; part-time 21

Teaching Assistantship (12)

5676–6324

9

3

Teaching

Ph. D. (81/84) AFA 1, GT 1.

Total: 2

Illinois

Southern Illinois University, Edwardsville 62026

MATHEMATICS, STATISTICS, AND COMPUTER SCIENCE

Applications due: 7/1/85

Robert N. Pendergrass, Chairman

Faculty 21; Published 5

Graduate Students: full-time 15; full-time first year 8; part-time 21

Teaching Assistantship (15)

4050–4500

9

100

20

Teaching

Indiana

Purdue University, West Lafayette 47907

STATISTICS

Applications due: 5/31/85

Shanti S. Gupta, Head

Faculty 18; Published 17

Graduate Students: full-time 44; full-time first year 10; part-time 7

Fellowship (1)

6000

12

270

Teaching Assistantship (35)

5200–6200

10

270

6

Teaching

Research Assistantship (5)

5000–6000

10

270

20

Research

Iowa

Iowa State University, Ames 50011

COMPUTER SCIENCE

Applications due: 3/1/85

George O. Strawn, Chairman

Faculty 18; Published 6

Graduate Students: full-time 85; full-time first year 36; part-time 7

Fellowship (5)

827/mo.

9

*20

Grading, research

Teaching Assistantship (50)

827/mo.

9

20

Grading

Research Assistantship (10)

827/mo.

9

*20

Research

*Resident: $8736; nonresident: $1800.

M.A. AND PH.D. PROGRAMS AT HAWAII

The University of Hawaii Mathematics Department has an excellent young faculty of 37 members. The Ph.D. program is relatively new, and the small number of graduate students makes for an extremely favorable student-faculty ratio. The academic, living, and recreational environments are very agreeable. Teaching assistantships are available starting at $5676 plus a tuition waiver. Additional compensation is available for summer teaching. For details write:

T. C. Craven, Graduate Chairman – Department of Mathematics
University of Hawaii at Manoa – Honolulu, HI 96822

AN EQUAL OPPORTUNITY EMPLOYER

290
<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
<th>DEGREES AWARDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(number anticipated</td>
<td>paid to student</td>
<td>paid by</td>
<td>hours</td>
<td>type</td>
</tr>
<tr>
<td>1985-1986)</td>
<td>dollars</td>
<td>student ($)</td>
<td>per week</td>
<td>of service</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Applications due: 3/1/85*</td>
<td>Bachelor's by inst. 3418</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. K. Steiner, Chairman</td>
<td>Faculty 68; Published 43</td>
<td>Bachelor's by dept. 17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Students: full-time 59; full-time first year 21; part-time 3</td>
<td>Master's by dept. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (55)</td>
<td>6700-8118</td>
<td>9</td>
<td>1360/yr.*</td>
<td>4-6^</td>
</tr>
<tr>
<td>Research Assistantship (5)</td>
<td>6000-7200</td>
<td>9</td>
<td>1360/yr.</td>
<td>Research</td>
</tr>
<tr>
<td>PACE***</td>
<td>340/sem.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Late applications accepted.
**Graduate College fellowship of $680 per year available to those with good academic standing.
***Premium for Academic Excellence, based upon prior academic achievement and offered by the Graduate College.

Kansas

University of Kansas, Lawrence 66045

COMPUTER SCIENCE

William G. Bulgren, Acting Chair
Graduate Students: full-time 123; full-time first year 50; part-time 20

Teaching Fellowship (35) 6800-9000 9 300 20 Teaching
Research Assistantship (2) 7200-7500 9 575 20 Research
Grading and Assisting (20) 5500-5600 9 575 20 Grading, assisting

Louisiana

McNeese State University, Lake Charles 70609

MATHEMATICS, COMPUTER SCIENCE AND STATISTICS

George F. Mead, Jr., Head
Graduate Students: full-time 10; full-time first year 3; part-time 4

Teaching Assistantship (4) 4000 9 483 6^ Teaching
Special Assistantship (2) 4000 9 483 20

Tulane University, New Orleans 70118

MATHEMATICS

James T. Rogers, Jr., Chairman
Graduate Students: full-time 23; full-time first year 5; part-time 5

Teaching Assistantship (25) 5800-8000 9 175 3-4^ Teaching

Massachusetts

Boston University, Boston 02134

MATHEMATICS

R. Devaney, Chairman
Graduate Students: full-time 45; full-time first year 29; part-time 16

Fellowship (2) 5500-6050 9 12 Teaching, grading
Teaching Fellowship (20) 6050-6350 9 12 Teaching

University of Massachusetts at Boston 02125

MATHEMATICS AND COMPUTER SCIENCE

Colin Godfrey, Chair
Graduate Students: full-time 30; full-time first year 12; part-time 18

Teaching Assistantship (12) 4400-4600 9 Waived 12 Teaching

*6/1/85 foreign students, 8/1/85.

Michigan

Wayne State University, Detroit 48202

MATHEMATICS

Togo Nishiura, Chairman
Graduate Students: full-time 47; full-time first year 17; part-time 22

Fellowship (2) 4500** 9 | Teaching |
Teaching Assistantship (22) 5000-6550** 9 6^ |

*Late applications will be accepted.
**Stipend includes health insurance, and, in some cases, housing.
Minnesota

University of Minnesota, Minneapolis 55455

STATISTICS
Seymour Geisser, Director
Applications due: 3/15/85
Graduate Students: full-time 44; full-time first year 16; part-time 18

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellowship (4)</td>
<td>6498-7200</td>
<td>9</td>
<td>*</td>
</tr>
<tr>
<td>Teaching Assistantship (23)</td>
<td>7680</td>
<td>9</td>
<td>*</td>
</tr>
<tr>
<td>Research Assistantship (4)</td>
<td>7880</td>
<td>9</td>
<td>*</td>
</tr>
<tr>
<td>Alumni Scholarship (1)</td>
<td>2560</td>
<td>9</td>
<td>*</td>
</tr>
</tbody>
</table>

*7-15 credits: resident $720, nonresident $1440.

Montana

Montana State University, Bozeman 59717

MATHEMATICAL SCIENCES
K. Tiahrt, Head
Applications due: 4/15/85
Graduate Students: full-time 32; full-time first year 13; part-time 0

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellowship (2)</td>
<td>500</td>
<td>9</td>
<td>400</td>
</tr>
<tr>
<td>Teaching Assistantship (32)</td>
<td>5900-11000</td>
<td>9</td>
<td>400</td>
</tr>
<tr>
<td>Research Assistantship (3)</td>
<td>5900-11000</td>
<td>9</td>
<td>400</td>
</tr>
</tbody>
</table>

Ph. D. (81/84) AFA 1, S 1. Total: 2

Nebraska

University of Nebraska–Lincoln 68588

COMPUTER SCIENCE
Roy F. Keller, Chairman
Applications due: 7/15/85
Graduate Students: full-time 52; full-time first year 12; part-time 20

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Assistantship (26)</td>
<td>7000-10000</td>
<td>9</td>
<td>Waived</td>
</tr>
<tr>
<td>Research Assistantship (2)</td>
<td>7000-10000</td>
<td>9</td>
<td>Waived</td>
</tr>
</tbody>
</table>

Ph. D. (81/84) CS 3. Total: 3

New Jersey

Stevens Institute of Technology, Hoboken 07030

PURE AND APPLIED MATHEMATICS
Milos Dostal, Acting Head
Applications due: 2/15/85
Graduate Students: full-time 19; full-time first year 6; part-time 10

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellowship (1)</td>
<td>6000</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (8)</td>
<td>6300-6800</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Research Assistantship (1)</td>
<td>6000</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Ph. D. (81/84) AFA 1, P 1, CS 1, AM 1, Other 1. Total: 5

New York

Adelphi University, Garden City 11530

MATHEMATICS AND COMPUTER SCIENCE
Jonathan Hodgson, Chairman
Applications due: 3/15/85
Graduate Students: full-time 18; full-time first year 2; part-time 58

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Teaching Fellowship (2)</td>
<td>7600</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Teaching Assistantship (9)</td>
<td>3000-4500</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Scholarship (5)</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuition Scholarship</td>
<td>50%-54 credits per year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ph. D. (81/84) Total: 3

City University of New York, Graduate Center, New York 10036

MATHEMATICS
Martin Moskowitz, Executive Officer
Applications due: 2/1/85*
Graduate Students: full-time 60; full-time first year –; part-time 15

<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellowship (28)</td>
<td>6000</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Ph. D. (81/84) Total: 20

*Late applications considered.
<table>
<thead>
<tr>
<th>TYPE OF ASSISTANCE</th>
<th>STIPEND</th>
<th>FEES</th>
<th>SERVICE REQUIRED</th>
<th>DEGREES AWARDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(number anticipated 1985-1986)</td>
<td>paid to student</td>
<td>paid by student ($)</td>
<td>hours per week of service</td>
<td>Academic year 1983-1984</td>
</tr>
</tbody>
</table>

**State University of New York at Albany 12222**

**COMPUTER SCIENCE**

- Applications due: 3/15/85
- Richard E. Stearns, Chair

| Fellowship (1-2) | 7000 | 9 |  |
| Teaching Assistantship (23) | 5000-6000 | 9 |  **20** | Grading, teaching |
| Research Assistantship (1) | 5000-6000 | 9 |  **Research** |

*Ten credit waiver.

**University of Rochester, Rochester 14627**

**MATHEMATICS**

- Applications due: 2/15/85
- Sanford L. Segal, Chairman

| Teaching Fellowship (8) | 6500-8500 | 9-12 | 3-4* | Assisting |
| Teaching Assistantship (26) | 5000-7000 | 9-12 | 3-4* | Assisting |
| Summer Fellowship (4) | 1000-2000 | 3 |  |

**North Carolina State University, Raleigh 27695**

**OPERATIONS RESEARCH**

- Applications due: 2/15/85
- Salah E. Elmaghraby, Director

| Fellowship (2) | 3000-12000 | 9 |  |
| Teaching Assistantship (10) | 5500-7000 | 9 | 796 | 20 |
| Research Assistantship (7) | 8250-9750 | 12 | 796 | 20 |

**University of North Carolina, Chapel Hill 27514**

**BIOSTATISTICS**

- Applications due: Open
- James E. Grizzle, Chairman

| Teaching Assistantship (2) | 5830-7711 | 9 | 1085 | 20 | Teaching |
| Research Assistantship (25) | 7774-10281 | 12 | 1085 | 20 | Research |
| Traineeship (10) | 5292 | 12 |  |

**Ohio State University, Columbus 43210**

**STATISTICS**

- Applications due: 4/1/85
- J. S. Rustagi, Chairman

| Fellowship (2) | 5670-6480 | 9 |  |
| Teaching Assistantship (34) | 5670-6480 | 9 | 20 |
| Research Assistantship (3) | 5670-6480 | 9 | 20 |

**Pennsylvania**

**Bryn Mawr College, Bryn Mawr 19010**

**MATHEMATICS**

- Applications due: 3/1/85
- Frederick Cunningham, Chairman

| Teaching Assistantship (1) | 3400-5000* | 9 | 8475** | *** |

*Plus tuition.

**University of Shippensburg, Shippensburg 17257**

**MATHEMATICS AND COMPUTER SCIENCE**

- Applications due: *
- James L. Sieber, Chairman

| Graduate Assistantship (5-7) | 2705 | 9 | 20 | Miscellaneous |

*As soon as possible.
TYPE OF ASSISTANCE
(number anticipated 1985-1986)

STIPEND
paid to student dollars
FEES
paid by student ($) months
SERVICE REQUIRED
hours per week type of service

DEGREES AWARDED
Academic year 1983-1984

Temple University, Philadelphia 19122

STATISTICS
William Wei, Chairman

Faculty 24; Published 21
Graduate Students: full-time 22; full-time first year 7; part-time 17

B.S. Bachelor's by inst. 2995
Ph. D. Bachelor's by dept. 5
Master's by dept. 7

Fellowship (1)
7000 9
Teaching Assistantship (2)
8000 9 20 Teaching
Research Assistantship (10)
5000-6000 9 20 Research

Puerto Rico

University of Puerto Rico, Rio Piedras 00931

MATHEMATICS
David E. Pastor, Chairman

Applications due: 2/15/85
Graduate Students: full-time 45; full-time first year 7; part-time 66

B.S. Bachelor's by inst. 2612
Ph. D. Bachelor's by dept. 47
Master's by dept. 7

Fellowship (3)
350 10
Teaching Assistantship (35)
350 10 *
Research Assistantship (5)
350 10 18

*6 hours of teaching contact hours or 18 hours of tutoring or grading.

Tennessee

Memphis State University, Memphis 38152

MATHMATICAL SCIENCES
R. J. Faudree, Chairman

Applications due: 4/1/85
Graduate Students: full-time 45; full-time first year 7; part-time 66

B.S. Bachelor's by inst. 1358
Ph. D. Bachelor's by dept. 3
Master's by dept. 1

Teaching Assistantship (33)
5100-5600 9 48/sem. hr. 20 Teaching

Tennessee Technological University, Cookeville 38505

MATHEMATICS AND COMPUTER SCIENCE
Leland L. Long, Acting Chairman

Applications due: 3/1/85
Graduate Students: full-time 5; full-time first year 1; part-time –

B.S. Bachelor's by inst. 2612
Ph. D. Bachelor's by dept. 47
Master's by dept. 7

Teaching Assistantship (6)
4500 9 6 Teaching

Texas

Southern Methodist University, Dallas 75275

STATISTICS
William R. Schucany, Chairman

Applications due: 4/1/85
Graduate Students: full-time 19; full-time first year 7; part-time 3

B.S. Bachelor's by inst. 1358
Ph. D. Bachelor's by dept. 3
Master's by dept. 1

Teaching Assistantship (18)
6500 9 3 Teaching
Dean's Award (1)
11000 9 3 Teaching

*Late applications accepted.

Texas A&M University, College Station 77843

MATHEMATICS
H. E. Lacey, Head

Applications due: 3/1/85
Graduate Students: full-time 32; full-time first year 5; part-time –

B.S. Bachelor's by inst. 5980
Ph. D. Bachelor's by dept. 27
Master's by dept. 6

Teaching Assistantship (75)
6300-7075 9 500 10-12 Recitation section, related duties

*Late applications will be accepted.

University of Texas at Arlington 76019

MATHEMATICS
V. Lakshmikantham, Chairman

Applications due: 4/15/85
Graduate Students: full-time 55; full-time first year 15; part-time 26

B.S. Bachelor's by inst. 2500
Ph. D. Bachelor's by dept. 40
Master's by dept. 7

Teaching Assistantship (45)
6300 9 20 Grading, teaching, research

Ph. D. Bachelor's by dept. 8
Master's by dept. 5
Other 5. Total: 10

University of Texas at Arlington 76019

APPLICATIONS DUE: 4/15/85
B.S. Bachelor's by inst. 2500
Ph. D. Bachelor's by dept. 40
Master's by dept. 7
Other 5. Total: 10

294
<table>
<thead>
<tr>
<th>Type of Assistance</th>
<th>Stipend</th>
<th>Fees</th>
<th>Service Required</th>
<th>Degrees Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Sciences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eugene F. Schuster, Chairman</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (12)</td>
<td>5200-6000</td>
<td>9</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Instructorship (3)</td>
<td>6000-8000</td>
<td>9</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>University of Texas at El Paso 79968</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>James Madison University, Harrisonburg 22807</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics and Computer Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diane M. Spresser, Head</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (5)</td>
<td>4000</td>
<td>9</td>
<td>6c</td>
<td></td>
</tr>
<tr>
<td>Virginia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Wyoming, Laramie 82071</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenneth J. Gross, Head</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (24)</td>
<td>5535-7380</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (4)</td>
<td>5535-7380</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simon Fraser University, Burnaby, British Columbia V5A 1S6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. A. C. Graham, Chairman</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship**</td>
<td>11100</td>
<td>12</td>
<td>490/sem</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (100)</td>
<td>3100-3670</td>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (9)</td>
<td>3360</td>
<td>4</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Open Scholarship (4)</td>
<td>8500</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stipend (8)</td>
<td>2400-2900</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Université de Montréal, Montréal, Québec H3C 3J7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aubert Daigleault, Director</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Fellowship (18)</td>
<td>1650-4900</td>
<td>8</td>
<td>1-4c</td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (57)</td>
<td>2172</td>
<td>8</td>
<td>2c</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (30)</td>
<td>1800-6930</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scholarship (36)</td>
<td>5000-11600</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of British Columbia, Vancouver, British Columbia V6T 1W5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. M. Varah, Head</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (15)</td>
<td>6400</td>
<td>8</td>
<td>1414</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (10)</td>
<td>10560</td>
<td>12</td>
<td>1414</td>
<td></td>
</tr>
<tr>
<td>Scholarship (10)</td>
<td>11000</td>
<td>12</td>
<td>1414</td>
<td></td>
</tr>
</tbody>
</table>

*To receive priority.

*One month prior to start of the semester.

**Number anticipated not known.

*555; visa students without agreement between their country and Quebec: $6525.

University of British Columbia, Vancouver, British Columbia V6T 1W5

<table>
<thead>
<tr>
<th>Type of Assistance</th>
<th>Stipend</th>
<th>Fees</th>
<th>Service Required</th>
<th>Degrees Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. M. Varah, Head</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (15)</td>
<td>6400</td>
<td>8</td>
<td>1414</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (10)</td>
<td>10560</td>
<td>12</td>
<td>1414</td>
<td></td>
</tr>
<tr>
<td>Scholarship (10)</td>
<td>11000</td>
<td>12</td>
<td>1414</td>
<td></td>
</tr>
<tr>
<td>TYPE OF ASSISTANCE</td>
<td>STIPEND</td>
<td>FEES</td>
<td>SERVICE REQUIRED</td>
<td>DEGREES AWARDED</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>---------</td>
<td>------</td>
<td>------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>(number anticipated 1985-1986)</td>
<td>paid to student dollars</td>
<td>paid by student ($)</td>
<td>hours per week of service</td>
<td>Academic year 1983-1984</td>
</tr>
<tr>
<td>MATHEMATICS</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Maurice Sion, Head</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Graduate Students: full-time 28; full-time first year 12; part-time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fellowship (7)</td>
<td>11600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Assistantship (45)*</td>
<td>6000-6200</td>
<td>8</td>
<td>** 12</td>
<td></td>
</tr>
<tr>
<td>Research Assistantship (45)</td>
<td>3500-5300</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Package-teaching assistantship and research assistantship is usually offered providing over $12000 for 12 months. **First $1750, second $1300, third $876.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

University of Manitoba, Winnipeg, Manitoba R3T 2N2

STATISTICS
L. K. Chan, Head
Faculty 13; Published 12
Graduate Students: full-time 17; full-time first year 10; part-time 0
Marking and Demonstration (20) Varies 8 1100 Varies
Ph. D. (81/84) S 3. Total: 3

University of Toronto, Toronto, Ontario M5S 1A1

COMPUTER SCIENCE
Allan B. Borodin, Chairman
Faculty 32; Published 9
Graduate Students: full-time 111; full-time first year 42; part-time 40
Connaught Fellowship (3) 8500 12 Waived Ph. D. (81/84) CS 21. Total: 21
Teaching Assistantship (30) 906.56-1013.58 4 * 4 Tutoring, grading
Research Assistantship (30) 9360-10560 12 *
NSERC Scholarship (35) 11600-17500 12 *
Ontario Graduate Scholarship (4) 6915 12 *
University Open Fellowship (19) 6600 12 *
*Canadian: $1352; Visa students: $6225.

University of Windsor, Windsor, Ontario N9B 3P4

MATHMATICS
D. J. Britten, Chairman
Faculty 22; Published 19
Graduate Students: full-time 14; full-time first year 4; part-time 2
Teaching Assistantship (15) 2500-5600 9 40 Ph. D. (81/84) S 3, AM 2. Total: 5
Research Assistantship (5) 10560 12 Research
Scholarship (5) 3000 12

Errata

The number of faculty members who published a technical paper or book in the last three years by the UNIVERSITY OF GEORGIA, Department of Mathematics, should have been 26 not 14.

The number of Ph.D.'s granted in the last three years at INDIANA UNIVERSITY, BLOOMINGTON, Department of Mathematics, should have been ANT 2, AFA 11, GT 1, P 1, S 4, AM 2, Other 1. Total: 22.
Critical, Historical, or Expository Theses

Supplementary List

The list below supplements the list published on page 915 of the December 1984 Notices.

California
Stanford Univ
Statistics
Ph.D.

North Carolina
Univ of North Carolina, Chapel Hill
Biostatistics
Ph.D.

Massachusetts
Boston Univ
Mathematics
Ph.D.

Tennessee
Memphis State Univ
Mathematical Sciences
Ph.D.

New York
Adelphi Univ
Mathematics and Computer Science
D.A.

Texas
Southern Methodist Univ
Statistics
Ph.D.

Univ of Texas, Arlington
Mathematics
Ph.D.

Canada
Univ of British Columbia
Computer Science
Ph.D.

Univ of Manitoba
Statistics
Ph.D.

Univ of Toronto
Computer Science
Ph.D.

Axiomatic Set Theory

James E. Baumgartner, Donald A. Martin and Saharon Shelah, Editors

Mathematicians interested in understanding the directions of current research in set theory will not want to overlook this book, which contains the proceedings of the AMS Summer Research Conference on Axiomatic Set Theory, held in Boulder, Colorado, June 19–25, 1983. This was the first large meeting devoted exclusively to set theory since the legendary 1967 UCLA meeting, and a large majority of the most active research mathematicians in the field participated. All areas of set theory, including constructibility, forcing, combinatorics and descriptive set theory, were represented: many of the papers in the proceedings explore connections between areas. Readers should have a background of graduate-level set theory.

There is a paper by S. Shelah applying proper forcing to obtain consistency results on combinatorial cardinal "invariants" below the continuum, and papers by R. David and S. Friedman on properties of $\mathfrak{b}$. Papers by A. Blass, H.-D. Donder, T. Jech and W. Mitchell involve inner models with measurable cardinals and various combinatorial properties.

T. Carlson largely solves the pin-up problem, and D. Velleman presents a novel construction of a Souslin tree from a morass. S. Todorcevic obtains the strong failure of the □ principle from the Proper Forcing Axiom and A. Miller discusses properties of a new species of perfect-set forcing. H. Becker and A. Kechris attack the third Victoria Delfino problem while W. Zwicker looks at combinatorics on $P_\kappa(\lambda)$ and J. Henle studies infinite-exponent partition relations. A. Blass shows that if every vector space has a basis then AC holds. I. Anellis treats the history of set theory, and W. Fleissner presents set-theoretical axioms of use in general topology.

Contemporary Mathematics
Volume 31, x + 259 pages (softcover)
1980 Mathematics Subject Classifications:
03E05, 03E10, 03E15, 03E25, 03E35 and others
ISBN 0-8218-5026-1; LC 84-18457
Publication date: November 1984
List price $25, institutional member $20, individual member $15
To order, please specify CONM/31N

Shipping/Handling: 1st book $2, each add’l $1, max. $25; by air, 1st book $5, each add’l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
Recent Appointments

Committee members' terms of office on standing committees expire on January 31 of the year given in parentheses following their names, unless otherwise specified.


R. H. Bing, Richard K. Lahsof and Shing-Tung Yau have been appointed by President Irving Kaplansky to the Committee to Select the Winner of the Veblen Prize. Professor Yau will serve as chairman.

Reports of Past Meetings

The November Meeting in San Diego

The eight hundred and fifteenth meeting of the American Mathematical Society was held at San Diego State University in San Diego, California on Friday and Saturday, November 9-10, 1984. The meeting was held in conjunction with a meeting of the Southern California Section of the Mathematical Association of America. There were 262 registrants of which 190 were members of the Society. F. David Lesley served as the local organizer for the Meeting.

Invited Addresses. By invitation of the Committee to Select Hour Speakers for Far Western Sectional Meetings, there were two invited one-hour addresses.

Dragan Milicic of the University of Utah spoke on Representation theory and D-modules. He was introduced by J. L. Taylor.

John Guckenheimer of the University of California, Santa Cruz, spoke on Beyond the transition to chaos. He was introduced by J. W. Helton.

Special Sessions. By invitation of the same committee, there were five special sessions of selected papers. The topics of these special sessions, the names of the organizers and the lists of speakers are as follows:


Graph theory and applications, J. D. Elwin, San Diego State University. The speakers were Edward A. Bender, John Donald, John Elwin, Richard Hager, Paul Kaschube, Aram K. Kevoian, Daniel Marcus, Henryk Mine, Hugo S. H. Sun and S. Gill Wiliamson.

Representations of semi-simple Lie groups, Tom Enright, University of California at San Diego, La Jolla, and Joseph Wolf, University of California, Berkeley. The speakers were Jeffrey Adams, Susan Addington, William H. Barker, Brian D. Boe, Devra Garfinkle, Henryk Hecht, Rebecca A. Herb, John J. Milson, Robert A. Proctor, Jonathan Rosenberg, Hugo Rossi, Brad Shelton, P. C. Trombi, V. S. Varadarajan and Roger Zierau.

Complex analysis in honor of Stefan Warschawski, Carl H. FitzGerald, University of California at San Diego, La Jolla, and F. David Lesley, San Diego State University. The speakers were Albert Baernstein II, David A. Brannan, Louis deBranges, Peter Duren, S. D. Fisher, Carl H. FitzGerald, D. Hamilton, Walter Hengartner, David A. Herron, Roger A. Horn, James A. Jenkins, Jacob Korevaar, F. David Lesley, Willm A Luxemburg, Albert Marden, C. David Minda, Kotaro Oikawa, Bruce O'Neill, Bruce Palka, Edgar Reich, Burton Rodin, Glenn Schober, Evelyn Silvia, Nobuyuki Suita and A. M. Trembinska.


Contributed Papers. There were two sessions of contributed ten-minute papers of ten and five speakers each. They were chaired by Saul Drobnies and Betty Garrison respectively.

MAA Program. The MAA program included two hour addresses as follows: one by Everett Bull of Pomona College titled Why don't you get a bigger computer?, and another by Fred Dashiell of the Inference Corporation titled Symbolic mathematics by computer: New opportunities for the mathematician. There was also a Saturday afternoon luncheon sponsored by the MAA. The luncheon speaker was Michael Golomb of Purdue University, West Lafayette, who delivered an address titled, Reminiscences of an immigrant mathematician.

Hugo Rossi
Associate Secretary

Salt Lake City, Utah
The Council Meeting in Anaheim

The Council met on 8 January 1985 at 2:00 P.M. in California Room E of the Anaheim Convention Center. President Irving Kaplansky was in the chair.

The Council was informed of the results of the election of 1984. See the report in this of the Notices.

The Council changed the name of the Committee on Summer Institutes to the Committee on Summer Institutes and Special Symposia. The charge to the Committee is correspondingly enlarged.

The Council approved the trial of an occasional regional meeting principally devoted to a single broad topic, for example algebra or geometry. That is, all of the invited addresses and special sessions would be charged to the topic, for example algebra or geometry. That is, all contributed papers.

The Council recommended an amendment to the bylaws that reduces the size of the Council by almost half.

The terms of appointed committees have been changed so that in general they will begin on February 1 instead of January 1. An effect is that a committee that meets at the time of the January meeting will be in the hands of the old chairman rather than a new one. Another effect is that newly appointed members will attend for indoctrination rather than as members.

The Committee on Human Rights had several items to report. One is that the Moroccan mathematician Sion Assidon has been released from prison and reunited with his family. It is thought that inquiries and protests by this Society and others were a contributing factor.

Another concern is the recent arrest of three Chilean mathematicians, Ada Cam, Manuel Alarcon, and Douglas Fuentesi of the mathematics department of the University of Antofagasta. Initial inquiries about the reasons for their arrest and their whereabouts received the answer that nothing was known. The Committee on Human Rights and President Kaplansky sent cables of inquiry and there were similar communications from the National Academy and from other mathematical societies. Thus two of the three have been released and the third is in a detention center for three months. It is thought that the demonstration of concern was an important factor in the release.

The Council adjourned at 5:40 P.M.

The Business Meeting in Anaheim

The Business Meeting was held in the [room] of the Anaheim Convention Center on 10 January 1985 about 4:30 P.M., following the award of the Cole Prize. President Kaplansky was in the chair.

The Secretary reported on some actions of the Council of 8 January, as detailed above.

It was noted that the Summer Meeting of 1987, jointly with the Mathematical Association of America, was approved. The succession of summer activity then consists of the joint meeting of 1985 in Laramie, the ICM 86 in Berkeley displacing the Summer Meeting, the joint meeting of 1987 at a place to be designated, and the Centennial of the Society in 1988. The continuation of joint summer meetings in 1989 and beyond is still under study.

The Council has been concerned with the apparent anti-Semitic stance of the journal Matematicheski Sbornik, which the Society publishes in translation as part of a contract to translate a set of Russian journals. As an expression of their concern, the Council proposed some time ago that a loose sheet be inserted in each copy or wrapper with the following wording:

The American Mathematical Society has been cognizant of the Mathematical distinction of the journal Matematicheski Sbornik. For this reason and as a service to the mathematical community, it was happy to enter into a contract with VAAP (All-Union Agency for Authors Rights) to translate the journal and publish the translation. At the same time, the Society wishes to record the fact that it deplores the anti-Semitic bias that has appeared to become part of the editorial policy of the journal. The American Mathematical Society hopes that this aspect of policy in the management of the journal will change.

The Trustees approved and the mailing began with the January 1985 issue.

The Secretary noted that extended reports from the Treasurer, the Secretary, and the Executive Director are to appear in this issue of the Notices.

The President reported on distinguished mathematical accomplishments of the past year.

Three amendments to the bylaws, recommended by the Council, were passed. The first changes the name Mathematical Surveys to Mathematical Surveys and Monographs. This corresponds to a modest redirection of the nature of the series. The change occurs in two places in the bylaws, to wit, in the name of the publication committee in Article III, Section 2, and in the name of the publication in Article IX, Section 1.

The second amendment concerns the Executive Committee, which consists of four members elected from the Council by the Council and three members ex officiis. The term of office is prescribed in Article VII, Section 1 where it is stated that "[t]he term of office for elected members of the executive committee shall be two years, two of the elected members retiring annually." The amendment changes the term to four years, with one elected member retiring annually.

The third amendment is concerned with corporate membership. It alters Article IX on Dues and Privileges of Membership by deleting Section 5 (which sets the dues of corporate members), deleting words from Section 6 as noted in square brackets and relabeling Section 5, and supplying a new Section 6. Thus Sections 5 and 6 are to be as follows.

Section 5. The privileges of [a corporate or] an institutional member shall depend on its dues

299
in a manner to be determined by the Council, subject to approval by the Board of Trustees.

These privileges shall be in terms of Society publications to be received by the institution and of the number of persons it may nominate for ordinary membership in the Society.

Section 6. Dues and privileges of corporate members of the Society shall be established by the Council subject to approval by the Board of Trustees.

It should be noted that the Council recommended dues of $2000 for corporate members ($3000 for those who choose certain privileges with respect to copyright). The Council further recommended that corporate members be entitled to send up to five representatives to meetings with registration at members' rates and to use the Employment Register and Employment Information in the Mathematical Sciences (with a ceiling on the number of ads) without charge. The Trustees approved these dues and privileges.

At the close of the meeting, the President thanked the members of the Committee on Arrangements.

The meeting adjourned at 5:40 P.M.

_Everett Pitcher_  
Bethlehem, Pennsylvania

**Election Results of 1984**

The newly elected Vice-President of the Society is Linda Preiss Rothschild. The newly elected Members-at-Large of the Council are A. T. Bharucha-Reid, Daniel M. Burns, Joseph B. Keller, Audrey A. Terras, and David A. Vogan, Jr.

Ramesh A. Gangolli was elected to the position of Trustee. All candidates in noncontested elections were elected to their respective offices.

The candidates elected to the Nominating Committee of 1985-1986 are Vera S. Pless, Mary Ellen Rudin, Michael Shub, and Raymond O. Wells, Jr. The composition of the Council for 1985 follows.

**COUNCIL FOR 1985**

President: Irving Kaplansky  
Ex-President: Julia B. Robinson  
Vice-Presidents: Linda Preiss Rothschild, Jacob T. Schwartz, Stephen Smale  
Secretary: Everett Pitcher  
Associate Secretaries: Frank T. Birtel, W. Wistar Comfort, Robert M. Fossum, Hugo Rossi  
Treasurer: Franklin P. Peterson  
Associate Treasurer: Steve Armentrout

**MEMBERS-AT-LARGE**

A. T. Bharucha-Reid  
Daniel M. Burns  
Michael G. Crandall  
Peter L. Duren  
David Eisenbud  
Susan J. Friedlander  
Paul R. Halmos  
Robin Hartshorne  
Melvin Hochster  
Joseph B. Keller  
Carlos E. Kenig  
Michael Shub  
Olga Taussky-Todd  
Jean E. Taylor  
Audrey A. Terras  
William P. Thurston  
David A. Vogan, Jr.

**COMMUNICATIONS COMMITTEE**

Chairman, Committee to Monitor Problems in Communication: Marian B. Pour-El

**PUBLICATIONS COMMITTEES**

Bulletin Editorial Committee  
Hyman Bass  
Meyer Jerison  
Colloquium Editorial Committee  
Raoul H. Bott  
Barry Mazur  
Proceedings Editorial Committee  
Richard R. Goldberg  
Irwin Kra  
Andrew Odlyzko  
Donald S. Passman  
Transactions and Memoirs Editorial Committee  
Donald L. Burkholder  
William B. Johnson  
Tilla Klotz Milnor  
Walter David Neumann  
Mathematical Reviews Editorial Committee  
Robert G. Bartle  
Melvin Hochster  
Mathematical Surveys Editorial Committee  
M. Susan Montgomery  
R. O. Wells, Jr.  
Gian-Carlo Rota  
Mathematics of Computation Editorial Committee  
Walter Gautschi  
Donald Goldfarb  
AMS Representatives, Board of Editors of American Journal of Mathematics  
Spencer Bloch  
Richard B. Melrose

**Election Results of 1984**

The newly elected Vice-President of the Society is Linda Preiss Rothschild. The newly elected Members-at-Large of the Council are A. T. Bharucha-Reid, Daniel M. Burns, Joseph B. Keller, Audrey A. Terras, and David A. Vogan, Jr.

Ramesh A. Gangolli was elected to the position of Trustee. All candidates in noncontested elections were elected to their respective offices.

The candidates elected to the Nominating Committee of 1985-1986 are Vera S. Pless, Mary Ellen Rudin, Michael Shub, and Raymond O. Wells, Jr. The composition of the Council for 1985 follows.

**COUNCIL FOR 1985**

President: Irving Kaplansky  
Ex-President: Julia B. Robinson  
Vice-Presidents: Linda Preiss Rothschild, Jacob T. Schwartz, Stephen Smale  
Secretary: Everett Pitcher  
Associate Secretaries: Frank T. Birtel, W. Wistar Comfort, Robert M. Fossum, Hugo Rossi  
Treasurer: Franklin P. Peterson  
Associate Treasurer: Steve Armentrout
Officers of the Society, 1984 and 1985

Except for the Members-at-Large of the Council, the month and year of the first term and the end of the present term are given. For Members-at-Large, of the Council, the last year of the present term is listed.

COUNCIL

Presidents:
- Julia B. Robinson 1/83-12/84
- Irving Kaplansky 1/85-12/86
Ex-President: Julia B. Robinson 1/85-12/86
President-Elect: Irving Kaplansky 1/84-12/84

Vice Presidents:
- Calvin C. Moore 1/83-12/84
- Linda Preiss Rothschild 1/85-12/86
- Jacob T. Schwartz 1/84-12/85
- Stephen Smale 1/84-12/85

Secretary: Everett Pitcher 1/67-12/86
Associate Secretary: Frank T. Birtel 1/77-12/86

Ex-President:
- Julia B. Robinson 1/85-12/85

President-Elect:
- Irving Kaplansky 1/84-12/84

Vice Presidents:
- Calvin C. Moore 1/83-12/84
- Linda Preiss Rothschild 1/85-12/86
- Jacob T. Schwartz 1/84-12/85
- Stephen Smale 1/84-12/85

Secretary: Everett Pitcher 1/67-12/86
Associate Secretary: Frank T. Birtel 1/77-12/86

Treasurer: Franklin P. Peterson 8/73-12/86
Associate Treasurer: Steve Armentrout 7/77-12/86

Members-at-Large
All terms are for 3 years and expire on December 31 of the given year

1984
- Peter A. Fillmore
- Melvin Hochster
- Robert P. Langlands
- M. Susan Montgomery
- Hector J. Sussman
- Paul R. Halmo*

1985
- Peter L. Duren
- Susan J. Friedlander
- Robin Hartshorne
- Michael Shub
- Olga Taussky-Todd
- Jean Taylor
- David A. Vogan, Jr.

1986
- Michael G. Crandall
- David Eisenbud
- Melvin Hochster*
- Carlos Kenig
- Hugo Rossi

1987
- A. T. Bharucha-Reid
- Daniel A. Burns
- Joseph B. Keller
- Audrey A. Terras
- William P. Thurston

*Members-at-large, as provided for in Article 7, Section 4 (last sentence) of the Bylaws of the Society.

Publications and Communications Committees

Bulletin Editorial Committee
- Hyman Bass 1/84-12/86
- Meyer Jerison 1/80-12/85
- Calvin C. Moore 1/82-12/87

Colloquium Editorial Committee
- Raoul H. Bott 1/85-12/87
- Barry Mazur 1/84-12/86
- John W. Milnor 1/79-12/84
- Louis Nirenberg 1/83-12/85
- Stephen Smale 1/78-12/83

Mathematical Reviews Editorial Committee
- Robert G. Bartle 1/83-12/85
- Melvin Hochster 1/84-12/86
- Morton Lowengrub 1/82-12/87
- Melvin Hochster* 1/84-12/86
- Carlos Kenig 1/83-12/86
- Jean Taylor 1/84-12/87
- David A. Vogan, Jr.
- William P. Thurston

Mathematics of Computation Editorial Committee
- Donald G. B. Chiswell 1/79-12/84
- M. Susan Montgomery 1/85-12/87
- Gian-Carlo Rota 1/84-12/86
- R. O. Wells, Jr. 1/83-12/85

Mathematical Surveys and Monographs Editorial Committee
- Donald W. Anderson 1/79-12/84
- M. Susan Montgomery 1/85-12/87
- Gian-Carlo Rota 1/84-12/86
- R. O. Wells, Jr. 1/83-12/85

Mathematics of Computation Editorial Committee
- Walter Gautschi 1/84-12/86
- Donald Goldfarb 1/86-12/87
- John E. Osborn 1/84-12/86
- Daniel Shanks 1/79-12/84
- Hugh C. Williams 1/83-12/85

Chairman, Committee to Monitor Problems in Communication
- Marian B. Pour-El 1/85-12/85
- Lynn A. Steen 1/84-12/84

Proceedings Editorial Committee
- Thomas H. Brylawski 1/80-12/84
- Richard R. Goldberg 1/84-12/87
- Irwin Kra 1/84-12/87
- Andrew M. Odlyzko 1/84-12/85
- Donald S. Passman 1/85-12/88
- George R. Sell 1/83-12/86
- Daniel W. Stroock 1/84-12/87
- J. Jerry Uhl, Jr. 1/82-12/85

Representatives on American Journal of Mathematics
- Spencer Bloch 1/83-12/85
- Richard B. Melrose 1/84-12/86

Transactions and Memoirs Editorial Committee
- Donald L. Burkholder 1/83-12/86
- William B. Johnson 1/82-12/85
- Tilla Klotz Milnor 1/84-12/87
- Walter David Neumann 1/83-12/86
- Linda Preiss Rothschild 1/83-12/86
- Lances W. Small 1/83-12/86
- Joel A. Smoller 9/82-12/83

BOARD OF TRUSTEES

Steve Armentrout (ex officio) 7/77-12/86
Ramesh A. Gangolli 1/85-12/89
Frederick W. Gehring 1/83-12/87
Ronald L. Graham 1/82-12/86
Irving Kaplansky (ex officio) 1/85-12/86

301
**Classified Advertisements**

**SUGGESTED USES** for classified advertising are books or lecture notes for sale, books being sought, positions available, exchange or rental of houses, and typing services.

**THE RATE IS $0.55 per word with a minimum of $5.00.** The same ad in 6 consecutive issues is $3.00 per word. Type will be set solid unless centering and spacing are requested. A centered line of any length or the equivalent in white space is $5.00. A word is defined as a group of characters with space at each end. Prepayment is required of individuals but not of institutions. For an additional $10.00 charge, announcements can be placed anonymously. Correspondence will be forwarded.

**DEADLINES** are listed on the inside front cover.

**U. S. LAWS PROHIBIT** discrimination in employment on the basis of color, age, sex, race, religion or national origin. "Positions Available" advertisements from institutions outside the U. S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U. S. laws. Details and specific wording may be found following the Classified Advertisements in the January and August issues of the Notices.

**SITUATIONS WANTED ADVERTISEMENTS** from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-556-7774 and speak to Wahlene Siconio for further information.

**SEND AD AND CHECK TO:** Advertising Department, AMS, P. O. Box 6248, Providence, Rhode Island 02940. Individuals are requested to pay in advance, institutions are not required to do so.

---

**POSITIONS AVAILABLE**

**PURDUE UNIVERSITY CALUMET**
Hammond, Indiana
Department of Mathematical Sciences
Applications are invited for a tenure-track position in mathematical sciences starting August 1985. Candidates must have a Ph.D. in Mathematics, Statistics, or Computer Science. Salary is competitive and there are excellent fringe benefits, including full TIAA/CREF contributions and paid sabbatical leaves.

The Department of Mathematical Sciences at Purdue Calumet has programs leading to the Bachelor of Science and Master of Science degrees. The Department currently has twenty full-time faculty members.

Members of the staff teach the full-range of undergraduate courses as well as specialized graduate courses.

Candidates should have an interest in teaching and research.

Hammond is located in northwest Indiana and is a thirty minute drive from the Chicago Loop.

Applicants are asked to submit résumés and obtain at least three letters of recommendation.

Please address correspondence to: Head, Department of Mathematical Sciences, Purdue University Calumet, Hammond, Indiana 46323 – An Affirmative Action/Equal Opportunity Employer.

---

**ARIZONA STATE UNIVERSITY**
Department of Mathematics
Applications are invited for anticipated positions at ranks of Assistant and Associate Professor. There is a possibility of appointments at Professor rank. Visiting positions are also expected. Send vita and direct three letters of recommendation to J. Bustoz, Chair, Department of Mathematics, Arizona State University, Tempe, AZ 85287. A.S.U. is an equal opportunity employer.

---

**WILKES COLLEGE**
Faculty Position

The Department of Mathematics and Computer Science invites applications for a tenure-track position beginning fall, 1985. Ph.D. or ABD in computer science or a Ph.D. in mathematics and substantial training in computer science is required. Wilkes College has 1800 undergraduates; the department has 13 faculty members and 175 majors. Send résumé and three letters of recommendation to Richard E. Sours, Chairman, Department of Mathematics and Computer Science, Wilkes College, Wilkes-Barre, PA 18766.

---

**UNIVERSITY OF CALIFORNIA, LOS ANGELES**
DEPARTMENT OF MATHEMATICS
Subject to administrative approval, a few adjunct assistant professorships; two year appointment only; strong research and teaching background; no restriction as to field.

Salary $26,600 for academic year. Teaching load: Five quarter courses per year. To apply, write to Yiannis N. Moschovakis, Chair, Los Angeles, CA 90024.

UCLA is an equal opportunity affirmative action employer.

---

**COMPUTER SCIENCE AT PROVIDENCE COLLEGE**
The Department of Mathematics and Computer Science at Providence College invites applications for two positions in Computer Science. These positions become available in September 1985. Applicants should possess the Ph.D. or its equivalent in Computer Science. Candidates with a M. S. in Computer Science will also be considered for non-tenure track appointments. Providence College is a four year, co-education, very selective liberal arts college conducted under the auspices of the Dominican Fathers. It enrolls 3500 students of which approximately 200 are mathematical science majors.

The duties of this position include 9–12 hours of teaching in Computer Science, the pursuit of research interests and participation in the growth of our rapidly expanding department. Salary and rank are commensurate with qualifications. Applications will be considered until the position is filled. Please send vita, transcripts and the names of three references to:

Search Committee
Department of Mathematics/Computer Science
Providence College
Providence, Rhode Island 02918

Providence College is an equal opportunity affirmative action employer.

---

**SOUTHWEST TEXAS STATE UNIV., DEPT. OF MATH/CSC,**
SAN MARCOS, TX 78666. One or more assist. or assoc. professors expected for fall 1985. Possibility of tenure-track appointments. Ph.D. (or equiv.) and potential for excellence in research and teaching required. Prefer those in math, ed., applied math., computer science, diff. eq. (o.d.e. or p.d.e.), dynamical systems, number theory and topology.

Contact Chairman, Southwest Texas State University, San Marcos, TX 78666. Application deadline: 2/1/85; late applications considered if openings exist. SWTSU is an equal opportunity/affirmative action employer.
NEW MEXICO STATE UNIVERSITY

Visiting position(s) and possible tenure-track position(s) in mathematics, numerical analysis, statistics or computer vision. Start August 26, 1985. Salary for 1985-86 academic year: $21,000 or higher and dependent upon rank, qualifications and experience. Ph.D. (or equivalent) and strong commitment to teaching and research essential. Applications are kept on file through hiring period and positions filled as openings occur. Send vita and arrange for three reference letters to be sent to Carol L. Walker, Head, Department of Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003. An Equal Opportunity/Affirmative Action Employer.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS & STATISTICS

Applications are invited for two tenure-track statisticians, either at Assistant Professor or Associate Professor levels for September 1985, subject to budgetary constraints. For an Associate Professor position, substantial achievement in research, teaching and consulting in statistics is required. For an Assistant Professor position, applicants should have a Ph.D. in statistics and demonstrated ability in research and teaching. In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. Those interested should submit a curriculum vitae and references to:

Dr. J. H. Burry,
Head
Department of Mathematics and Statistics
Memorial University of Newfoundland
St. John’s, Newfoundland
Canada
A1C 5S7

KEAN COLLEGE OF NEW JERSEY

UNION, NEW JERSEY

Dean of Natural Sciences, Nursing and Mathematics
SEARCH EXTENDED

Kean College of New Jersey is seeking candidates for the position of Dean of Natural Sciences, Nursing and Mathematics. The Dean reports to the Vice President of Academic Affairs and is responsible for the development and administration of plans to meet the needs of students served by the School of Natural Sciences, Nursing and Mathematics and for the fostering of excellence in programs, instruction, and research.

Kean College of New Jersey is a multi-purpose State College with graduate and undergraduate programs and an enrollment of approximately 13,000 students. It is located on a 150-acre campus in Union Township and Hillside. The Dean is a member of the Council of Deans and working within the context of shared governance, participates in the formulation, evaluation, and administration of College policies and procedures.

Candidates must hold the minimum of a Ph.D. in an academic discipline related to the School of Natural Sciences, Nursing and Mathematics or other appropriate area. Educational administrative experience at a policy level in a public four year college or university and a commitment to participative management are highly desired. A minimum of five years' college teaching experience is required.


Applicants should submit resumes and statements describing their qualifications, and a written statement indicating their administrative philosophy and views on major issues in higher education. They should also have three letters of reference and graduate transcripts sent to:

Dr. A. Bryan Lees, Chairperson
Search Committee for the Dean of Natural Sciences, Nursing and Mathematics
Room T-130
Kean College of New Jersey
Union, New Jersey 07083

All materials must be received by March 22, 1985. Minority and Women Candidates Encouraged to Apply.

An Equal Opportunity/Affirmative Action Employer.

ROCHESTER INSTITUTE OF TECHNOLOGY

Department of Mathematics

Rochester, NY 14623

At least one asst/assoc prof., tenure-track position anticipated for Sept., 1985. Ph.D. in math or statistics preferred, MS with extensive applied experience considered. Preferred specialties: Applied prob/stat, or, computational math, graph theory, discrete math. Applicant must have primary interest in teaching undergrad math, as well as doing some research or consulting. Salary: Competitive, negotiable. Contact: Prof. James Glasenapp, Chairman, Faculty Recruiting Committee. RIT is affirmative action/equal opportunity employer.

UNIVERSITY OF MANCHESTER INSTITUTE OF SCIENCE AND TECHNOLOGY

CHAIR IN PURE MATHEMATICS

Applications are invited from suitably qualified persons for a new Chair in Pure Mathematics tenable in the Department of Mathematics from 1 October 1985 or as soon as possible thereafter. Candidates should have research interests in Algebra or a related field such as algebraic number theory or algebraic geometry. Requests for application forms and further particulars, quoting reference MAT/23, should be sent to the Registrar, Room 89, UMIST, PO Box 88, Manchester M60 1QD, United Kingdom, to whom completed application forms should be returned by 14 April 1985.
POSITIONS AVAILABLE

Applied Mathematics
Washington State University
The Department of Pure and Applied Mathematics expects an opening for a tenure-track position starting August 1985. Applicants should have active research interests in OPERATIONS RESEARCH, preferably with emphasis on discrete or stochastic optimization. An additional position may occur; applicants with active research interests in NUMERICAL ANALYSIS and/or COMPUTATIONAL STATISTICS are invited to apply. The position(s) requires a Ph.D., with competence in teaching relevant graduate and undergraduate courses and the capability of supervising doctoral dissertations. While appointments are planned at the Assistant Professor level, more senior applicants are encouraged to apply. The University is an equal opportunity/affirmative action employer. Applications from members of minority groups, women, and handicapped persons are encouraged. Vitas and three (3) letters of reference should be sent by March 15, 1985, to:
Professor John R. Cannon
Chairman, Search Committee
Department of Pure and Applied Mathematics
Washington State University
Pullman, Washington 99164-2930

MATHMATICS OVERSEAS: The Department of Mathematics at the American University of Beirut (AUB) invites applications for tenue-track faculty positions, available October 1, 1985 in the following fields: Preference for Statistics, Analysis and Topology, but other specialties will also be considered. Applicants should hold the Ph.D. degree and appointments are normally made for a three-year period in the rank of Assistant Professor. The Department has a faculty of 13 lines, an undergraduate B.A./B.S. program and an M.A./M.S. graduate program with thesis. Interested persons may send their curriculum vitae and inquiries to Chairman, Department of Mathematics, American University of Beirut, Beirut, Lebanon, with copy to Personnel Services, AUB, 850 Third Avenue, New York, NY 10022. AUB is an equal opportunity, affirmative action employer.

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE DEPARTMENT OF MATHEMATICS
CHARLOTTE, N.C. 28223
Assistant/Associate Professor (tenure track, rank depends on qualifications and experience). Ph.D. in mathematics, statistics, or operations research required. Preferred areas: applied probability/stochastic modeling/optimization, numerical analysis, differential geometry/dynamical systems, classical analysis. Exceptional candidates regardless of field will also receive serious consideration. To apply, send a resume and transcripts to Faculty Selection Committee, Department of Mathematics, University of North Carolina at Charlotte, Charlotte, N.C. 28223; and arrange to have four letters of recommendation addressed to Prof. B. Weinstock, Chairman, sent to same address. UNCC IS AN EQUAL OPPORTUNITY EMPLOYER.

PRINCETON UNIVERSITY
FACULTY POSITIONS IN MATHEMATICS AND MATHEMATICAL PHYSICS
Applications are invited from persons with an established record of research accomplishment in algebraic number theory, complex analysis, topology, or mathematical physics, for senior faculty positions in the mathematics department, or, for mathematical physics, jointly in the mathematics and physics departments. Inquiries, accompanied by vita and publication record, should be addressed promptly to Wu-Chung Hsiang, Chairman, Department of Mathematics, Fine Hall, Washington Road, Princeton, NJ 08544. Princeton University is an equal opportunity, affirmative action employer.

MACALESTER COLLEGE
The Department of Mathematics and Computer Science is inviting applications for a full-time position, beginning September 1985. Applicants should have a degree (preferably Ph.D.) in mathematics or computer science. Initial appointment is for one year, position may become tenure track. Salary is competitive. Applications, including resume and three references, should be addressed to John Schue, Chair, Department of Mathematics and Computer Science, St. Paul, MN, 55105, prior to March 15, 1985. Phone (612) 696-6335. Macalester is an affirmative action, equal opportunity employer.

UNIVERSITY OF SOUTHERN CALIFORNIA
DEPARTMENT OF MATHEMATICS
LOS ANGELES, CA 90089-1113
Applications are invited for several tenure track Assistant Professorships, available for September 1985, and for some senior level positions at the ranks of Professor and Associate Professor. Recent Ph.D.'s are expected to teach two courses per semester, and must show strong research promise. Applicants for senior level positions should have an outstanding record of research and scholarly achievements. Persons specializing in Stochastic Processes, Partial Differential Equations, Combinatorial Analysis and areas of Applied Mathematics such as Numerical Analysis are especially encouraged to apply. Applications should be addressed to Chairman, Search Committee, University of Southern California, Department of Mathematics, DRB 306, Los Angeles, California 90089-1113.

DEPARTMENT OF MATHEMATICS
COLLEGE OF CHARLESTON
Applications are invited for three tenure-track positions at the junior or senior level available Fall, 1985. Candidates must have a Ph.D. in one of the mathematical sciences, a commitment to undergraduate teaching, and potential for continuing research. The normal teaching load is 12 hrs/wk with course reductions for those engaged in research. The minimum salary is $25,000. Internal grants for release time or financial support for research projects are available as is travel support. Applicants should send a vita and have three letters of recommendation sent to William L. Golightly, Chairman, Department of Mathematics, College of Charleston, Charleston, SC 29424. The College of Charleston is an Affirmative Action/Equal Opportunity Employer.

HENDRIX COLLEGE
Department of Mathematics, Robert Eslinger, Chairman, Conway, Arkansas 72032
Assistant Professor, tenure track position anticipated beginning September 1985, to teach introductory through advanced undergraduate mathematics, contribute to an established undergraduate research program, and share responsibility for curriculum development especially in applied mathematics and statistics. Ph.D in math or applied math, demonstrated teaching excellence and promise for continued professional growth essential. Evaluations of applicants will begin April 1. Send cover letter, vita, 3 letters of recommendation and transcripts for consideration. Hendrix College is an equal opportunity employer.

SOUTHWEST TEXAS STATE UNIV., DEPT. OF MATH/CS, SAN MARCOS, TX 78666. One or more non-tenure track instructorships expected for fall 1985. Master's degree in mathematics or computer science and potential for excellence in teaching required. Contact Chairman, Department of Mathematics and Computer Science, Southwest Texas State University, San Marcos, TX 78666. Application deadline: 2/1/85. Late applications considered if openings exist. Southwest Texas State University is an equal opportunity/affirmative action employer.
POSITIONS AVAILABLE

UNIVERSITY OF ARIZONA
DEPARTMENT HEAD SEARCH REOPENED

The Department of Mathematics at the University of Arizona is seeking a permanent Department Head.

The Department of Mathematics offers degree programs in Mathematics, from the B.A. through the Ph.D., supports an Interdisciplinary Ph.D. Program in Applied Mathematics, and provides service courses for a large undergraduate student body. Department members are involved in numerous research projects. In the last two years, faculty members have received a Sloan Fellowship, a Guggenheim Fellowship, an NSF Post-Doctoral Fellowship, a Presidential Young Investigators Award, and over a dozen research grants. Two NSF Postdoctoral Fellows are currently serving their fellowship tenure at Arizona.

The Head will be asked, first of all, to lead the Department as it continues to develop national prominence in a variety of research areas. The Head will also be involved in the implementation of new undergraduate programs and in the coordination of these programs with other Departments.

Inquiries and applications should be sent to: Head Search Committee, Department of Mathematics, University of Arizona, Tucson, AZ 85721.

Applications should contain a curriculum vita and the names of at least three references who can evaluate the candidate’s background in research and administration. Applications should be received before April 1, 1985 to be guaranteed consideration.

The University of Arizona is an Affirmative Action/Equal Opportunity employer.

CHAIRPERSON
DEPARTMENT OF MATHEMATICS
WEST VIRGINIA UNIVERSITY

Applications and nominations are invited for the position of Chairperson of the Department of Mathematics at West Virginia University. The Chair is the chief administrative officer of the department. The search is for a person who has a strong research record, a commitment to excellence in instruction, and the ability to provide scientific and administrative leadership of the 35-member department, which offers B.S. and M.S. degrees.

West Virginia University is the state’s sole comprehensive, land-grant, doctoral institution with an enrollment of 20,000 students. The Department of Mathematics is part of the College of Arts and Sciences.

A complete application consists of a vita and the names and addresses of at least four references. Applications will be received until the position is filled but should arrive by February 1, 1985, to insure consideration.

Applications and nominations should be addressed to Dr. Emory Kemp, Chair, Mathematics Department Chair Search Committee, 201 Woodburn Hall, West Virginia University, Morgantown, West Virginia 26506.

West Virginia University is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF BRIDGEPORT
CHAIRPERSON, DEPARTMENT OF MATHEMATICS

Tenure-track appointment beginning Fall 1985. Candidates must have a Ph.D. in Mathematics/Mathematical Sciences. Applicants should have evidence of leadership ability and excellence in teaching. Research interests in Applied Mathematics/Statistics preferred, but outstanding candidates in any field will be considered. Some expertise in Computer Science is desirable. The Department offers degree programs in Mathematics and Computer Science, and graduate programs are under development. Send resume and names of four references to Dr. Grace Ho, Mathematics Department, University of Bridgeport, Bridgeport, CT 06601. UB is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
RIVERSIDE

Faculty Position in Computer Science

Applications are invited for a tenure-track position in Computer Science beginning with the 1985-86 academic year. Applicants must have a Ph.D. in Computer Science and a demonstrated commitment to teaching and research. Candidates from all areas of specialization in Computer Science will be considered.

Rank and salary are open; candidates for senior rank must have leadership ability and a proven research record. The Computer Science program at Riverside is housed in the well-established Department of Mathematics, which offers bachelor’s, master’s, and doctoral degrees in Mathematics as well as the B.S. and M.S. in Computer Science. The Department owns four VAX 11/750s and various microcomputers. General campus facilities include an IBM 4341-2, a PRIME 750, and two VAXs.

To apply, send résumé with names of three references to:
Professor Theodore J. Barth, Chair
Computer Science Search Committee
Department of Mathematics and Computer Science
University of California
Riverside, CA 92521

The University of California is an Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF CALIFORNIA
RIVERSIDE, CALIFORNIA

Applications are invited for one or more temporary positions beginning in September 1985. These positions are funded at the Assistant Professor level, but there is some slight flexibility in salary. They are open to applicants from all research areas within mathematics and computer science with significant accomplishments or high potential in both research and teaching. Candidates should send vita and arrange for at least three letters of recommendation to be sent to: Professor J. K. Oddson, Chair, Search Committee, Department of Mathematics, University of California, Riverside, California 92521.

The University of California is an Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF MATHEMATICS
AND COMPUTER SCIENCE
CALIFORNIA STATE UNIVERSITY
LOS ANGELES, CALIFORNIA 90032

Assistant or Associate Professor, tenure-track position. Ph.D. in Mathematics or Ph.D. in Computer Science with a background in Mathematics required. Strong computer science background desirable. Starting date: September 1985. Salary: $24200 — $35200 with additional summer employment possibilities. Evaluation of applicants will begin February 1, 1985.

Send inquiries to Wayne Bishop, Chair, at the above address. An Equal Opportunity, Affirmative-Action, Handicapped Title IX Employer.

ST. JOHN'S UNIVERSITY, NEW YORK
STATE ISLAND CAMPUS

The Division of Mathematics and Science invites applications for a tenure-track position at the assistant professor level beginning September 1985. Ph.D. in mathematics or computer science is required; some experience with computers is desirable. Duties include undergraduate teaching in mathematics and computer science; research potential is expected. Send résumé and three letters of recommendation to: Dr. David Patterson, Chairman of the Division of Mathematics and Science, St. John’s University, 300 Howard Ave., New York, N.Y. 10301.

An Equal Opportunity Employer—M/F
Mathematics: Plymouth State College, tenure track, Inst./Asst. Professor position (Sept. 85). Doctorate preferred (doctoral candidate considered) with strong background in statistics or applied mathematics. Responsibilities include teaching 12 hours per semester of undergraduate non-major and major courses, student advising and other college faculty activities. The college is located in a rural, central NH town 125 miles north of Boston. Competitive salary commensurate with background and experience. Deadline: 4/1/85 or extended if necessary. Send vita, graduate transcripts, and three letters of recommendation to: Dr. Wm. J. Roberts, Chm., Search Committee, Dept. of Mathematics, Plymouth State College, Box F, Plymouth, NH 03264.

Tenure-track assistant professorship for Fall 1985. The person should possess a Ph.D. in mathematics or mathematics education, and should have strong promise in research and must have received the Ph.D. after 1 January 1984 (but may be of any age); no restrictions as to field; salary $30,800. Three year appointment; research supplement of $3,400 first summer. Teaching load: Four quarter courses per year, including one advanced course in candidates field. Deadline for applications is January 15, 1985. To apply, write to Yiannis N. Moschovakis, Chair, Los Angeles, CA 90024.

University of Wyoming is an equal opportunity employer.

Department of Mathematics
University of Wyoming

Tenure-track assistant professorship for Fall 1985. The person in this position will direct the freshman mathematics courses, which include over 60% of the department's enrollments and which heavily impact the overall quality of the University's undergraduate educational function. Roughly two-thirds time will be devoted to instruction and the directorship, with the remaining one-third time devoted to research. Applicants should possess a Ph.D. in mathematics or mathematics education, have excellent credentials in teaching throughout the undergraduate program including remedial instruction, should show evidence of being effective in the department's interface with public education in the State, and should have accomplishments or strong potential in research. Applications should include a detailed résumé, three letters of recommendation, and any other supporting information. Inquiries and applications should be addressed to Professor Richard E. Ewing, Chairman, Personnel Committee, Mathematics Department, University of Wyoming, Laramie, Wyoming 82071.

University of Wyoming is an equal opportunity employer.

University of Wyoming, Computer Science/Mathematics. Visiting Professorships available in fall of 85. Persons with partial sabbatical support especially encouraged to apply. Professor Henry Bauer, Computer Science Department, Box 3682, University of Wyoming, Laramie, WY 82071.

University of Wyoming is an equal opportunity employer.

UNIVERSITY OF ILLINOIS

The Department of Mathematics and the Department of Secondary Education at the University of Illinois at Urbana-Champaign are inviting applications for one or two faculty positions that would involve major liaison responsibilities with the secondary schools in Illinois as well as teaching and scholarly activity.

Position Description and Duties: The individual assigned to this full-time faculty position will hold a joint appointment with the Department of Mathematics (3/4-time) and the Department of Secondary Education (1/4-time). The primary duties for the position are:

1) to assume primary responsibility for the development of articulation and assistance programs in mathematics for secondary schools in Illinois;
2) to teach mathematics education courses;
3) to engage in scholarly activity in mathematics education.

Required Qualifications:
1) Earned doctorate in Mathematics or Mathematics Education or the equivalent.
2) Experience in secondary school teacher training program development and/or secondary school curriculum development in mathematics.
3) Current background and scholarly interest in research in mathematics education.

Desirable Qualifications:
1) Teaching experience at the secondary school level and/or experience with university programs for secondary school teachers and students in mathematics.
2) Experience in curricular research and design in mathematics.
3) Experience in dealing with secondary school systems at the statewide level.

This tenure track position will carry the title of Assistant Professor or Associate Professor of Mathematics Education. Salary: Negotiable with a $20,000 minimum.

Starting Date: August 26, 1985 or June 10, 1985.

In order to ensure full consideration applications must be received by March 1, 1985. Interviews may be conducted prior to the closing date for applications.

Contact: Professors Anthony Peressini or Kenneth Travers, Search Committee Co-Chairs, Department of Mathematics, 273 Altgeld Hall, University of Illinois, 1409 W. Green St., Urbana, Illinois 61801 (tel. 217-333-6336). To apply, forward a letter of application and a résumé, along with a list of three individuals who can be contacted for letters of recommendation.

The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF CALIFORNIA, LOS ANGELES

DEPARTMENT OF MATHEMATICS

Three or four E. R. Hedrick Assistant Professors. Applicants must show strong promise in research and must have received the Ph.D. after 1 January 1984 (but may be of any age); no restrictions as to field; salary $30,800. Three year appointment; research supplement of $3,400 first summer. Teaching load: Four quarter courses per year, including one advanced course in candidates field. Deadline for applications is January 15, 1985. To apply, write to Yiannis N. Moschovakis, Chair, Los Angeles, CA 90024.

UCLA is an equal opportunity affirmative action employer.
POSITIONS AVAILABLE

Director
New Master's Program in Computer Science
Boston College

Boston College invites applications and nominations for the position of Director of its new Master's Program in Computer Science.

The job could be very rewarding. The director will have the opportunity to influence the direction of the curriculum, the composition of the faculty, the directions of the research program and even the structure of the director's position itself. The Administration strongly supports our program and has offered considerable financial support. We expect to have the Director in place by September of 1985 and the first students entering the Program in September of 1986.

Boston College is a congenial and exciting place. It is neither in Boston nor is it a college. It is in the Boston suburb of Newton, with its excellent public schools. It is a university with five professional schools and many doctoral programs. With fourteen thousand students, it is among the most selective universities in the country. It had one of the largest applicant pools of a private university in the US last year and applications are up 30% this year. We have four VAX-11/780's and over two hundred Macintoshes, all dedicated to academic use.

Please write to:
Prof. Peter Kugel, Chairman
Computer Science Department
Boston College, Chestnut Hill, MA 02167

An equal opportunity, affirmative action employer.

AUSTIN PEAY STATE UNIVERSITY, DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE, CLARKSVILLE, TENNESSEE 37044. Applications are invited for two tenure-track positions for fall 1985 in computer science and in mathematics. All specialties will be considered. Ph.D. or a substantial training beyond M.S. desired. Teaching primarily at undergraduate level. Send letter of application, résumé, transcripts and three letters of recommendation by April 1 to Dr. William Stokes, Chairman. APSU is an Equal Opportunity, Affirmative Action Employer.

NORTHEASTERN UNIVERSITY
Department of Mathematics
Applications are invited for position of Assistant or Associate Professor and one Post-Doctoral Lectureship. A Ph.D. is required, and priority will be given to candidates with strong records of scholarship and excellence in teaching. Particular needs of the department are in Applied Mathematics and Statistics. All positions start Fall 1985. Please send résumé and three letters of references to: Hiring Committee Chairman, Department of Mathematics, Northeastern University, Boston, MA 02115. Northeastern University is an Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF CALIFORNIA
RIVERSIDE, CALIFORNIA

Applications are invited for a faculty position in Mathematics beginning September 1985. This position is unrestricted as to level of appointment and area of specialization. Candidates must have demonstrated research ability and a commitment to excellence in teaching at the undergraduate and graduate levels. Candidates should send a vita and arrange for at least three letters of recommendation to be sent to: Professor James D. Stafney, Chair, Search Committee, Department of Mathematics, University of California, Riverside, California 92521.

The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA, LOS ANGELES
DEPARTMENT OF MATHEMATICS

Subject to administrative approval, a few assistant professorships, with special attention given to candidates in applied mathematics, algebraic number theory, modular forms, several complex variables and topology. Strong research and teaching background required. Sufficiently outstanding candidates in other fields and/or at higher levels will also be considered. Salary $26,600 for academic year. Teaching load: Five quarter courses per year. Also several positions for visitors and lecturers. To apply, write to: Yannis N. Moschovakis, Chair, Los Angeles, CA 90024.

UCLA is an equal opportunity affirmative action employer.

THE UNIVERSITY OF ALABAMA
DEPARTMENT OF MATHEMATICS

The mathematics department has received funding for a new senior position in applied mathematics. We expect to hire at the rank of associate professor. We also anticipate approval of another, similar, position next year. We invite applications from experienced mathematicians in applied mathematics with excellent records in research and teaching. We are looking for someone who will help us develop our research group and our graduate programs in applied mathematics. Applications or inquiries should be sent to: Martyn Dixon, Chairman, Mathematics Search Committee, P.O. Box 1416, University, AL 35486. THE UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

HOBART AND WILLIAM SMITH COLLEGES
Department of Mathematics and Computer Science
Applications are invited for two tenure-track positions, beginning September 1985.

Position 1: Assistant or Associate Professor; Ph.D. in Mathematics with strong background (preferably a Master’s) in Computer Science required; teach all levels of undergraduate mathematics and computer science and participate in the General Curriculum.

Position 2: Assistant Professor; Ph.D. in Mathematics with some background and strong interest in Computer Science required; teach all levels of undergraduate mathematics and some computer science, and participate in the General Curriculum.

For both positions, candidates should have strong commitment to excellence in teaching and promise of continued scholarly activity. Teaching load two courses per trimester. Salary negotiable and competitive.

Applicants should send detailed résumé, three letters of recommendation (at least one including comments on teaching ability), and undergraduate and graduate transcripts (photocopies) to: Professor Irving Bentsen, Chairman, Department of Mathematics and Computer Science, Hobart and William Smith Colleges, Geneva, New York 14456.

An Equal Opportunity Employer.

UNIVERSITY OF LOWELL, Lowell, Mass. MATHEMATICS

Several tenure-track positions at all levels anticipated for academic year 1985-86. All areas considered but statistics and applied mathematics preferred. Requirements are: Ph.D., strong research credentials, evidence of active interest in quality teaching and U.S. Citizenship or permanent resident status. Rank and salary commensurate with experience. Applicants should send vita, statement of current research activities and three letters of recommendation to: Professor Alan Doerr, Personnel Committee, Department of Mathematics, University of Lowell, Lowell, Mass. 01854. Positions contingent upon funding. The University of Lowell is an equal opportunity/affirmative action, Title IX, 504 employer.
POSITIONS AVAILABLE

UNIVERSITY OF CINCINNATI
Department of Computer Science

Applications are invited for several tenure-track positions in Computer Science beginning September 1, 1985. Candidates should have a Ph.D. in Computer Science or closely related field. Emphasis is on teaching advanced undergraduate courses in the mainstream of computer science and implementing a multidisciplinary graduate program. Joint appointments with other departments are possible. Rank and salary are open. Candidates for a senior endowed position must be capable of leadership in research in theoretical or experimental computer science and curriculum development.

The maximum teaching load is two courses per quarter. Salary is competitive and fringe benefits are excellent.

Résumés should be sent to the Faculty Search Committee for Computer Science, Mall Location 8, University of Cincinnati, Cincinnati, OH 45221. Applications will be considered as received and the positions are open until filled. The University of Cincinnati is an AA/EÖ employer, and encourages applications from women and minority candidates.

MATHEMATICS: Southern Technical Inst. anticipates one or more tenure-track positions beginning Sept. 1985. Ph.D. in Mathematics and a background in technology preferred. M.S. in Mathematics required. Southern Technical Institute offers four-year degree in Engineering Technology and is located in Marietta, Ga., a suburb of Atlanta. Most teaching is in the lower division. Research not required. A complete application consists of an application letter, a complete résumé, three letters of reference, and transcripts of all college work. Applications completed by 21 March 1985 will be considered first. Inquiries and applications should be addressed to Dr. H. R. Andrews, Chrm. Mathematics Search Committee, Southern Technical Institute, Marietta, Ga. 30060.

HARVEY MUDD COLLEGE; DISCRETE MATHEMATICS/COMPUTER SCIENCE: A tenure-track position in the mathematics department is available at the Assistant Professor level. Qualifications include a Ph.D. in mathematics or computer science with a strong emphasis in discrete mathematics and the theoretical aspects of computer science. Responsibilities include teaching, research, curriculum development, and the supervision of industrially-sponsored projects in these areas. Harvey Mudd College, one of the nation's most selective undergraduate colleges, offers degrees in mathematics, engineering, chemistry, and physics. The person appointed to this position will work with mathematicians and computer scientists on the faculty in the further development of the existing mathematics major option in computer science. The five Claremont Colleges and the Claremont Graduate School [with about forty mathematicians and computer scientists in all] and the site in Southern California provide an attractive professional setting. Reply to: Professor Courtney S. Coleman, Mathematics Department, Harvey Mudd College, Claremont, CA 91711, 714-621-8023. An equal opportunity/affirmative action employer.

SAINT LOUIS UNIVERSITY
Department of Mathematics and Computer Science
St. Louis, MO 63103

Two tenure-track positions are available at the Assistant Professor level to begin fall 1985. The department offers undergraduate majors in Mathematics and Computer Science and a doctorate in Mathematics. Persons holding a Ph.D. in Mathematics or Computer Science who are committed to teaching and research and are willing to participate in the undergraduate Computer Science program are invited to apply. Send a vita and arrange for three letters of recommendation to be sent to Professor Charles Ford at the above address. An equal opportunity, affirmative action employer.

Department of Mathematics
University of Bristol

Applications are invited for two lectureships, i.e. tenure-track positions, anticipated in nonlinear mathematics or fluid dynamics and mathematical logic or the theory of computation. Applicants should have a good research record and be likely to interact with present members of the Department. Other things being equal, preference will be given to young candidates with rights to work in the United Kingdom. The salary scale is 7,520–14,952 pounds p.a. (to be reviewed) and initial salary will be determined according to qualifications, experience and age. The posts are tenable from October 1985. The selection process may begin at once.

In the first instance, please obtain further particulars from Head, Department of Mathematics, University Walk, Bristol BS8 1TW, England.

UNIVERSITY OF HONG KONG
Lectureship in MATHEMATICS

Applications are invited for a Lectureship in the Department of Mathematics, tenable from September 1985. Applicants specialising in any main branch of mathematics will be considered.

Annual salary (superannuable) is on an 11-point scale: HK$118,080–247,560 (US$1 = HK$7.80 on 3.1.85). Starting salary will depend on qualifications and experience and current rates, salaries tax will not exceed 17% of gross income. Housing benefits at a rental of 7½% of salary, children's education allowances, leave and medical benefits are provided.

Further particulars and applications forms may be obtained from the Secretary General, Association of Commonwealth Universities (Appts), 36 Gordon Square, London WC1H 0PF, or from the Appointments Unit, Secretary's office, University of Hong Kong, Hong Kong. Closing date: 15 April 1985.


CARNEGIE-MELLON UNIVERSITY
Department of Mathematics
Discrete Mathematics Position

The Department of Mathematics at Carnegie-Mellon University has a faculty opening in Discrete Mathematics. Applicants are expected to show exceptional research promise as well as clear evidence of achievement in the fields of Category Theory, Universal Algebra, Fix Point and Algebraic Semantics of Programming Languages, Partial Algebra, Ordered Structures, Category Theoretical version of Abstract Model Theory and Nonstandard Dynamic Logic. The applicant should be able to teach Logic, Logics of Programs and Universal Algebra. Salary will be based on the qualifications of the candidate. Interested candidates should send a résumé, a copy of their transcript, and three reference letters to Professor George J. Fix, Head, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA 15213. To ensure consideration, the above materials must be received on or before 1 April 1985. Carnegie-Mellon University is an Affirmative Action/Equal Opportunity Employer.

BROWN UNIVERSITY

Professors at the Associate level or above, with tenure, beginning July 1, 1986. Salary to be negotiated. Applicants should have outstanding records of research and strong commitment to teaching. Curriculum vitae and 3 letters of recommendation should be received by October 15, 1985. Equal Opportunity/Affirmative Action Employer. Address inquiries to John Werner, Providence, RI 02912, Executive Officer.
POSITIONS AVAILABLE

Skidmore College
Department of Mathematics and Computer Science
Saratoga Springs, NY 12866-0851

Associate/Assistant Professor of Computer Science to develop curriculum to enhance computer science minor. Candidates should be able to develop and teach data structures, database management, graphics and systems design courses. Applicants should possess a Ph.D. in computer science or related discipline.

Assistant Professor of Mathematics to teach undergraduate mathematics courses and introductory computer science courses. Candidates should have a Ph.D. in mathematics with some background in computing.

Skidmore College operates two DEC VAX 11/750's with 40 micro computers to support academic computing. Please send a letter of application, résumé and at least three references by March 21 to Robert P. DeSieno, Chair, Department of Mathematics and Computer Science, Skidmore College, Saratoga Springs, NY 12866-0851. An affirmative Action/Equal Opportunity Employer.

DEPARTMENT OF MATHEMATICS
KANSAS STATE UNIVERSITY

Applications are invited for several anticipated temporary (9-month) positions at the Assistant Professor level, or above, beginning August, 1985. Salary commensurate with qualifications. Candidates in all fields of mathematics are encouraged to apply. Strong interest in both teaching and research is expected. Ph.D. in mathematics or equivalent required.

Starting date: August 15, 1985; Application deadline: April 1, 1985. Contact: R. Richard Summerhill, Department Head, Department of Mathematics, Kansas State University, Manhattan, Kansas 66506. (913)532-6750. KSU is an AA/EOE.

The Department of Mathematics at Brock University seeks a sabbatical replacement, at the Assistant Professor level, for the period September 1, 1985 to June 30, 1986. Candidates should have a Ph.D., and will be expected to teach two undergraduate courses in the area of real and complex analysis and differential equations, and to conduct research. Candidates should send a curriculum vitae and arrange for three letters of reference to be sent to the Chairman, Department of Mathematics, Brock University, St. Catharines, Ontario, L2S 3A1, Canada. In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. Applications should be submitted no later than April 15, 1985.

INSTITUTE FOR DEFENSE ANALYSES
COMMUNICATIONS RESEARCH DIVISION

Applications are invited for Ph.D. level mathematicians for research positions on our technical staff. Initial appointment would be for one or two years, possibly leading to a permanent position.

Additionally, we also organize each year a summer program (SCAMP) for which places are available. Wide mathematical interests, and the ability to motivate one's own work are more important than knowledge of specific areas of mathematics. Facility in computer programming and some knowledge of statistics would be definite assets.

Salaries will be competitive and commensurate with experience and qualifications. IDA/CRD is an equal opportunity/affirmative action employer, and encourages applications from women and members of minority groups. Send résumé and publication list to:

Dr. N. J. Patterson
Deputy Director
IDA/CRD
Thanet Road
Princeton, NJ 08540

U.S. citizenship required.

Applications are invited for a senior-level mathematician. The anticipated position is tenure-track and will be available in Fall, 1985. The successful candidate will be one with a distinguished research record who has had significant impact on the development of mathematics in recent years. The department's greatest strengths currently are in the fields of number theory, classical analysis and approximation theory, algebra, and probability and statistics. Temple University is conveniently located in urban Philadelphia, with easy access to the mathematical communities in New York, Princeton, Maryland and Washington, D.C., as well as Philadelphia. Salary will be commensurate with qualifications.

Applications, including a résumé and at least three letters of recommendation, should be sent to:

Professor L. Raymon, Chairman
Department of Mathematics
Temple University
Philadelphia, Pa. 19122

To be insured of consideration, applications should be received by March 15, 1985.

Temple University is an Affirmative Action/Equal Opportunity Employer.

MOORHEAD STATE UNIVERSITY
Moorhead, Minnesota

The Mathematics Department invites applications for a tenure-track position at the Assistant Professor level. The position involves teaching undergraduate mathematics courses, advising students, and university and departmental committee work. The teaching load is 12 hours per quarter. A Ph.D. in mathematics education is required. Some background in statistics, applied mathematics or mathematics education and evidence of successful college teaching experience are desirable. Application materials and a job description can be obtained from Dr. Milton Legg, Chairman, Mathematics Department, Moorhead, State University, Moorhead, Minnesota 56560. An equal opportunity/affirmative action employer.

ASSISTANT PROFESSOR OF MATHEMATICS
ST. MARY'S COLLEGE OF MARYLAND

Applications are invited for a permanent position in mathematics. We are looking for a person with a Ph.D. in mathematics who is interested in undergraduate teaching and able to contribute to the continuing development of a strong mathematics major program.

St. Mary's College is a public liberal arts college with 1300 students, 68 miles south of Washington, D.C. in the Chesapeake region. The mathematics program has five faculty members and approximately 50 majors. Normal teaching load is 12 credit hours (three courses) per semester.

Please submit your application including a résumé and three letters of reference by March 22, 1985 to Richard Stark, Chairman, Mathematics Search Committee, St. Mary's College of Maryland, St. Mary's City, Maryland 20686. EEO/AA Employer.

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

Department of Mathematics, Greensboro, North Carolina 27412. Senior faculty member with initial appointment as Department Head. The Department is responsible for offering general undergraduate instruction in mathematics, computer science, and statistics, and offers the M.A. and M.Ed. in mathematics. Candidates should have an outstanding research record and a commitment to excellence in teaching. The appointment will be at the rank of Professor with tenure. The Head administers the Department, made up of 25 faculty members and over 200 majors, and is responsible for providing leadership in the areas of teaching, research, and service. Salary will be commensurate with experience and qualifications. Applicants should send credentials and three letters of recommendation to Karl Ray Gentry, Chair, D. H. Search Committee. UNC-G is an Equal Opportunity/Affirmative Action Employer.
The Department of Mathematics and Statistics invites applications for a tenure-track position at the assistant professor level in discrete mathematics effective September 1, 1985. A Ph.D. or equivalent is required. Experience in teaching would be an asset. Duties include pursuing research in the appointee's area of expertise, and teaching three courses at the undergraduate level. Salary is commensurate with rank and experience. A curriculum vitae should be forwarded to Dr. L. M. Batten, Chair, Department of Mathematics and Statistics, University of Winnipeg, 515 Portage Avenue, Winnipeg, Manitoba, Canada R3B 2E9. In addition, three referees should be requested to forward letters directly to the above address. Closing date for applications is March 15, 1985. The position is subject to budgetary constraints. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents.

**COMPUTER SCIENCE**

Tenure-track faculty position beginning Fall, 1985. Responsibilities — undergraduate teaching (12 semester hours per semester) in a program leading to a B.A. or a B.S. in Computer Science. Required: M.S. in Computer Science. Rank and salary dependent on qualifications and experience. Send résumé, three letters of reference and graduate transcripts prior to March 15, 1985, to Director of Personnel, St. Ambrose College, 518 West Locust Street, Davenport, Iowa 52803.

**EQUAL EMPLOYMENT OPPORTUNITY**

Send a tear sheet and billing to:

Director of Personnel
St. Ambrose College
518 West Locust Street
Davenport, Iowa 52803.

**UNIVERSITY OF WATERLOO**

Applications are invited for a tenure-track position at the Assistant or Associate Professor level in the Department of Applied Mathematics, for a term beginning September 1, 1985. The successful candidate must have demonstrated research ability and should have a broad mathematical background. Preference will be given to applicants whose research interests are in the general area of partial differential equations, including both theoretical and applied aspects. However, outstanding applicants in other areas will also be considered. Résumé and three letters of recommendation should be sent to B. Forte, Chairman, Department of Applied Mathematics, University of Waterloo, Waterloo, Ontario, N2L 3G1. Deadline for applications: April 30, 1985 or until position is filled.

**RUTGERS, The State University Camden, New Jersey — Anticipated position at the Assistant or Associate Professor level. Candidates must have a Ph.D. in mathematics and a strong commitment to research and teaching. All fields considered. Send a résumé and three letters of recommendation (and for new Ph.D.s, a summary of the thesis and a statement of research plans) to: Howard Jacobowitz, Department of Mathematical Sciences, Rutgers University, Camden, New Jersey 08102.

**VISITING LECTURER POSITION**

Pending final budgetary approval, Visiting Lecturer with annual contract renewable for three years, to teach large beginning statistics courses and train graduate student teaching assistants. We are looking for an outstanding individual, with a demonstrated commitment to intellectual quality in teaching. Experience required. Salary negotiable in the range $27,568 to $33,000, depending on qualifications. There is some possibility of conversion to a permanent position. Inquiries to Rudy Beran, Chairman, Personnel, Department of Statistics, University of California 94720, by May 15, 1985. The University of California is an Equal Opportunity, Affirmative Action Employer.
POSITIONS AVAILABLE

DEAN
FACULTY OF NATURAL SCIENCES
AND MATHEMATICS
STATE UNIVERSITY OF NEW YORK AT BUFFALO

SUNY/Buffalo, the largest most comprehensive unit of the State University system, seeks a Dean for its Faculty of Natural Sciences and Mathematics. The Faculty comprises 269 full-time persons in the departments of Biological Sciences, Chemistry, Computer Science, Geological Sciences, Mathematics, and Statistics which offer degree programs from baccalaureate through doctoral levels. The Dean will be expected to provide effective academic leadership, stimulate the strengthening and development of research, teaching, and service activities, and be responsible for effective management of personnel and budget resources. Candidates should have demonstrated a commitment to scholarly excellence and qualify for a tenure full professor appointment in one of the above disciplines. Women and minority candidates are encouraged to apply.

Forward nominations and applications by March 15, 1985 to: Dr. Donald W. Ronne, Search Committee Chair, SUNY/Buffalo, 521 Capen Hall, Buffalo, New York 14260.

SUNY/Buffalo is an Equal Opportunity/Affirmative Action Employer.

BELOIT COLLEGE
Department of Mathematics and Computer Science.

Applications are invited for a tenure-track position at the assistant professor level, beginning fall 1985. We seek a Ph.D. in mathematics or computer science with a strong interest in undergraduate teaching in a liberal arts environment. Preference to candidates who can teach some computer science courses as well as mathematics. Send letter and résumé to Philip Straffin, Chair, Mathematics and Computer Science, Beloit College, Beloit, Wis. 53511 by March 31. Arrange to have three letters of reference and appropriate transcripts forwarded. Beloit College is an Equal Opportunity, Affirmative Action Employer.

POSITIONS IN COMPUTER SCIENCE
DEPAUL UNIVERSITY
CHICAGO, ILLINOIS

DePaul University invites applications for tenure-track positions in Computer Science at all levels. The starting date is September 1985. Any area of specialization will be considered. An applicant should hold a Ph.D. in Computer Science or be a candidate for such a degree; consideration will also be given to holders of Ph.D. degrees in Mathematics or related fields who express an interest in Computer Science. Duties include a six-hour teaching load and research. Tenure details and salary are negotiable. Benefits include the standard health insurance. U.S. citizenship is not required.

The Department of Computer Science and Information Systems at DePaul has over 1200 majors which are nearly equally divided between undergraduate and graduate students. Facilities include two VAX 11/780s, a VAX 11/750, an IBM 4341, a PDP 11/60, a PDP 11/44, a PDP 11/23, a Harris 800, ten LSI-11's and numerous microcomputers. Individual faculty offices are equipped with high speed terminals. The Department is in the process of equipping an Artificial Intelligence Laboratory, a Robotics Laboratory and has a Vision Laboratory. There are also two PC laboratories. Faculty interests include artificial intelligence, computer vision, applied statistics, applied graph theory, information systems, compiler design, semantics of programming languages, and computer architecture. Applications will be received until positions are filled. Send résumé and at least three letters of reference to: Helmut P. Epp, Chairman, Department of Computer Science and Information Systems, DePaul University, 243 S. Wabash, Chicago, IL 60604.

DePaul University is an equal opportunity employer.

Department of Mathematics
John Jay College of Criminal Justice
The City University of New York

Assistant Professor, tenure-track position, 9/1/85. Requirements: Ph.D.; demonstrated potential for research; strong commitment to teaching. Computer science, numerical analysis or operations research background preferred. John Jay College of Criminal Justice, located in Manhattan, is a senior college in CUNY. Send résumé, graduate transcript, relevant reprints, dissertation abstract and three letters of reference to Samuel Graff, Chairperson, Department of Mathematics, John Jay College of Criminal Justice, 445 West 59th Street, N.Y., N.Y. 10019 by May 1, 1985. AA/EOE Employer.

UNIVERSITY OF CALIFORNIA, IRIVINE
DEPARTMENT OF MATHEMATICS
IRVINE, CALIFORNIA 92717

Two faculty positions at the level of Assistant Professor in Applied Mathematics, available beginning academic year 1985–86. A Ph.D. degree, publications, and evidence of active interest in quality teaching are required. Examples of preferred research areas: partial differential equations, non-linear phenomena, applied functional analysis, and numerical analysis. Send applications, a curriculum vitae, and the names of three or more references to Professor Martin Schechter, Department of Mathematics, University of California, Irvine, CA 92717. An Affirmative Action/Equal Opportunity Employer.

ILLINOIS WESLEYAN UNIVERSITY
Chair of Mathematics

I I L L I N O I S  W E S L E Y A N  U N I V E R S I T Y

I l l i n o i s  W e s l e y a n  U n i v e r s i t y  s e e k s  a  D e p a r t m e n t  H e a d  i n  M a t h e m a t i c s .  T h e  d e p a r t m e n t  i s  c o m p o s e d  o f  f o u r  f u l l - t i m e  p e r s o n n e l  a n d  f o r m s  B A ' s  b o t h  i n  M a t h e m a t i c s  a n d  M a t h e m a t i c s - C o m p u t e r  S c i e n c e .  T h e  d e p a r t m e n t  c u r r e n t l y  h a s  4 2  m a j o r s  a n d  d e l i v e r s  6 0 0  c o u r s e  u n i t s  p e r  y e a r ,  t h e  m a j o r i t y  t o  s t u d e n t s  i n  t h e  n a t u r a l  s c i e n c e s  a n d  i n  b u s i n e s s ;  t h u s , t h e  d e p a r t m e n t  s e e k s  t o  o f f e r  s t o r m a g o r s  f o r  i t s  m a j o r s  a s  w e l l  a s  s e r v e  t h e  b r o a d e r  i n t e r e s t s  o f  t h e  U n i v e r s i t y .  C a n d i d a t e s  m u s t  h a v e  t h e  P h . D .  i n  M a t h e m a t i c s ,  a n d  p r o v e n  r e c o r d  o f  t e a c h i n g  a n d  r e s e a r c h .  P r e f e r r e n c e  s h a l l  b e  g i v e n  t o  c a n d i d a t e s  w i t h  s t r o n g  c r e d e n t i a l s  i n  a n a l y s i s  o r  s o m e  a r e a  o f  a p p l i e d  m a t h e m a t i c s .  R a n k  a n d  s a l a r y  a r e  n e g o t i a b l e .  I n t e r e s t e d  c a n d i d a t e s  s h a l l  s e n d  a  c u r r i c u l u m  v i t a e  a l o n g  w i t h  n a m e s  a n d  a d d r e s s e s  o f  t h r e e  r e f e r e n c e s  t o :  R o g e r  S c h n a i t t e r ,  D i r e c t o r ,  D i v i s i o n  o f  N a t u r a l  S c i e n c e ,  I l l i n o i s  W e s l e y a n  U n i v e r s i t y ,  B l o o m i n g t o n ,  I L  6 1 7 0 1 .  I W U  i s  a  n e q u a l  o p p o r t u n i t y  e m p l o y e r .

The College at New Paltz
State University of New York

The Department of Mathematics and Computer Science invites applications for tenure track positions in Computer Science for the term beginning September, 1985. Salary and rank determined by qualifications. The Department seeks applicants who can make an immediate and substantial contribution to undergraduate and Master's programs in Computer Science, especially applicants with expertise in Computer Architecture or Computer Networks. A Ph.D. in Computer Science, or a Ph.D. in a related field and Master's or equivalent in Computer Science. Evidence of excellence in teaching and scholarly achievement. The school is located in the scenic Hudson Valley-Catskill Mountains region, 75 miles north of NYC, with easy access to several major IBM facilities in the area. Send a letter explaining professional qualifications, a résumé, and the names, addresses, and telephone numbers of three professional referees to: Lawrence Fialkow, Chair, Computer Science Search Committee Box 10

The College at New Paltz, State University of New York
New Paltz, New York 12561

Review of applications will begin January 10, 1985. An AA/EOE. Women and minorities are urged to apply.
POSITIONS AVAILABLE

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF CALIFORNIA
RIVERSIDE, CALIFORNIA

Applications are invited for a tenure-track assistant professorship beginning September 1985. This position is open to applicants in all areas of specialization. Candidates must have demonstrated research ability and a commitment to excellence in teaching at the undergraduate and graduate levels. Candidates should send a vita and arrange for at least three letters of recommendation to be sent to: Professor James D. Stafney, Chair, Search Committee, Department of Mathematics, University of California, Riverside, California 92521. The University of California is an Equal Opportunity/Affirmative Action Employer.

Teaching/Research, Ph.D. 1969. Analysis/D.E. over twenty years' teaching. Several publications. c/o March classified, AMS, P.O. Box 6248, Providence, RI 02940.

MYRIAS RESEARCH CORPORATION is looking for numerical analysts, and theoretical/mathematical physicists with experience in physical modelling applications on the world's fastest computers. Successful candidates will join the Applications Research Group in the development and analysis of parallel algorithms for use on the Myrias 4000 Parallel Computer System. The Myrias 4000 is a modularly expandable parallel computer which implements a high level language solution to the multiprocessing problem. The Myrias 4000 provides the programmer with a powerful new tool: Recursive Parallel Methods, and supports a wide range of arithmetic: 8-, 16-, and 32-bit fixed point, and 32-, 64-, and 128-bit floating point. A Myrias 4000 will be available in our laboratory for algorithm development.

Please send a resume and the names of three references to: Dr. Martin Walker, Head of Applications Research, Myrias Research Corporation, #200 - 10328 - 81st Ave., Edmonton AB T6E 1X2 Canada.

In accordance with Canadian immigration requirements, this advertisement is directed, in the first instance, at Canadian citizens and permanent residents.

ANNOUNCEMENT

THE MONROE MARTIN PRIZE IN APPLIED MATHEMATICS

THE INSTITUTE FOR PHYSICAL SCIENCE AND TECHNOLOGY at the UNIVERSITY OF MARYLAND, College Park, is pleased to announce the third MONROE MARTIN PRIZE for an OUTSTANDING PAPER OR CONTRIBUTION IN APPLIED MATHEMATICS by a young research worker. The recipient will be asked to present his or her work at the Monroe Martin Lecture at the University of Maryland in December, 1985 when the recipient will be awarded a prize of $500, plus travel expenses. Candidates must be residents of North America and not more than 35 years of age at the filing deadline. Submitted papers must be by a single author and have been published, or accepted for publication, in the open literature subsequent to January 31, 1980. The work must not have been performed in connection with the completion of requirements for an academic degree. Candidates should submit their papers, printed or typed in English, with a covering letter before August 31, 1985 to:

Director
Institute for Physical Science and Technology
University of Maryland
College Park, Maryland 20742.

Other interested persons are encouraged to recommend possible candidates for this award. Announcement of the award and scheduling of the Monroe Martin Lecture will take place by November 1, 1985.

FOR SALE

ISTITUTO NAZIONALE DI ALTA MATEMATICA
FRANCESCO SEVERI
ROME — ITALY

Recent publications:

Free boundary problems

Proceedings of a seminar held in Pavia — September—October 1979, by:

Two volumes for 523 + 606 pages, $70.00.

Monge-Ampère equations and related topics

Proceedings of a seminar held in Firenze — September—October 1980, by:

One volume, 248 pages, $25.00.

Topics in modern harmonic analysis

Proceedings of a seminar held in Torino and Milano — May—June 1982, by:

Two volumes for 541 + 536 pages, $80.00.

Orders must be prepaid and should be addressed to:
Istituto Nazionale di Alta Matematica Francesco Severi
P. le Aldo Moro 5
Città Universitaria
00185 ROMA, Italia.

ASSISTANT PROFESSOR
TENURE-TRACK

The Department of Mathematics and Computer Science at Millersville University, Millersville, PA, is seeking a well-qualified person in mathematics to fill an Assistant Professor tenure-track position beginning Fall, 1985.

Candidates must hold a Ph.D. in mathematics and be qualified to teach most of the traditional undergraduate mathematics curriculum. Preference will be given to applicants with a strong background in probability and statistics. TEACHING EXCELLENCE IS A PRIMARY CONSIDERATION. Salary will be determined by professional qualifications. Fringe benefits are among the highest in the country.

The department consists of 25 full-time faculty members. Degrees offered: B.A. in Mathematics, B.S. in Mathematics, B.S. and M.Ed. in Math Education, and B.S. in Computer Science. The University Computer Services currently support DEC VAX and IBM 4361 computers and 50 DEC Rainbow micro systems. Standard packages such as SAS, BMD and SPSS are available. Microcomputer/terminal stations are available in faculty offices. Excellent undergraduate libraries exist at departmental and university level.

Millersville is the oldest of the 14 universities in the Pennsylvania System of Higher Education serving approximately 5,000 students. The campus is located in a suburb of Lancaster, a progressive, historical city. Located less than three hours from N.Y.C., Washington, D.C., and Philadelphia, it offers a safe, pleasant life-style and clean climate with easy access to the Jersey shore, Pocono resorts and Chesapeake Bay.

Interested applicants should submit resume of education and experience, transcripts, and three letters of reference to: Professor Edmund Pribitkin, Chairman, Staff Development Committee, Department of Mathematics and Computer Science, MILLERSVILLE UNIVERSITY, Millersville, PA 17551. Applications will be considered beginning February 1, 1985, and will continue until position is filled.

Millersville earnestly seeks and is eager to receive applications from women and minority candidates. Affirmative Action/Equal Opportunity Employer.

\[
\prod_{j \geq 0} \left( \sum_{k \geq 0} a_{jk} x^k \right) = \sum_{n \geq 0} z^n \left( \sum_{k_0, k_1, \ldots \geq 0 \atop k_0 + k_1 + \ldots = n} a_{0k_0} a_{1k_1} \cdots \right).
\]

Device independence and perfection in mathematical composition ... 

\TeX

is now available on mainframes, minis, workstations like SUN, Apollo, CDS 3000, IBM PC, and will soon be available on the Macintosh. Screen Preview facilities. Print pages on QMS Lasergrafix, Imagen, Xerox 9700, and other printers. \TeX to PostScript support. Typesetting on an Autologic APS-5.

Contact: TEXTSET, Inc.
416 Fourth Street, P.O. Box 7993
Ann Arbor, Michigan 48107
(313) 996-3566
Get the Most out of \TeX on your IBM-PC XT or AT

\TeX, the computer typesetting program destined to become the standard for typesetting mathematics and other technical text, is now available on your IBM-PC XT or AT. In order to exploit \TeX fully, you will want to use the powerful macro packages, like \texttt{AMSTeX} and \texttt{LATeX}, that put complicated \TeX constructions at your finger tips. The \texttt{AMSTeX} macro package has been designed to deal with all the intricacies of mathematical typesetting, easily producing such things as

\[
\sum_{l \text{ odd}} \binom{n}{l} = 2^{n-1} \quad \int_{M} \int_{\partial M} d\omega = \int_{\partial M} \omega \quad \begin{pmatrix}
\begin{array}{cccc}
a_{11} & a_{12} & \cdots & a_{1n} \\
a_{21} & a_{22} & \cdots & a_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
a_{m1} & a_{m2} & \cdots & a_{mn}
\end{array}
\end{pmatrix}
\]

and

\[
H^{p,q} \quad \begin{array}{c}
E_{2}^{p,0} \otimes E_{2}^{0,q} \\
\downarrow f \\
\downarrow f_{3}
\end{array} \quad \xrightarrow{\alpha} \quad \begin{array}{c}
E_{2}^{p,q} \\
\downarrow f_{3}
\end{array}
\]

\texttt{LATeX}, incorporating many of the features of the document preparation program \texttt{SCRIBE}, is especially useful for longer documents, where it will automatically label Chapters, sections, theorems, etc.

\texttt{AMSTeX} and \texttt{LATeX} working together—

Now you can have all the features of \texttt{AMSTeX} and \texttt{LATeX} at the same time. Michael Spivak, the creator of \texttt{AMSTeX}, has combined the two macro packages into a consistent whole, extending the capabilities of each.

If you are using \TeX with the \texttt{AMSTeX} and \texttt{LATeX} macro packages, you will want this powerful extension. \$49.95 for an IBM PC disk, including UPS shipment. The introductory \texttt{PCTeX} manual is included, together with instructions for using the combined macro package.

Courses on \texttt{AMSTeX}, \texttt{LATeX} and macro writing—

Dr. Spivak has prepared a special 2-day course on \texttt{AMSTeX}, to be given at sites that can provide classroom facilities and audio-visual support. This course will be especially valuable to mathematicians, technical secretaries, and others who want to use \TeX for copy with large amounts of mathematics. A course on \texttt{LATeX} and an advanced course on macro writing are also planned. For details, please call: (713) 523-5700.

\texttt{TeXperts}, 1001 Jefferson Plaza, Suite 112, Wilmington, DE 19801.

\TeX is a trademark of the American Mathematical Society, IBM is a registered trademark of International Business Machines, Inc., \texttt{PC TeX} is a trademark of Personal \TeX, Inc.
PC \TeX™
A Complete Implementation of \TeX
For the IBM PC/XT and AT

Now available for your microcomputer: a real typesetting system, capable of producing journal quality output! Your IBM PC/XT or AT can now run \TeX, the state-of-the-art typesetting program developed by PROF. DONALD E. KNUTH at Stanford University. \TeX reads standard ASCII files and produces files that can be used to obtain printed output on a wide variety of devices—from dot matrix printers to laser printers to phototypesetters.

\TeX is being supported as a standard language for mathematical typesetting by the American Mathematical Society, which has produced the \texttt{AMS-\TeX} macro package. \texttt{AMS-\TeX} greatly simplifies the setting of complex mathematical formulas and also allows the same computer file to be printed in the style of different journals. You can produce preprints of a paper on your own printer, while a journal can use the same file to print the version that will be published.

PC \TeX is a complete \TeX—with input and output files compatible with all implementations of \TeX. PC \TeX was developed by Lance Carnes, the first to implement \TeX on a small computer (Hewlett-Packard 3000) and the editor for the “small” \TeX department of the \TeX Users Group Newsletter.

Minimum system requirements: IBM PC/XT or AT or work-alike with a 10M hard disk and 360K floppy. 512K memory to run \TeX, 640K to run \texttt{IATEX}.

- Price $279.00. PC-DOT, the program to produce printed output on the IBM graphics printer, or on the Epson RX, MX, FX series, is priced separately at $100.00. Prof. Knuth’s \TeX manual, \textit{The \TeXbook}, is also available, for $15.00.

- California residents, please add sales tax.

- For each PC \TeX or PC \TeX, PC-DOT purchase, add $3.00 for shipping (UPS). Or add $8.00 for UPS 2nd Day Air.

- Quantity discounts available. Also available: memory boards, previewer for use with high-resolution screens, drivers for Imagen and QMS laser printers.

Personal \TeX, Inc. 20 Sunnyside, Suite H, Mill Valley, CA 94941 (415) 388-8853

\TeX is a trademark of the American Mathematical Society, PC \TeX is a trademark of Personal \TeX, Inc., IBM is a registered trademark of International Business Machines, Inc., Epson is a registered trademark of Epson, Inc., Imagen is a trademark of Imagen, Inc., and QMS is a trademark of QMS, Inc.
MATHEMATICAL SCIENCES RESEARCH INSTITUTE
BERKELEY, CALIFORNIA

SPECIAL ANNOUNCEMENT

MIDCAREER SABBATICAL SUPPLEMENTS

During the 1986-87 year, which begins in August 1986, the Institute will have available a number of membership awards specifically intended for mathematicians on sabbatical leave. Applicants must be six years or more beyond the doctorate; awards can be for a period covering the whole year, a semester, or a quarter, and can range in dollar amount up to half the applicant’s salary for the period in question. The number of such awards is expected to be between 6 and 10.

Applicants from all fields will be considered. Whether or not the applicant will have any connection with the area of the main program for 1986-87 (Number Theory with Connections in Algebraic Geometry) will not be an issue in the judging of the applications.

The deadline is October 1, 1985. Please make sure that your file is complete by that date; awards will be announced in early November so as to give applicants ample time to make their plans.

To apply, send an informal letter of application and submit a plan for research or study. Include an up-to-date curriculum vita and bibliography. Letters of recommendation are encouraged but not required; they should be solicited by the applicant and should be on hand by the same deadline (October 1).

The usual deadline for applications for 1986-87 from all mathematicians (but especially postdoctoral ones) remains January 1, 1986, and this will be formally announced soon. Unsuccessful candidates from the October competition will automatically be considered for awards during the January competition, although most of the January awards will be postdoctoral fellowships for mathematicians of Ph.D. age five years or less.

Criteria to be used in evaluating the midcareer applications will include the appropriateness of the plan for research or study, the financial requirements, and other relevant factors.

If you have questions, you are invited to ask for more information. Write to Irving Kaplansky, Director, Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, California 94720.

The Institute is committed to the principles of Equal Opportunity and Affirmative Action
TURN YOUR IBM PC® INTO AN EXPERIENCED TECHNICAL TYPIST WITH SUPERSCRIPT™

\[ F(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}y^2} dy \]

SuperScript software lets you type any mathematical expression—at any size—and insert it anywhere in your text.

Create your own special characters and symbols using SuperScript. You see on your screen exactly what will be printed—displayed in large, easily read characters.

Works on a standard IBM PC with graphics adapter, standard dot matrix printer and your existing word processing software. SuperScript requires no added hardware or boards.

Power. Flexibility. Affordability. Check out SuperScript. It doesn’t just make technical typing possible. It makes it fast and easy.

Write or call Technical Support Software, Inc., PO. Box 289, Chestnut Hill, MA 02167, 617-734-4130

EMPHASIS YEAR 1985–86
Department of Mathematics, Statistics and Computer Science
The University of Illinois at Chicago

COMPUTERS IN MATHEMATICAL RESEARCH

Faculty and visitors will offer seminars and courses on topics including:

- Automated Reasoning.
- Algorithms of Nonlinear Optimization.
- Computation in Algebraic Geometry.
- Computation in Group Cohomology.
- Computational Number Theory.
- Computation in Topology.
- Symbolic Algebra for Group Theory and Combinatorics.

Anticipated conferences include:

- Computers in Algebra (November 1985)
- Computers in Topology (January 1986)
- Computers in Geometry (March 1986)

Funds for additional visitors and students may be available. For further information, contact S. Smith, R. Larson, P. Wagreich, or M. Tangora. Department of Mathematics, Statistics and Computer Science, The University of Illinois at Chicago, Box 4348, Chicago, Illinois 60680. Telephone (312) 996-8616 or 996-3041. BITNET: UO9254 at UICVM (ARPA gate via WISVM. BITNET).

UNIVERSITY OF CAPE TOWN
Associate Professor of Mathematics

Applications are invited for an Associate Professorship in Mathematics, presently vacant. Candidates should be well qualified in at least one branch of mathematics, but particular fields are not specified. Salary range: R28 893–R35 377 per annum, with an annual bonus of nearly one month’s salary and attractive staff benefits.

Applicants should submit a full resume and the names and addresses of three referees not later than 31 March 1985 to the Registrar (Attention: Appointments Office), Department EK/511 University of Cape Town, Private Bag, Rondebosch, 7700, South Africa, from whom further information should be obtained. Late applications will be accepted. UCT is an equal opportunity employer.
NEW FROM *Publish or Perish, Inc.*

Mathematics Lecture Series, 11
Invariance Theory, The Heat Equation, And the Atiyah-Singer Index Theorem
Prof. Peter B. Gilkey, University of Oregon

This new book by Prof. Gilkey gives a complete treatment of the Atiyah-Singer index theorem by heat equation methods, with invariance theory used to identify the integrand of the index theorem for the four classical elliptic complexes with the invariants of the heat equation.

Chapter 1 reviews results from analysis, including standard elliptic material, together with material necessary to discuss Lefschetz fixed point formulas and other topics.

Chapter 2 reviews characteristic classes from the point of view of differential forms, gives an invariant-theoretic characterization of the Euler form, and discusses the Pontrjagin forms of the tangent bundle and the Chern forms of the coefficient bundle using invariance theory.

In Chapter 3 a heat equation proof of the Hirzebruch signature theorem is followed by a discussion of the half-spin representations, the spin complex and a formula for the A genus, the Riemann-Roch formula using the SPINc complex and finally the Atiyah-Singer theorem in full generality.

The final chapter is devoted to more specialized topics, including some recent work by the author: elliptic boundary value problems and the Gauss-Bonnet theorem for manifolds with boundary; the twisted eta invariant and the Atiyah-Patodi-Singer twisted index formula; $K$-theory of spherical space forms; Singer's conjecture for the Euler form and related questions; local formulas for the invariants of the heat equation; spectral geometry.

With a bibliography and index. viii + 349 pages, cloth. $40.00.

AVAILABLE ONCE AGAIN

Spaces of Constant Curvature, Fifth Edition
Prof. Joseph A. Wolf, University of California at Berkeley

The fifth and final edition of this now classical work contains a few new additions and corrections to the fourth edition. The most significant change is that all the previous corrections, which had been reproduced from typewritten copy, have now been typeset, including the new tables and new Dynkin diagrams. Page numbering has also been corrected to include the extra pages added after the first edition.

xviii + 412 pages, cloth. $40.00.

These books may be purchased directly from Publish or Perish, Inc. There is a 20% discount for orders from libraries and institutions. Orders from individuals must be prepaid, and receive a 15% discount. This price includes postage (4th class).

Publish or Perish, Inc., 1001 Jefferson Plaza, Suite 112, Wilmington, DE 19801
Applications are invited for teaching appointments in the Department of Mathematics. Candidates should possess at least a PhD degree in Mathematics or its equivalent. Preference will be given to candidates who are able to teach in one or more of the following areas:

- Numerical Analysis
- Operational Research
- Probability
- Statistics

Applications for positions in other areas may also be considered.

Gross annual emoluments range as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>Emoluments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer</td>
<td>S$30,770–63,570</td>
</tr>
<tr>
<td>Senior Lecturer</td>
<td>S$57,590–101,930</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>S$89,300–123,000</td>
</tr>
</tbody>
</table>

(US$1 = S$2.17 approximately)

The commencing salary will depend on the candidate’s qualifications, experience and the level of appointment offered.

Leave and medical benefits are provided. Under the University’s Academic Staff Provident Fund Scheme, the staff member and the University are each required to contribute at the present rate of 25% of his salary, the contribution of the staff member and the University being subject to a maximum of S$1,250 per month and S$1,750 per month respectively. The sum standing to the staff member’s credit in the Fund is tax-free and may be withdrawn when the staff member leaves Singapore/Malaysia permanently.

Depending on the type of contract offered, other benefits may include: a settling-in allowance of S$1,000 (single) or S$2,000 (married), subsidized housing at nominal rentals ranging from S$120 to S$216 p.m., education allowance for up to three children, subject to a maximum of S$10,000 per annum per child, passage assistance and baggage allowance for the transportation of personal effects to Singapore. Staff members may undertake consultation work, subject to the approval of the University, and retain consultation fees up to a maximum of 60% of their gross annual emoluments in any one year.

Application forms and further information on terms and conditions of service may be obtained from:

The Director
Personnel Department
National University of Singapore
Kent Ridge
Singapore 0511

Mr. Peter Lim
Director, North America Office
National University of Singapore
Suite 4J, One Harkness Plaza
61 West 62nd Street
New York, N.Y. 10023
U.S.A.
Tel: (212) 765-1670
The University of New Mexico Department of Mathematics and Statistics with the support of The University of New Mexico Foundation announces the lecture series

RECENT ADVANCES IN MATHEMATICS AND STATISTICS

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 19</td>
<td>The Shortest Network Problem.</td>
<td>Dr. Ronald L. Graham, Bell Laboratories</td>
</tr>
<tr>
<td>March 26</td>
<td>Recent Advances in Mathematical and Statistical Optimization.</td>
<td>Dr. Michael R. Osborne, Australian National University</td>
</tr>
<tr>
<td>April 2</td>
<td>A Theory of Statistics Built on Massive Computations.</td>
<td>Professor Bradley Efron, Stanford University</td>
</tr>
<tr>
<td>April 9</td>
<td>The Use of Mathematical Physics in Geometry.</td>
<td>Professor Hermann Flaschka, University of Arizona</td>
</tr>
<tr>
<td>April 16</td>
<td>Hamiltonian Structures for Fluids, Plasmas and General Relativity.</td>
<td>Professor Jerrold E. Marsden, University of California, Berkeley</td>
</tr>
</tbody>
</table>

All lectures will be held at 3:30 P.M. For further information write David A. Sanchez, Chairman, Dept. of Mathematics and Statistics, University of New Mexico, Albuquerque, NM 87131.

---

THE MATHEMATICS DEPARTMENT
ARIZONA STATE UNIVERSITY
TEMPE, ARIZONA

announces a

NATIONAL SCIENCE FOUNDATION
C.B.M.S.
REGIONAL CONFERENCE*
entitled

SPECIAL FUNCTIONS,
PHYSICS AND COMPUTER ALGEBRA
MAY 20—MAY 24, 1985

principal lecturer

PROFESSOR GEORGE E. ANDREWS
Pennsylvania State University

SELECTION OF PARTICIPANTS

Allowances for travel and subsistence for approximately 25 participants will be available. We particularly wish to encourage applications from women and members of minority groups. Address inquiries and requests for application forms to:

Professors E. Ihrig and M. E.H. Ismail
Department of Mathematics
Arizona State University
Tempe, AZ 85287

Applications deadline: April 1

*Pending final N. S. F. approval.

---

Structural Topology in an interdisciplinary journal on the applications of classical and contemporary mathematics (especially geometry) to the solution of morphological and structural problems. The problems arise in architecture, design and the plastic arts, and in a host of scientific disciplines ranging from crystallography and molecular chemistry to computer automation and scene analysis. The articles published cover three principal themes: the morphology of polyhedral and other special forms, its recognition and its use in the design process, the juxtaposition or packing of these forms and the structural rigidity of the resulting objects. The aim of the Journal is to promote interchange among researchers in the field and between them and practitioners, to publish recent results, recent applications and unsolved problems and to describe teaching projects and materials pertaining to the field. The Journal is published by the Structural Topology Research Group with Dr. Henry Crapo, as editor in chief, and with the collaboration of the Association mathematique du Quebec and of the Université du Quebec à Montreal.

Subscriptions are sold by series of two issues, at the cost of Can. $37 for institutions and Can. $25 for individuals. The fourth series will comprise issues 10 (November 1984) and 11 (May 1985); the fifth, issues 12 (November 1985) and 13 (May 1986). For more information write to: La Revue Topologie structurale, Département de mathématiques, Université du Québec à Montréal, Case postale 8888, Succursale "A", Montréal, Québec, Canada, H3C 3P8. Papers for publication could also be sent to this address.
POSTDOCTORAL RESEARCH APPOINTMENTS IN NONLINEAR MATHEMATICS AND PHYSICS

Los Alamos National Laboratory, one of the nation’s foremost scientific research organizations, is seeking candidates for our Postdoctoral Research Program. Exciting joint appointments are available between the Center for Nonlinear Studies and the Theoretical Division. Areas of particular interest include: nonlinear analysis, nonlinear partial differential equations, soliton theory, reaction diffusion systems, bifurcation theory, pattern and interface instabilities, chaos and the onset of turbulence numerical analysis and fully developed plasma turbulence. Applications of these studies in hydrodynamic instabilities, polymer dynamics and biophysics are encouraged.

Operated by the University of California for the Department of Energy, the Laboratory provides excellent working conditions and opportunities for advanced research. Our location in the mountains of Northern New Mexico offers a pleasant lifestyle in a setting of great natural beauty.

For further information please contact:
David K. Campbell,
Acting Chairman
Los Alamos National Laboratory,
DIV 85-AJ MS-B258
Los Alamos, New Mexico 87545
(505) 667-1444

and request application forms from:
Richard O. Garcia
Los Alamos National Laboratory
MS-P205
Los Alamos, New Mexico 87545

UNIVERSITY OF VIRGINIA
The Department of Mathematics wishes to fill the McConnell-Bernard Chair of Mathematics.

Applications are sought from candidates who have made outstanding research contributions in some area or areas of the mathematical sciences. The starting date is negotiable. For a full application, send a curriculum vitae, including the names of at least three references to:

Chairman, Department of Mathematics
Mathematics/Astronomy Building
University of Virginia
Charlottesville, Virginia 22903

Tentative applications or enquiries are also welcome, and will be treated in confidence.

An affirmative action/ equal opportunity employer.
DYNAMICAL SYSTEMS in "ASTERISQUE"

Having fascinating theoretical aspects and connections with other fields as physics, engineering science, biology, economics,..., Dynamical Systems play an important role in modern science.

The following issues of Astérisque are devoted to this subject, several of them being self-contained monographs which present material not published elsewhere in book form.

Other texts by M.R.Herman, M.Chaperon, ..., are scheduled to appear in the near future.

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air, 1st book $5, each add'l $3, max. $100 Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard
Count on Wiley textbooks for all fields of mathematics.

<table>
<thead>
<tr>
<th>Title</th>
<th>Edition</th>
<th>ISBN</th>
<th>Pages</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus with Analytic Geometry</td>
<td>2nd</td>
<td>(0-471-08271-6)</td>
<td>1264</td>
<td></td>
</tr>
<tr>
<td>Elementary Linear Algebra</td>
<td>4th</td>
<td>(0-471-04840-6)</td>
<td>464</td>
<td></td>
</tr>
<tr>
<td>Applications of Linear Algebra</td>
<td>3rd</td>
<td>(0-471-86800-0)</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Elementary Numerical Analysis</td>
<td></td>
<td>(0-471-89733-7)</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Applied Calculus</td>
<td></td>
<td>(0-471-83036-5)</td>
<td>480</td>
<td></td>
</tr>
</tbody>
</table>

To be considered for complimentary copies, write to LeRoy Davis, Dept. JW-4157. Please include course name, approximate enrollment, title of current text, and texts desired.

Wiley leading the way for over 150 years.

JOHN WILEY & SONS, Inc.
605 Third Avenue
New York, N.Y. 10158
In Canada: 22 Worcester Road
Rexdale, Ontario M9W 1L1
A Volume in the COMPUTER SCIENCE AND
APPLIED MATHEMATICS Series...

THE THEORY OF MATRICES
SECOND EDITION WITH
APPLICATIONS
PETER LANCASTER
MIRON TISMEMETSKY
A Publication of ACADEMIC PRESS CANADA
March 1985, c. 439 pp., in preparation
ISBN: 0-12-435560-9


Two Volumes in the MATHEMATICS IN SCIENCE AND ENGINEERING Series...

THEORY OF MULTIOBJECTIVE OPTIMIZATION
YOSHIKAZU SAWADGI
HIROTAKA NAKAYAMA
TETSUZO TANINO
April 1985, c. 252 pp., in preparation
ISBN: 0-12-620370-9


BILINEAR TRANSFORMATION METHOD
YOSHIKAZU MATSUMOTO
1984, 248 pp., $50.00/ISBN: 0-12-480480-2


ENUMERATION AND DESIGN
Edited by
DAVID M. JACKSON
SCOTT A. VANSTONE
A Publication of ACADEMIC PRESS CANADA
1984, 328 pp., $59.50/ISBN: 0-12-379120-0


PROGRESS IN GRAPH THEORY
Edited by
J. ADRIAN BONDY
U.S.R. MURTY
A Publication of ACADEMIC PRESS CANADA
1984, 554 pp., $59.50
ISBN: 0-12-114320-1


Now Available in Paperback...

APPLICATION AND IMPLEMENTATION OF FINITE ELEMENT METHODS
J.E. AKIN
1982, 384 pp., $60.00/ISBN: 0-12-047650-9 (Cloth)
1984, 384 pp., $25.00/ISBN: 0-12-047652-5 (Paper)
Change of Address

Members of the Society who move or who change positions are urged to notify the Providence Office as soon as possible.

Journal mailing labels must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the Combined Membership List). In addition, the AMS maintains records of members' honors, awards, and information on Society service; information of the latter kind appears regularly in the Notices.

When changing their addresses, members are urged to cooperate by supplying the information requested below—the Society's records are of value only to the extent that they are current and accurate.

If your address has changed, or will change within the next two or three months, please place the peel-off label from the back cover (which contains your name, member code, and address) in the rectangle provided below (or on a copy of this page), supply any other information appropriate for the AMS records, and mail to the address given below.

Place Notices label here

Change effective as of: ____________________________

New Mailing Address: ____________________________

New Position: ____________________________

If mailing address is not that of your employer, please supply the following information:

New Employer: ____________________________

Location of employer: ____________________________

City      State/Province        Country      Zip Code

Recent honors and awards: ____________________________

Personal Items for publication in the Notices: ____________________________

Mail completed form to:
Membership Department, AMS, P. O. Box 6248, Providence, RI 02940

325
Pettis Integral and Measure Theory
Michel Talagrand

This book is concerned with the notion of pointwise compact sets of measurable functions and related measure-theoretic problems. The author provides an extensive self-contained development of the theory of Pettis integration, the natural field of application. Other fields of application included are Riemann-measurable functions on groups, measurability problems and empirical measures.

The main results of this work should be accessible with only a working knowledge of abstract measure theory and an elementary knowledge of functional analysis and topological measure theory. No previous knowledge of Pettis integration is required, and the reader should never have to look for a reference in specialized papers, only in basic books.

The book is organized into three parts. Chapters 1 through 7 deal with Pettis integration and topological measure theoretic tools. Abstract measure theoretic tools are used in Chapters 2, 6 and 7. But since they are more technical, their study is delayed until Chapters 8 through 14. Chapters 15 and 16 deal with applications and more specialized questions.

An Extension of the Galois Theory of Grothendieck
André Joyal and Myles Tierney

The development of the theory of topos was guided by the analogy between the category of sheaves on a site and sheaves on an ordinary topological space. In this work the authors intend to deepen this analogy by establishing a theorem which compares, in a precise way, this new concept of space to the classical notion of topological space. This comparison takes the form of a two-fold extension of the idea of space.

Firstly, in classical topology, a space is a set X equipped with a topology of open sets \( \mathcal{O}(X) \subseteq \mathcal{P}(X) \). Here, the authors replace \( \mathcal{O}(X) \) by an arbitrary complete lattice satisfying the distributive law \( u \wedge (\bigvee_{i \in I} u_i) = \bigvee_{i \in I} (u \wedge u_i) \). Such a lattice is called a locale. The concept of sheaf on a locale is clear and gives rise to a corresponding topos. The category of (extended) spaces and continuous maps is the dual of the category of locales. Joyal and Tierney study this category systematically, developing particularly the concept of open mapping.

Secondly, they show that the difference between an arbitrary Grothendieck topos and their new notion of space lies in the possibility of action by a spatial groupoid. That is, if \( G_1 \rightarrow G_0 \) is a groupoid in the category of (extended) spaces, then the general notion of Grothendieck topos is captured by considering sheaves on \( G_0 \) with a continuous action by \( G_1 \). This is an extension of Grothendieck’s interpretation of classical Galois theory.

The basic technique used by the authors is descent theory for morphisms of locales, developed in the general set theory of an arbitrary elementary topos.

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air, 1st book $5, each add'l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 507, Providence, RI 02901-507, or call toll free 800-556-7774 to charge with Visa or MasterCard.
Proceedings of the Conference on Banach Algebras and Several Complex Variables

F. Greenleaf and D. Gulick, Editors

These proceedings result from a conference on Banach Algebras and Several Complex Variables held June 21–24, 1983, to honor Professor Charles E. Rickart upon his retirement from Yale University. Articles present recent advances in a wide spectrum of topics related to Banach algebras, function algebras and infinite dimensional holomorphy, areas where Professor Rickart has made important contributions. From a research point of view, the articles of J. Esterle and B. Kramm are of special interest.

Although the topics in this volume are diverse, a general knowledge of fundamental notions appearing in Banach algebra theory will suffice for understanding most articles.

Contents

H. Alexander. Capacities in C°
G. Allan. Holomorphic left-inverse functions
B. Aupetit. Geometry of pseudoconvex open sets and distribution of values of analytic multivalued functions
J. Bachar. Some results on range transformations between function spaces
W. Bade. Recent results in the ideal theory of radical convolution algebras
W. Bade and P. Curtis. Module derivations from commutative Banach algebras
F. Bonsall. Criteria for boundedness and compactness of Hankel operators
H. Dales. Algebra and topology in Banach algebras
I. Glicksberg. Orthogonal and representing measures
B. Kramm. Nuclearity (resp. Schwartzity) helps to embed holomorphic structure into spectra
D. Kumagai. Maximum modulus algebras and multi-dimensional analytic structure
K. Laursen. Central factorization in C*-algebras and its use in automatic continuity
J. McClure. Nonstandard ideals and approximations in primary weighted L¹-algebras
A. O’Farrell. K. Preskenis and D. Walsh. Holomorphic approximation in Lipschitz norms
M. Rajagopalan and P. Ramakrishnan. Uses of βS in invariant means and extremely left amenable semigroups
R. Rochberg. Deformation theory for uniform algebras: An introduction
W. Rudin. Nevanlinna’s interpolation theorem revisited
S. Sakai. Unbounded derivations in C*-algebras and statistical mechanics
D. Sarason. Remotely almost periodic functions
Z. Slodkowski. Analytic multifunctions, q-plurisubharmonic functions and uniform algebras
E. Stout. Algebraic domains in Stein manifolds
J. Wada. Sets of best approximations to elements in certain function spaces
J. Wermer. Green’s functions and polynomial hulls
B. Yood. Continuous homomorphisms and derivations on Banach algebras
W. Zame. The maximal ideal space of a commutative Banach algebra

Contemporary Mathematics
Volume 32, xiv + 295 pages (softcover)
1980 Mathematics Subject Classifications:
32Axx, 32Bxx, 32Fxx, 46Hxx, 46Jxx
ISBN 0-8218-5034-2; LC 84-18443
Publication date: November 1984
List price $28, institutional member $22, individual member $17
To order, please specify CONM/32N

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air, 1st book $5, each add'l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
Structure of Factors
and Automorphism Groups
Masamichi Takesaki

This book describes the recent development in the structure theory of von Neumann algebras and their automorphism groups. It gives a quick survey of the Tomita-Takesaki theory needed for the latter use, then moves on to the duality theory for crossed products and automorphism groups, which is applied to the structure theory of factors of type III. The last part is devoted to Connes' theory of injective factors. The book can be viewed as a guided tour to the state of the art.

Contents
I. Noncommutative Integration
II. General Theory of Crossed Products and Duality
III. Structure of Factors of Type III
IV. Connes' Theory of Injective Factors and Automorphisms

1980 Mathematics Subject Classification: 46L10

CBMS Regional Conference Series in Mathematics
Number 51, iv + 107 pages (soft cover)
List price $18, individuals $11
ISBN 0-8218-0701-5; LC 83-6435
Publication date: June 1983
To order, please specify CBMS/51N

Orderings, Valuations
and Quadratic Forms
Tsit-Yuen Lam

These notes were developed from the ten lectures the author gave at the CBMS Regional Conference held at Carleton College, Northfield, Minnesota in August, 1981. Much new material not covered in the lectures has been added to make this into a full-length book.

The main topics treated in this book are orderings, valuations and quadratic forms. Orderings and valuations are related through the notion of compatibility; valuations and quadratic forms are related through the notion of residue forms, while quadratic forms and orderings are related through the notion of signatures. In the recent literature, this triumvirate of topics and their remarkable relationships and interplay has been the object of an intensive and fruitful study. This book provides an authoritative account of these recent developments, covering, in particular, many results from original research papers published in the last fifteen years.

After a beginning chapter on the reduced theory of quadratic forms, the author lays the foundation for the study of the compatibility notion between orderings (resp. preorderings) and valuations. This is followed by an introduction to the techniques of residue forms and the relevant Springer theory. The author then presents the solution of the Representation Problem due to Becker and Bröcker, with simplifications due to Marshall. The notice of fans plays an all-important role in this approach. The text goes on to treat the theory of real places and the real holomorphy ring, and proves Bröcker's theorem on the trivialization of fans. (The material on the holomorphy ring should be of interest and reference value for workers in commutative algebra.) Two important invariants of a preordering, the chain length and the stability index, are studied in detail. Other topics treated include the notion of semiorderings, its applications to SAP fields and SAP preorderings, and the valuation-theoretic Local-Global Principle for reduced quadratic forms.

The presentation in these notes is largely self-contained, and does not presuppose any advanced knowledge of orderings or quadratic forms. The only prerequisite is perhaps a good working knowledge of general valuation theory, and some familiarity with the basic notions and terminology of quadratic form theory as contained, for instance, in the first two chapters of the author's previous book published by W. A. Benjamin. The present notes may therefore be read either as a sequel to the author's Benjamin book, or as an independent introduction to ordered fields and reduced quadratic forms using valuation-theoretic techniques.

1980 Mathematics Subject Classifications: 10C04, 12J10, 12J15; 10C01, 12J25, 12J25.

CBMS Regional Conference Series
Volume 52, viii + 144 pages (soft cover)
List price $17, individuals $10
ISBN 0-8218-0702-1; LC 83-11729
Publication date: August 1983
To order, please specify CBMS/52N

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air 1st book $5, each add'l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
MAA MINICOURSE PREREGISTRATION FORM, LARAMIE, WYOMING

August 12-15, 1985

MUST BE RECEIVED IN WASHINGTON, DC, NO LATER THAN JUNE 14, 1985

Please complete this form and return it with your payment to

Mathematical Association of America
1529 Eighteenth Street, NW, Washington, DC 20036
Telephone: 202-387-5200

DEADLINE: Preregistration for Minicourse fee(s): June 14, 1985

NOTE: All dues and meeting registration fees paid to AMS or MAA by professional mathematicians are tax deductible.

N.B.: [ ] I plan on preregistering for the Joint Meetings only in order to attend the MAA Minicourse(s) indicated below. It is my understanding that, should the course(s) of my choice be filled, full refund of the Joint Meetings preregistration fee will be made.

MINICOURSE PREREGISTRATION

1) (Please print) Surname First Middle

2) ____________________________ Mailing address for confirmation of Minicourse(s)

3) Employing institution__________________________

4) Please enroll me in the following Minicourse(s). Enclosed is my payment of $___________ (Make check payable to MAA. Canadian checks must be marked "In U.S. Funds"). Method of payment:

Check [ ] VISA [ ] MasterCard [ ]

Credit card number ____________________________ expiration date __________

Signature (name as it appears on the credit card)

<table>
<thead>
<tr>
<th>First Choice</th>
<th>Alternate</th>
<th>Fee</th>
<th>Minicourses</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>$25</td>
<td>#1 - Geometry for college teachers (Branko Grünbaum, U of Washington)</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>$25</td>
<td>#2 - Applied mathematics via classroom experiments (Herbert R. Bailey, Rose-Hulman Institute of Technology)</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>$25</td>
<td>#3 - Teaching experiential applied mathematics, (TEAM) (James R. Choike, Oklahoma State U)</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>$35</td>
<td>#4 - Computing in undergraduate linear algebra (Eugene A. Herman, Grinnell College)</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>$35</td>
<td>#5 - Microcomputer software in mathematics instruction (Roy E. Myers, Pennsylvania State U, Kensington)</td>
</tr>
</tbody>
</table>

Participants are limited to two Minicourses each.
The Swiss Federal Institute of Technology in Zurich invites applications for a non-tenured position of

ASSISTANT PROFESSOR OF MATHEMATICS

Duties of the new professor include teaching for undergraduate and graduate engineering students and research in one field, preferably applied mathematics.

Young and active scientists with a record of original contributions should submit their applications with curriculum vitae and list of publications before March 31, 1985, to the President, Swiss Federal Institute of Technology, 8092 Zurich, Switzerland.

---

**BOUNDARY VALUE PROBLEMS FOR ELLIPTIC PSEUDODIFFERENTIAL EQUATIONS**

by G. I. Eskin, translated by S. F. Smith

The English edition differs from the Russian in that an Introduction and three new sections (§§ 25-27) have been added. Moreover, various corrections, improvements and remarks have been made by the author throughout the book, especially in Chapter 6.

**CONTENTS**

1. Generalized functions and the Fourier transform
2. Boundary value problems for an elliptic pseudodifferential operator in a halfspace
3. Smoothness of solutions of pseudodifferential equations
4. Systems of elliptic pseudodifferential equations in a halfspace
5. Pseudodifferential operators with variable symbols
6. Boundary value problems for elliptic pseudodifferential operators in a bounded domain with smooth boundary
7. Applications

---

**Summer List of Applicants**

**Instructions for Applicant Form on facing page**

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

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

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

Address forms to the Mathematics Meetings Housing Bureau, P. O. Box 6887, Providence, RI 02940. The deadline for receipt is June 14, 1985. See pages 240 and 244 for more information.

**A Specialties**

AL = Algebra
BI = Biomathematics
CB = Combinatorics
CN = Control
CT = Circuits
EC = Economics
FA = Functional Analysis
FL = Fluid Mechanics
HM = History of Math
MB = Mathematical Biology
MO = Modelling
MS = Management Science
NT = Number Theory
PR = Probability
ST = Statistics
AR = Academic Research
AT = Academic Teaching
NR = Nonacademic R&D
NC = Nonacad. Consulting
NS = Nonacademic Supervision

**B Career Objectives**

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

**D Duties**

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

**Location**

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

**U.S. Citizenship Status**

C = U.S. Citizen
T = Temporarily in U.S.
P = Permanent Resident
N = Non-U.S. Citizen
**APPLICANT:** Name__________________________________________

Mailing address (include zip code) ____________________________________________

A. Specialties ____________________________________________________________

B. Career objectives and accomplishments

ACADEMIC: ☐ Research, ☐ Teaching

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

Near-term career goals ____________________________________________________

Significant achievements or projects, including role ____________________________

Honors and offices _________________________________________________________

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

Selected titles of papers, reports, books, patents _______________________________

C. Degree Year Institution

D. No. of abstracts, internal reports

E. No. of papers accepted

F. No. of books and patents

**EMPLOYMENT HISTORY:**

<table>
<thead>
<tr>
<th>Employer</th>
<th>Present</th>
<th>Previous</th>
<th>Previous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>___________________________</td>
<td>___________________________</td>
<td>___________________________</td>
</tr>
<tr>
<td>Years</td>
<td>_______ to _______</td>
<td>_______ to _______</td>
<td>_______ to _______</td>
</tr>
</tbody>
</table>

**DESIRED POSITION:**

D. Duties _________________________________________________________________

I. Available mo._____/yr.____ Location ___________________________ Salary ______

K. References (Name and Institution)

| ___________________________ | ___________________________ |
| ___________________________ | ___________________________ |

M. Citizenship __________________________________________________________

M. I plan to attend the Summer Meeting yes ☐ no ☐
Conference on Modern Analysis and Probability
(1982, Yale University)
Richard Beals, Anatole Beck, Alexandra Bellow
and Arshag Hajian, Editors

The Conference in Modern Analysis and Probability in honor of Professor Shizuo Kakutani was held on June 8–11, 1982, at Yale University on the occasion of his retirement. In these Proceedings the papers that were submitted for this Conference are presented. Initial funding was provided by the National Science Foundation.

The three major areas of mathematics on which the Conference focused were functional analysis, probability theory, and ergodic theory. Most of the articles presented were works by the respective authors on problems that were pioneered by Professor Kakutani in the past. Questions in Brownian motion, induced transformations, representation of M-spaces, and fixed point theorems were discussed.

Contents
Roy L. Adler and Leopold Flatto, Cross section map for the geodesic flow on the modular surface
M. A. Akcoglu and L. Sucheston, On identification of superadditive ergodic limits
J. R. Baxter and R. V. Chacon, The equivalence of diffusions on networks to Brownian motion
A. Bellow and V. Losert, On sequences of density zero in ergodic theory
J. van den Berg and M. Keane, On the continuity of the percolation probability function
Felix E. Browder, Coincidence theorems, minimax theorems, and variational inequalities
J. R. Choksi, Recent developments arising out of Kakutani's work on completion regularity of measure
J. R. Choksi and S. J. Eigen, An automorphism of a homogeneous measure algebra which does not factorize into a direct product
Daniel I. A. Cohen, Another generalization of the Brouwer fixed point theorem
Yael Naim Dowker, An ergodic theorem
Nathaniel A. Friedman, Higher order partial mixing
Hillel Furstenberg, IP-systems in ergodic theory
Arshag Hajian and Yuji Ito, Induced transformations on a section
Edwin Hewitt, Conjugate Fourier series on the character group of the additive rationals
Kyōsuke Ito, A stochastic differential equation in infinite dimensions
Kinrad Jacobs, Ergodic theory and combinatorics
William B. Johnson and Joram Lindenstrauss, Extensions of Lipschitz mappings into a Hilbert space
Robert R. Kallman, A uniqueness result for a class of compact connected groups
L. A. Kalcovitz, Two extremal properties of functions
Robert Kaufman, On Bernoulli convolutions
Harvey B. Keynes and Mahesh G. Nerurkar, Generic theorems for lifting dynamical properties by continuous affine cocycles
Bruce Kitchens, Linear algebra and subshifts of finite type
Anthony Lo Bello, The etymology of the word ergodic
Peter A. Loeb, A functional approach to nonstandard measure theory
Dorothy Maharam, On positive operators
Brian Marcus, Karl Petersen and Susan Williams, Transmission rates and factors of Markov chains
I. Namioka, Ellis groups and compact right topological groups
William Parry and Klaus Schmidt, Invariants of finitary isomorphisms with finite expected code-lengths
Maiza Ratner, Ergodic theory in hyperbolic space
Haskell P. Rosenthal, Embedding of $L^1$ in $L^1$
Daniel J. Rudolph, Inner and barely linear time changes of ergodic $R^k$-actions
M. J. Sharpe, Processes evolving from the indefinite past
Erik G. F. Thomas, An infinitesimal characterization of Gelfand pairs
Nils Tongring, Multiple points of Brownian motion
Benjamin Weiss, Measurable dynamics
Kosaku Yosida and Shigetake Matsuura, A note on Mikusinski's proof of the Titchmarsh convolution theorem
Robert J. Zimmer, Ergodic actions of arithmetic groups and the Kakutani-Markov fixed point theorem

1980 Mathematics Subject Classifications: 46Bxx, 60Gxx, 28Dxx

Contemporary Mathematics
Volume 26, xii + 432 pages (soft cover)
List price $34, institutional member $27, individual member $20
ISBN 0-8218-0300-X; LC 84-484
Publication date: May 1984
To order, please specify CONM/26N

Shipping/Handling: 1st book $2, each add'l $1, max. $25; by air, 1st book $5, each add'l $3, max. $100
Prepayment is required. Order from American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-556-7774 to charge with Visa or MasterCard.
**PREREGISTRATION AND HOUSING FORM, LARAMIE, WYOMING**

**AMS Short Course**
August 10-11, 1985

**Joint Mathematics Meetings**
August 12-15, 1985

Please complete this form and return it with your payment to:
Mathematics Meetings Housing Bureau
P.O. Box 6887, Providence, Rhode Island 02940 - Telephone 401-272-9500, Ext. 239

**DEADLINES:**
- Preregistration: June 14, 1985 for preregistration fee(s)
- Residence Hall Room Payments: June 14, 1985
- Cancellations: Preregistration may be cancelled until August 9 by writing or calling the Mathematics Meetings Housing Bureau; see above. 90% of the preregistration fee(s) will be refunded if notification is received by this date. Confirmed residence hall reservations may be cancelled until July 25 and full payment will be refunded; however, after that date, only partial refunds will be allowed. Full refunds will be made of MAA 25-year Banquet tickets if notification is received prior to July 26; after that date, 50% refund applies.
- Changes: Changes in arrival and departure dates must be made with the Mathematics Meetings Housing Bureau by August 9. After that date, please call message center number at Laramie.

**NOTE:** All dues and meeting registration fees paid to AMS or MAA by professional mathematicians are tax deductible.

**REGISTRATION FEES**

<table>
<thead>
<tr>
<th></th>
<th>Preregistration (by mail prior to 6/14)</th>
<th>At Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Mathematics Meetings</td>
<td>$55</td>
<td>$72</td>
</tr>
<tr>
<td>Member of AMS, MAA,IME</td>
<td>$14</td>
<td>$18</td>
</tr>
<tr>
<td>Student, Unemployed or Emeritus</td>
<td>$84</td>
<td>$100</td>
</tr>
<tr>
<td>MAA SHORT COURSE</td>
<td>$25</td>
<td>$30</td>
</tr>
<tr>
<td>Member/Nonmember</td>
<td>$35</td>
<td>$10</td>
</tr>
<tr>
<td>Student or Unemployed</td>
<td>$55</td>
<td>$72</td>
</tr>
<tr>
<td>Nonmember</td>
<td>$72</td>
<td>$18</td>
</tr>
</tbody>
</table>

*All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned from their latest position. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and is retired on account of age from his or her latest position.

**PREREGISTRATION SECTION:** Please check the function(s) for which you are preregistering:
- Joint Meetings [ ]
- AMS Short Course [ ]

1) (Please print) **Surname**
2) **First**
3) **Middle** (optional)
4) **Address:**
   - Number and street
   - City State
5) Address for confirmation of room reservation, if other than above
6) Name of spouse
7) Number of children
8) Member of AMS [ ]
   - MAA [ ]
   - IDME [ ]
   - Emeritus member [ ]
   - Nonmember [ ]
   - Member of other organizations: AWM [ ]
   - NAM [ ]
9) Joint Meetings fee $________
10) AMS Short Course fee $________
11) MAA 25-year Banquet ticket(s) @ $17.25 (for those not on 3-meal plan)
12) MAA 25-year Banquet ticket(s) @ $12.75 (for those on 3-meal plan)
13) FULL PAYMENT for residence hall accommodations enclosed $________ (Partial refund applies after July 25.)
14) TOTAL AMOUNT ENCLOSED FOR 9 through 13 $________ (Make checks payable to AMS; Canadian checks must be marked "In U.S. Funds"). VISA or MasterCard credit cards may be submitted for payment.

**For office use only:**

<table>
<thead>
<tr>
<th>Codes</th>
<th>Options</th>
<th>Dates</th>
<th>Residence Hall</th>
<th>Rm. Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special:</td>
<td>Aml. pb</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PREREGISTRATION AND HOUSING REQUEST FORM (continued)

(Please read sections on housing and room rates in meeting announcements.)

UNIVERSITY HOUSING SECTION: (Please complete Sections I through IV below.)

NOTE: Full prepayment for room and board is required as noted in Item 13 on the reverse. Please make checks payable to AMS. Canadian checks must be marked "In U.S. Funds". VISA and MasterCard credit cards will also be accepted.

I. Please reserve the following residence hall accommodations and send confirmation to me at address below:

ADULTS AND CHILDREN (other than those occupying a portacrib)

Rates include breakfast, lunch, and dinner.

<table>
<thead>
<tr>
<th></th>
<th>Singles - one person</th>
<th>Doubles - two persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One day</td>
<td>$ 25.00</td>
<td>$ 40.00</td>
</tr>
<tr>
<td>Two days</td>
<td>$ 50.00</td>
<td>$ 80.00</td>
</tr>
<tr>
<td>Three days</td>
<td>$ 75.00</td>
<td>$120.00</td>
</tr>
<tr>
<td>Four days</td>
<td>$ 90.00</td>
<td>$145.00</td>
</tr>
<tr>
<td>Five days</td>
<td>$104.00</td>
<td>$171.00</td>
</tr>
<tr>
<td>Six days</td>
<td>$117.00</td>
<td>$186.00</td>
</tr>
<tr>
<td>Seven days</td>
<td>$130.00</td>
<td>$219.00</td>
</tr>
</tbody>
</table>

I will arrive on _____________ at ________ a.m./p.m., and depart on _____________ at ________ a.m./p.m.

I will share a double room with ____________________ who will arrive on _____________ at ________ a.m./p.m., and depart on _____________ at ________ a.m./p.m.

PLEASE LIST AGES OF ACCOMPANYING CHILDREN:

II. ADDRESS FOR CONFIRMATION OF ROOM RESERVATION:

Telephone number: __________________________
(area code)

IV. TRAVEL INFORMATION:

[ ] I plan to arrive by plane on _____________ scheduled to arrive at _____________
     (airline flight and number) 
     airport on _____________ at ________ a.m./p.m.
     (date) (time)

[ ] I plan to drive to the meeting.

Note: This additional information is being requested in order to assist the university's housing office in planning for heavy arrival times.
Order Form
(Use your peel-off label from the Notices)

Ordered by: __________________________ Mail to (if different): ______________________

<table>
<thead>
<tr>
<th>QTY</th>
<th>CODE</th>
<th>AUTHOR and TITLE</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Shipping and Handling  □ Surface  □ Air

Total due (All orders must be prepaid)  $

To order using VISA or MasterCard (for book orders only) fill out the following or call 800-556-7774

□ VISA  □ MasterCard, Account Number ________________________________
Expiration Date ___________ Signature ________________________________

Shipping and Handling

Books are sent via surface mail (UPS to U.S. addresses and printed matter elsewhere) unless air delivery is requested. The shipping and handling charges for book orders are shown below.

<table>
<thead>
<tr>
<th></th>
<th>First Book</th>
<th>Each Additional</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>$2</td>
<td>$1</td>
<td>$25</td>
</tr>
<tr>
<td>Air</td>
<td>$5</td>
<td>$3</td>
<td>$100</td>
</tr>
</tbody>
</table>

Journal back numbers, Mathematical Reviews indexes, and review volumes are sent via surface mail to any destination unless air delivery is requested. Postage for surface mail is paid by the AMS. Air delivery rates, which will be quoted upon request, must be paid by the purchaser.

A reminder: the individual member rate applies to the purchase of one copy of any book for personal use, and is not an alternative means of lowering costs for libraries.
New Generalized Functions and Multiplication of Distributions
by JEAN FRANÇOIS COLOMBEAU
NORTH-HOLLAND MATHEMATICS STUDIES, 84
Notas de Matemática (90), editor: Leopolda Nachbin
This volume presents a new mathematical theory of
generalized functions, more general than Distribution
Theory, giving a rigorous mathematical sense to any
product of a finite number of distributions and to
heuristic computations of Quantum Field Theory.
Although the physical motivations are emphasized, the
book is also addressed to mathematicians with no
knowledge of physics. This work opens a new domain
of research in both pure and applied mathematics.

CONTENTS: I. Introduction to the Multiplication of
Distributions. II. A Generalized Mathematical Analysis.
III. A Mathematical Setting for Quantum Field Theory
1984, xii + 376 pages. Price: US $38.50/Dfl. 100.00

Functional Analysis, Holomorphy and
Approximation Theory II
edited by GUIDO I. ZAPATA
NORTH-HOLLAND MATHEMATICS STUDIES, 86
Notas de Matemática (92), editor: Leopolda Nachbin
This volume contains 23 articles with detailed proofs,
on current topics of research in several branches of
analysis, including approximation theory, C*-algebras,
complex function theory, differential equations, locally
convex spaces, mathematical physics, operator theory
and optimization.
Most of the articles are revised and extended versions
of papers presented at the Seminário de Análise
Funcional, Holomorfia e Teoria da Aproximação held at
the Universidade Federal do Rio de Janeiro in August
3-7, 1981.
1984. x + 478 pages. Price: US $57.75/Dfl. 150.00
ISBN 0-444-86845-3

Topics on Perfect Graphs
edited by CLAUDE BERGE and VASEK CHVÁTAL
NORTH-HOLLAND MATHEMATICS STUDIES, 88
Annals of Discrete Mathematics, 21
The purpose of this book is to present selected results
on perfect graphs in a single work. These take the form
of reprinted classical papers, survey papers and new
results. They concern different aspects of perfect
graphs: general results; special cases of perfect
graphs; polyhedral point of view; which graphs are
imperfect; which graphs are perfect; and optimization in
perfect graphs.
The main features are:
• complete study of some special classes of perfect
graphs;
• recognition problems;
• optimization in perfect graphs.

Galois Groups and their
Representations
Proceedings of a Symposium held in Nagoya,
December 14–18, 1981
edited by Y. IHARA
ADVANCED STUDIES IN PURE MATHEMATICS, 2
CONTENTS: Notes on Metaplectic Automorphic
Functions and Zeta Functions. Hodge Structures of
Shimura Varieties Attached to the Unit Groups of
Quaternion Algebras. On the Zeta Function of an
Abelian Scheme over the Shimura Curve II. On the
Absolute Galois Groups of Local Fields I. On the
Absolute Galois Groups of Local Fields II. On
Generalized Hasse-Witt Invariants of an Algebraic
Curve. On Unramified Extension of Function Fields
over Finite Fields. Galois Groups of Unramified
Solvable Extensions. Two Dimensional Class
Field Theory. Residue Homomorphisms in Milnor
K-Theory.
1983. x + 172 pages. Price US $38.50/Dfl. 100.00
ISBN 0-444-86835-6
Titles in the Theory and Methods of Dynamical Systems

From the Applied Mathematical Sciences Series—

Singularities and Groups in Bifurcation Theory, Volume 1 (of 2)
M. Golubitsky and D.G. Schaeffer
Introducing the use of singularity-theory methods in bifurcation theory, this new book stresses bifurcation problems with one state variable. Intended for applied mathematicians and engineers, it refines and makes more accessible methods that have appeared before only in the research literature. Three case studies show how singularity-theory methods aid in the analysis of applied problems. 1985/463 pp./114 illus./hardcover $38.00 ISBN 0-387-90999-0

Nonlinear Oscillations, Dynamical Systems and Bifurcations of Vector Fields
J. Guckenheimer and P. Holmes
"This remarkable book is based on examples that illustrate the phenomena of bifurcation and chaos in both continuous and discrete dynamical systems... remarkable for its style and pedagogy... pure and applied mathematicians and their graduate students should find this book a rich source of examples, phenomena, and conjectures on which to base new theories." SIAM Review 1983/453 pp./206 illus./hardcover $34.00 ISBN 0-387-90819-6

The Lorenz Equations: Bifurcation, Chaos, and Strange Attractors
C. Sparrow
This is the first book to provide a comprehensive survey of the behavior of solutions to the Lorenz equations, reflecting the rapid progress in applications since the equations formulation in 1963. It offers clear insights into the equations' complicated theory, but assumes no knowledge of the Lorenz equations or of the advanced theory of differential equations. 1982/269 pp./91 illus./softcover $23.50 ISBN 0-387-90775-0

From Grundlehen der mathematischen Wissenschaften—

Nonlinear Analysis on Manifolds
Monge-Ampère Equations
T. Aubin
Examines the nonlinear problems which arise in Riemannian geometry. Designed as reference tool and an introduction to the field, this comprehensive book supplies essential background knowledge and develops practical methods which are then concretely applied to solving specific problems. 1982/204 pp/hardcover $39.00 ISBN 0-387-90704-1

Methods of Bifurcation Theory
S.-N. Chow and J. Hale
Emphasizing analytic methods and applications, this book presents the complete theory of both static and dynamic bifurcation. It not only describes the basic elements of nonlinear functional analysis but also discusses applications of differential equations to bifurcation theory. Also included are results presented in a form applicable to infinite-dimensional problems. 1982/515 pp./97 illus/hardcover $54.00 ISBN 0-387-90664-9

Geometrical Methods in the Theory of Ordinary Differential Equations
V.I. Arnold (Translated from the Russian by J. Szucs)
Arnold explores differential equations, with the emphasis on structural stability and concentrates on the many applications to various asymptotic methods. He also treats the theory and applications of perturbation, averaging, Poincaré normal forms, and bifurcation theory. Problems are included. 1982/334 pp./153 illus/hardcover $39.00 ISBN 0-387-90681-9

D. Gilbarg and N.S. Trudinger
"This book gives an admirably clear and comprehensive account of those parts of the theory of second-order quasilinear elliptic equations which relate most naturally to the Dirichlet problems for such equations... (contains) a complete and self-contained proof of the Schauder interior and boundary estimates for classical solutions of linear equations with Hölder-continuous coefficients...indispensable for those interested in this important area." Bulletin of the London Mathematical Society 1983/513 pp./hardcover $45.50 ISBN 0-387-13025-X

From Springer Series in Synergetics

Non-Equilibrium Dynamics in Chemical Systems
A. Pacault and C. Vidal

Chaos and Statistical Methods
Proceedings of the 6th Kyoto Summer Institute
September 12-15, 1983, Kyoto, Japan
ed. Y. Kuramoto
1984/273 pp./123 illus./hardcover $35.00 ISBN 0-387-13156-6

Stochastic Phenomena and Chaotic Behavior in Complex Systems
ed. P. Schuster
1984/271 pp./110 illus./hardcover $35.00 ISBN 0-387-13194-9

To Order: Please visit your local technical bookstore, or send payment, including $1.50 for postage, to: Springer-Verlag New York, Inc. Attn: Ken Quinn Dept. S940 175 Fifth Avenue, New York, New York 10010