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Henon Strange (See page 189)
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Hommage à P. A. Meyer et J. Neveu

This tribute to Paul André Meyer and Jacques Neveu displays their wide influence on modern probability theory by gathering nineteen original research papers, drawn from a large range of topics: potential theory, classical stochastic processes and their laws, non-commutative probability, estimates of heat kernels, entropy, ergodic theory, phase transition, stochastic models in financial markets, and excursion theory.

Tribute to Jean-Louis Loday, AMS/IP Studies

by gathering nineteen original research papers, drawn from diverse group of researchers.

Partial Order Methods in Verification


This book presents surveys on the theory and practice of modeling, specifying, and validating concurrent systems. It contains surveys of techniques used in tools developed for automatic validation of systems. Other papers present recent developments in concurrency theory, logics of programs, model-checking, automata and formal languages theory.

The volume contains the proceedings from the workshop, Partial Order Methods in Verification, which was held in Princeton, NJ, in July 1996. The workshop focused on both the practical and the theoretical aspects of using partial order models, including automata and formal languages, category theory, concurrency theory, logic, process algebra, program semantics, specification and verification, topology, and trace theory. The book also includes a lively e-mail debate that took place about the importance of the partial order dichotomy in modeling concurrency.

Operads: Proceedings of a Conference Held at the Centre International de Rencontres Mathématiques, Luminy, France (May-June 1995) and at a conference "Operads et Algèbres Homotopiques" held at the Centre International de Rencontres Mathématiques at Luminy, France (May-June 1995). Both meetings drew a diverse group of researchers.

Singularities and Complex Geometry

Qi-keng Lu, Shantou University, Guangdong, People's Republic of China, Stephen S.-T. Yau, and Anatoly Libgober, University of Illinois at Chicago, Editors

This book represents the proceedings of the joint U.S.-China Seminar on Singularity and Complex Geometry held at the Institute of Mathematics of the Chinese Academy, Beijing, in June 1994. This was the first gathering of Chinese and American mathematicians working in these fields (several Japanese mathematicians also took part). The volume covers a wide range of problems in areas such as CR-manifolds, value distribution theory of holomorphic curves, topology of the complements of algebraic plane curves with singularities and arrangements, topology of non-isolated singularities, gauge theory on resolutions of singularities, and residues of foliations. The articles give accounts of research in these fast developing areas. Much of the material appears here for the first time in print.

Titles in this series are co-published with International Press, Cambridge, MA.

The authors have arranged the contributions so as to emphasize certain themes around which the renaissance of operads took place: homotopy algebra, algebraic topology, polyhedra and combinatorics, and applications to physics.

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J.F. Jardine, University of Western Ontario, Canada

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Mathematicians and Social Responsibility

Joseph Rotblat is a nuclear physicist who left the Manhattan Project in December 1944 when it was discovered that the Germans were not working on an atomic bomb. For a number of Manhattan Project physicists, fear that the Nazis might be building an atomic weapon had been a motivating factor in developing an American one. By 1944 over a thousand physicists were employed at the mesa above Santa Fe. In November of that year, an Allied intelligence mission determined that the German atomic effort was unsuccessful. (There had never been any real danger of a Japanese bomb.) Rotblat was the only one to leave Los Alamos when there was still time to write a different history for the century.

When the war ended, Rotblat transformed his scientific research to medical physics, and he began to pursue nuclear disarmament. In December 1995 Rotblat and Pugwash, an organization he helped found, were jointly awarded the Nobel Peace Prize for their efforts to eliminate nuclear weapons. Pugwash is a movement that seeks to involve scientists, representing only themselves, and meeting and talking as scientists, in the issues of our day. Pugwash scientists shaped the partial test ban treaty, facilitated international treaties on chemical and biological warfare, and aided the transition to the peacetime economy that the end of the Cold War has made possible.

When I heard of Rotblat's award, I thought to write about mathematicians' social responsibility. At first I found the issue elusive. It is clear why physicists, chemists, biologists, should be concerned with the social consequences of their work. It is much more clear how questions of social responsibility apply to mathematicians. Some of us, it is true, work in applied areas, and there, whether the problems are reliability of telephone networks, or fluid flow over airplane wings, issues of social responsibility are clear. But many of the AMS membership are pure mathematicians employed in universities. Where does social responsibility lie when the output is a theorem about an abstraction?

As it so often does, the solution to the conundrum lies in its very center. As mathematicians we revel in abstraction. Many of us argue that unlike the situation with physicists, chemists, biologists, geologists, what we do has little to do with the real world. Yet in the same breath, almost all of us would argue that mathematicians are scientists.

It doesn't cut both ways. If we are scientists, if we view our work as important to the world, then we have obligations too. Our obligations extend beyond teaching calculus to freshmen.

They include responding to The Bell Curve as mathematicians, and unraveling the arguments behind the statistical claims in the book. Our obligations include examining the mathematics of Star Wars, and explaining, as David Parnas did, the complexities of establishing the correctness of millions of lines of computer code. Our responsibilities extend to preparing the biology students for the work they will actually do (rather than giving them a standard calculus course with the odd population biology example thrown in). Our obligations include providing programs, as Uri Triesman and others have done, that enable members of underrepresented groups to succeed in mathematics, and in science.

We can't pretend on the one hand to be protected from the mundane day-to-day, and on the other, argue that mathematics is fundamental and deserves wide support. Without doubt, these broadening efforts distract from the business of proving theorems; there are only twenty-four hours in a day. But as mathematicians, as scientists, we have an obligation to give back. Society has given us a marvelous freedom to pursue flights of fancy and call it work. Mathematicians are in a unique position of being able to understand and critique many complex social problems and solutions, from Lani Gunier's proposals about voting, to Ronald Reagan's Star Wars. We have a responsibility to do so.

—Susan Landau

1A recent popular book that argues class structure in the United States is based on intelligence, and that racial differences in IQ measurement are determined largely by genetics.
Letters to the Editor

Adjunct and "Regular" Faculty
Andy Magid’s editorial (Notices 43 (1996), p. 1324) raises a very important issue. This issue is the widespread use of adjunct faculty to teach undergraduate mathematics courses. His description understates the magnitude of the problem.

He notes that "...a disturbing trend to 'outsource' the teaching of entry-level core mathematics to adjuncts... has been proposed and sometimes implemented in a number of institutions." The use of adjuncts is very widespread. I know of no reliable data but would estimate that more than half of the institutions that teach undergraduate mathematics use adjuncts. At a well-respected local community college there are seventeen regular faculty and thirty-seven adjunct faculty in the mathematics department.

Magid also makes the assumption that every "regular" instructor is a better teacher than every adjunct instructor for all math courses. He says, "...mathematics is best taught by mathematicians, where we define the latter as having experience in and ongoing commitment to mathematical scholarship... The mathematics courses taught by substitute faculty are defective products." His assumption is that no adjunct instructor is a mathematician (by his definition) and all regular faculty are mathematicians (by his definition).

Thus, every math course taught by an adjunct instructor is "defective," and every math course taught by a regular instructor is not "defective." This is too gross a generalization for anyone to really believe. I suspect the percentage of regular faculty who are lousy teachers is about the same as the percentage of adjunct faculty who are lousy teachers. (If an adjunct faculty instructor is a poor instructor, at least that individual can be fired or not rehired.)

In any event, it is the mathematics departments (in most cases) that make the hiring and firing decisions for the adjunct faculty. If adjunct faculty are so bad, why were they hired?

The real tragedy in all this is the exploitation of the adjunct faculty. My experience is that the going pay rate for a one-semester undergraduate mathematics course is about $2,000. This includes no benefits, no office space, and no clerical support. It does include a text, a syllabus, and a map of the campus. If we assume one three-unit course is a quarter-time load, then 10 hours per week or 150 hours for the semester would be a good estimate for the number of hours required to teach such a course. (This may even include a few hours for mathematical scholarship.) The pay for this is $2,000. However, this is without benefits. Assuming a reasonable benefits package is worth about 40 percent of salary, this would be equivalent to a salary of $1,429 with benefits. This comes out to $9.53 per hour.

The editorial’s title is “Boycott Cut-Rate Mathematics Instruction!” Better titles would be “Boycott Lousy Mathematics Instruction” or “Equal Pay for Equal Work”.

Stan Benkoski
Wagner Associates
(Received November 4, 1996)

Editor’s Note
John D. Fulton, author of the 1996 AMS-IMS-MAA Annual Survey (Notices, December 1996, pp. 1493–1500) was incorrectly identified as provost at Virginia Polytechnic Institute. His actual title is vice-provost. His e-mail address is fultonj@vt.edu.

Erratum
Hyman Bass’s paper “Mathematicians as Educators” (Notices, January 1997, pp. 18–21) was presented at a May 17–19, 1996, Board on Mathematical Sciences workshop, and is part of the (to appear) workshop summary report “Actions for the Mathematical Sciences”. Copyright 1997 by the National Academy of Sciences. Courtesy of National Academy Press, Washington, D.C.
Some Old Problems and New Results about Quadratic Forms

William Duke

Introduction
It may be a challenging problem to describe the integer solutions to a polynomial equation in several variables. Which integers, for example, are represented by a quadratic polynomial? This question has a rich and complex history, and the theory it has motivated is still flourishing today. My aim in this article is to describe some recent developments in this theory, especially about positive quadratic forms in three variables, and to introduce the nonexpert to some of its basic themes. Let us begin with a classical and easily described example.

An Assertion of Fermat
As early as 1638 Fermat made the statement that every number is a sum of at most three triangular numbers, four squares, five pentagonal numbers, and so on.1 In a letter to Pascal in 1654 he describes it as being so far his most important result. Much doubt has been cast upon his claim for a proof, especially for the case of

\[ m = \frac{n_1^2 + n_1}{2} + \frac{n_2^2 + n_2}{2} + \frac{n_3^2 + n_3}{2} \]

1 Triangular numbers are the numbers 1, 3, 6, 10, ..., \((1/2)(n^2 + n)\), ..., squares are 1, 4, 9, 16, ..., \(n^2\), ..., pentagonal numbers are 1, 5, 12, 22, ..., \((1/2)(3n^2 - n)\), ..., and hexagonal numbers are 1, 6, 15, 28, ..., \(2n^2 - n\), .... In general, the \(n\)th polygonal number of order \(k\) is given by the quadratic polynomial \((1/2)(k - 2)n^2 - (k - 4)n\). To simplify statements, we shall include 0 as a polygonal number.

2 For an authoritative discussion of the early history and references, see [24].
with nonnegative integers $n_1, n_2,$ and $n_3$. This is equivalent to the equation
$$8m + 3 = (2n_1 + 1)^2 + (2n_2 + 1)^2 + (2n_3 + 1)^2,$$
so Gauss's statement is equivalent to the statement that every number of the form $8m + 3$ is a sum of three odd squares. The more general theorem that a number is a sum of three squares precisely when it is not of the form $4b(8m + 7)$ for $b \geq 0$ was first published by Legendre in 1798, and this fundamental result was given a definitive proof by Gauss in his *Disquisitiones* in 1801. That every number is a sum of four squares was proved earlier by Lagrange in 1772 building on work of Euler. In 1813 Cauchy gave the first proof of Fermat's assertion in total by deriving it in an elementary (but involved) way from the three triangular number theorem. Cauchy's theorem is sharp in the sense that there are numbers which cannot be represented by fewer than $k$ polygonal numbers of order $k$, for example, $2k - 1$.

Some time later Dirichlet gave a beautiful formula for the number of ways in which $m$ can be expressed as the sum of three triangular numbers. In the special case that $8m + 3$ is a prime it says that this number is the excess of the number of quadratic residues (squares modulo $8m + 3$) over nonresidues modulo $8m + 3$ in the interval from 1 to $4m + 1$. A triangular number is an example of a polygonal number of order three. The $n$th polygonal number of order $k$ may be defined as the sum of the first $n$ terms of an arithmetic progression with first term 1 and common difference $k - 2$, and so is given by the quadratic polynomial $(1/2)[(k - 2)n^2 - (k - 4)n]$. As their name implies, polygonal numbers have a geometric origin. This may be seen in the accompanying figure (Figure 1). Quite a lot of early number theory was concerned with various properties of these and other geometrically related sequences [4].

It has recently been pointed out by Guy [11] that some interesting and difficult problems about representing integers as sums of polygonal numbers are still open. Without going into details, I will describe an example where some progress has recently been made on one of these old problems. Legendre, in the third edition of his *Théorie des Nombres* of 1830, proved by elementary means that every number larger than 1,791 is a sum of four hexadecimal numbers. The question arose whether or not three hexagonal numbers eventually suffice. Theorem 1 of [10] has the following application to this question.

**Theorem.** Every sufficiently large number is a sum of three hexagonal numbers.

Since the $n$th hexagonal number is $n(2n - 1)$, which is also the $(2n - 1)$st triangular number, this result is a kind of strengthening of the three triangular number theorem of Gauss. However, it has the drawback of being noneffective in the sense that an explicit bound for the largest number which is not a sum of three hexagons cannot be given at present, unless one is willing to assume conjectures like the Riemann hypothesis. We shall see the origin of this defect later.

Before going into the general problem of representation and some of the methods used to study it, I will first describe two more recent results about quadratic forms placed in their historical context.

**A Paper of Ramanujan**

In 1917 Ramanujan [16] published a paper which was to have a big impact on subsequent research on representations by quadratic forms. He considered the problem of finding all integers $0 \leq a \leq b \leq c \leq d$ for which every positive integer is represented in the form
$$ax_1^2 + bx_2^2 + cx_3^2 + dx_4^2.$$

An elementary (and amusing) case-by-case analysis shows that in order for $1,2,3,5$ to be represented, the first three terms $(a, b, c)$ must be $(1,1,1), (1,1,2), (1,1,3), (1,2,2), (1,2,3), (1,2,4)$, or $(1,2,5)$. None of the associated ternary forms $ax_1^2 + bx_2^2 + cx_3^2$ represents all numbers, the smallest exceptions being, respectively, 7, 14, 6, 7, 10, 14, and 10. This leaves 55 possible quaternary forms, and, based on simple rules for the integers represented by the above ternaries which Ramanujan discovered empirically, he concluded that these 55 forms actually do rep-
represent all numbers.\textsuperscript{4} It is natural to generalize Ramanujan's problem to other quadratic forms. An integer-valued \(m\)-ary positive quadratic form (or just a form) is a homogenous quadratic polynomial \(Q(x) = Q(x_1, x_2, \ldots, x_m)\) with integral coefficients which satisfies \(Q(x) > 0\) for real \(x \neq 0\). Such a form may be represented in matrix notation by \(Q(x) = x^t Ax\) where \(A = \frac{1}{2}Q(1,1,\ldots,1)\) is a positive symmetric matrix. If \(A\) has integer entries, then \(Q(x)\) may be called an integer-matrix form, for example, the diagonal form \(ax_1^2 + bx_2^2 + cx_3^2 + dx_4^2\). Perhaps the final word on the subject of forms which represent all positive numbers has been given very recently by Conway and Schneeberger, who have provided the following elegant characterizations.

\textbf{Theorem [2].} If a positive integer-matrix quadratic form represents each of

\[1, 2, 3, 5, 6, 7, 10, 14, 15,\]

then it represents all positive integers.

\textbf{Conjecture.} If a positive integer-valued quadratic form represents each of

\[1, 2, 3, 5, 6, 7, 10, 13, 14, 15, 17, 19, 21, 22,\]
\[23, 26, 29, 30, 31, 34,\]
\[35, 37, 42, 58, 93, 110, 145, 203, 290,\]

then it represents all positive integers.

These statements are sharp in the sense that the form \(x_1^2 + 2x_2^2 + 5x_3^2 + 5x_4^2\) represents all numbers but 15, while \(4x_1^2 + x_1x_2 + x_2^2 + x_2x_3 + 2x_4^2 + 29x_4x_5 + 29x_5^2\) represents all but 290. They expect that their conjecture will soon be a theorem.

In his paper [16] Ramanujan also introduces the problem of finding the \(ax_1^2 + bx_2^2 + cx_3^2 + dx_4^2\) that represents all sufficiently large integers, a problem he refers to as being \textit{much more difficult and interesting}. This problem was essentially solved by Kloosterman [14] in 1926. Kloosterman's paper represents a major breakthrough, for in it he refined the circle method in a way that allowed him to obtain a qualitative result about representations by quaternary forms from a certain estimate for what is now known as a Kloosterman sum. In its simplest incarnation this is the finite sum

\[
K(n, p) = \sum_{d=1}^{p-1} e^{2\pi i n(d+\alpha)/p}
\]

for prime \(p\) and integral \(n\) not divisible by \(p\), where \(d\) is the multiplicative inverse of \(d\) modulo \(p\). Kloosterman's estimate, which was enough for the application to quaternary quadratic forms, was later superceded by Weil's best possible estimate

\[
|K(n, p)| \leq 2\sqrt{p}
\]

obtained as a consequence of the Riemann Hypothesis for curves.

Ramanujan's paper has also stimulated much work on the still-more-difficult theory for ternary forms. In a footnote he wrote that \textit{the even numbers which are not of the form \(x^2 + y^2 + 10z^2\) are the numbers \(4^k(16\mu + 6)\), while the odd numbers that are not of that form}, viz.,

\[3, 7, 21, 33, 43, 67, 79,\]
\[87, 133, 217, 219, 223, 253, 307, 391\ldots\]

\textit{do not seem to obey any simple law}. Dickson confirmed the observation about even numbers by a simple argument, but the problem of whether there are infinitely many odd numbers that are not represented remained open until recently. It follows from [10] that

\textbf{Theorem.} The set of odd numbers not represented by Ramanujan's form

\[x_1^2 + x_2^2 + 10x_3^2
\]

is finite.

Once again, the proof of this result does not yield an explicit bound for the number of exceptions. Actually, Ramanujan's list of exceptions is not complete and two more exist: 679 and 2,719. In an impressive recent paper, Ono and Soundararajan [15] have shown that if one assumes certain Riemann Hypotheses, then these are actually all.

\textbf{The Problem of Representation}

The above examples belong to the general problem of understanding which positive integers \(n\) are represented by a given integer-valued positive form \(Q(x_1, \ldots, x_m)\) for integral vectors \(x\), how many such vectors there are, and how these vectors are distributed.

A necessary condition for the integral solvability of \(n = Q(x)\) is that the congruence \(Q(x) \equiv n (mod q)\) have a solution for all positive integers \(q\) or, in other words, that \(n\) be represented over the \(p\)-adic integers for all \(p\). The local representability of \(n\) by \(Q(x)\), that is, the solvability of these congruences, does not in general guarantee the existence of an \textit{integral} solution to \(Q(x) = n\) unless we replace the individual form by a certain equivalence class of forms, the genus. The notion of a genus of forms was first introduced by Gauss in the binary case. To de-
fine it, first say that two forms $Q_1$ and $Q_2$ are equivalent over $\mathbb{Z}$ if there is a $U \in GL(m, \mathbb{Z})$ so that $U^t A_1 U = A_2$ for the associated matrices. Two (positive) forms $Q_1$ and $Q_2$ are said to belong to the same genus if, for each $q$, $Q_1$ is equivalent over $\mathbb{Z}$ to a form which is congruent modulo $q$ to $Q_2$. Another way of saying this is that $Q_1$ and $Q_2$ are equivalent over the $p$-adic integers for all $p$. Two forms equivalent over $\mathbb{Z}$ represent the same integers. This is not true for binary forms in the same genus tend to represent all integers for all $n$ as a sum of four squares is eight times the sum of those divisors of $n$ which are not multiples of four. In particular, it is never zero!

A theta series defines a holomorphic function on the upper-half plane $\mathcal{H}$ having the real line as a natural boundary. While its Fourier coefficients encode the integral representation properties of $Q(x)$, its behavior near the rational points encodes the local representation properties of $Q(x)$. The basic idea of the circle method is to approximate $\theta(z)$ by a function with similar behavior at the rational points $a/c$ and then compare Fourier expansions. This idea leads one to attempt to approximate $r(n)$ for $n > 0$ by an infinite series

$$
\rho(n) = c_Q \cdot n^{m/2 - 1} \sum_{c > 0} A_c(n)
$$

where $A_c(n)$ is a certain finite exponential sum and $c_Q$ is a positive constant depending on the form $Q$.

This series is called the singular series, since it arises from the rational singularities of $\theta(z)$. It has a remarkable relation with the local solvability of $Q(x) = n$. Let $r(n, q)$ be the number of solutions of the congruence $Q(x) \equiv n \pmod{q}$. It is shown that there is a product representation $\sum A_c(n) = \prod_p A_p(n)$ where $A_p(n)$ is the $p$-adic density of representation which is given by the stabilizing limit $A_p(n) = \lim_{q \to \infty} r(n, q)/q^{m-1}$. The series and product converge (absolutely if $m > 3$) to a nonzero limit exactly when we have local solvability.

In general, the analytic approach to the problem of integral representation is to write

$$
\rho(n) = \rho(n) + a(n)
$$

and try to estimate $a(n)$ from above and $\rho(n)$ from below when it is not zero.

It turns out that the only obstruction to $\rho(n)$ being essentially as large as $n^{m/2 - 1}$ when it is not zero is the possible existence of primes $p$ for which $Q(x)$ does not represent zero $p$-adically, which means that for some $a$, $Q(x) \equiv 0 \pmod{p^a}$ implies that $x \equiv 0 \pmod{p}$. No such $p$ exists when $m > 4$, so one has $\rho(n) \geq cn^{m/2 - 1}$, for some positive constant $c$. Jacobi was the first to exploit theta functions for representation problems. For $Q_4(x) = x_1^2 + x_2^2 + x_3^2 + x_4^2$, for example, he gave the nice identity

$$
\theta(z) = 1 + 8 \sum_{n \geq 1} \frac{ne(nz)}{1 + (-1)^n e(nz)}
$$

obtained by using the theory of elliptic functions. By expanding each term in the sum as a geometric series and then collecting together the coefficients of $e(nz)$, it can be seen that the number of representations of $n$ as a sum of four squares is eight times the sum of those divisors of $n$ which are not multiples of four. In particular, it is never zero!

A theta series defines a holomorphic function on the upper-half plane $\mathcal{H}$ having the real line as a natural boundary. While its Fourier coefficients encode the integral representation properties of $Q(x)$, its behavior near the rational points encodes the local representation properties of $Q(x)$. The basic idea of the circle method is to approximate $\theta(z)$ by a function with similar behavior at the rational points $a/c$ and then compare Fourier expansions. This idea leads one to attempt to approximate $r(n)$ for $n > 0$ by an infinite series

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$$

where $A_c(n)$ is a certain finite exponential sum and $c_Q$ is a positive constant depending on the form $Q$.

This series is called the singular series, since it arises from the rational singularities of $\theta(z)$. It has a remarkable relation with the local solvability of $Q(x) = n$. Let $r(n, q)$ be the number of solutions of the congruence $Q(x) \equiv n \pmod{q}$. It is shown that there is a product representation $\sum A_c(n) = \prod_p A_p(n)$ where $A_p(n)$ is the $p$-adic density of representation which is given by the stabilizing limit $A_p(n) = \lim_{q \to \infty} r(n, q)/q^{m-1}$. The series and product converge (absolutely if $m > 3$) to a nonzero limit exactly when we have local solvability.

In general, the analytic approach to the problem of integral representation is to write

$$
\rho(n) = \rho(n) + a(n)
$$

and try to estimate $a(n)$ from above and $\rho(n)$ from below when it is not zero.

It turns out that the only obstruction to $\rho(n)$ being essentially as large as $n^{m/2 - 1}$ when it is not zero is the possible existence of primes $p$ for which $Q(x)$ does not represent zero $p$-adically, which means that for some $a$, $Q(x) \equiv 0 \pmod{p^a}$ implies that $x \equiv 0 \pmod{p}$. No such $p$ exists when $m > 4$, so one has $\rho(n) \geq cn^{m/2 - 1}$, for some positive constant $c$, Jacobi was the first to exploit theta functions for representation problems. For $Q_4(x) = x_1^2 + x_2^2 + x_3^2 + x_4^2$, for example, he gave the nice identity

$$
\theta(z) = 1 + 8 \sum_{n \geq 1} \frac{ne(nz)}{1 + (-1)^n e(nz)}
$$

obtained by using the theory of elliptic functions. By expanding each term in the sum as a geometric series and then collecting together the coefficients of $e(nz)$, it can be seen that the number of representations of $n$ as a sum of four squares is eight times the sum of those divisors of $n$ which are not multiples of four. In particular, it is never zero!

A theta series defines a holomorphic function on the upper-half plane $\mathcal{H}$ having the real line as a natural boundary. While its Fourier coefficients encode the integral representation properties of $Q(x)$, its behavior near the rational points encodes the local representation properties of $Q(x)$. The basic idea of the circle method is to approximate $\theta(z)$ by a function with similar behavior at the rational points $a/c$ and then compare Fourier expansions. This idea leads one to attempt to approximate $r(n)$ for $n > 0$ by an infinite series

$$
\rho(n) = c_Q \cdot n^{m/2 - 1} \sum_{c > 0} A_c(n)
$$

where $A_c(n)$ is a certain finite exponential sum and $c_Q$ is a positive constant depending on the form $Q$.

This series is called the singular series, since it arises from the rational singularities of $\theta(z)$. It has a remarkable relation with the local solvability of $Q(x) = n$. Let $r(n, q)$ be the number of solutions of the congruence $Q(x) \equiv n \pmod{q}$. It is shown that there is a product representation $\sum A_c(n) = \prod_p A_p(n)$ where $A_p(n)$ is the $p$-adic density of representation which is given by the stabilizing limit $A_p(n) = \lim_{q \to \infty} r(n, q)/q^{m-1}$. The series and product converge (absolutely if $m > 3$) to a nonzero limit exactly when we have local solvability.

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when it does not vanish. (It is conventional in ana­
lytic number theory to write this as \( \rho(n) \gg n^{m/2-1} \), the positive constant \( c \) then being referred to as the implied constant.) For \( m = 3 \) and \( m = 4 \) such \( p \) may exist, but they are readily determined divisors of \( D \). If we restrict the powers to which such primes divide \( n \), then for \( \rho(n) \neq 0 \) we have the bound \( \rho(n) \gg n/\log(\log n) \) when \( m = 4 \), and for any \( \epsilon > 0 \) the bound \( \rho(n) \gg n^{1/2-\epsilon} \) when \( m = 3 \). The latter is a consequence of a theorem of Siegel [21] and is noneffective in the sense that no way of specifying the implied constant for a given \( \epsilon > 0 \) is known. This is the origin of the noneffectivity in our applications to ternary forms, and to remove it is a major unsolved problem in number theory. If one assumes the Riemann hypoth­
thesis for Dirichlet \( L \)-functions, then an ef­
ficive lower bound can be given for the case \( m = 3 \).

As for upper bounds for \( a(n) \), the circle method quickly yields the bound \( |a(n)| \ll n^{m/4} \), and this is enough to give the following result of Tartakowsky.

**Theorem** [22]. For forms in five or more vari­
ables, every sufficiently large number \( n \) that is
represented \( \pmod{D} \) is integrally represented.

For \( m = 4 \) the above bound for \( |a(n)| \) no longer suffices (just), and it is here that Kloosterman made his breakthrough by improving the estimate for \( a(n) \) and thus extending the above theorem to quaternary forms, provided that the powers to which certain primes divide \( n \) are re­
stricted or that only primitive representations are considered. The (primitive) representation the­
orem for forms in four or more variables has also been proved using algebraic methods (see [1]). For ternary forms a deeper barrier exists, and to overcome it so far only the analytic approach has been fully successful. To this end it is natural to exploit the relation between quadratic forms and modular forms.

**Fourier Coefficients of Modular Forms**

The central role of modular forms in the study of quadratic forms, after being hinted at by Hardy and Ramanujan, was made very clear by Hecke and Siegel. This is based on the fact that the theta function \( \vartheta(z) \) satisfies the transformation rule (for \( \gamma \in \Gamma \), a certain congruence sub­
group of the modular group)

\[
\vartheta \left( \frac{cz + d}{cz + d} \right) = \chi(y)(cz + d)^{m/2} \vartheta(z),
\]

\[
y = \begin{pmatrix} a & b \\ c & d \end{pmatrix}
\]

for a certain multiplier \( \chi(y) \), which may be given explicitly. The same is true for the function

\[
E(z) = \sum_{n \geq 0} \rho(ne^{inz}), \quad \rho(0) = 1,
\]

which has by construction the same behavior as the theta function at the rationals. This means that the difference \( f(z) = \vartheta(z) - E(z) = \sum_{n \geq 1} a(n)e^{inz} \) is a holomorphic function on \( \mathcal{H} \) that satisfies the same transformation rules but which has the property that the function \( y^{m/4}|f(z)| \), which is well defined on the quotient \( \Gamma \backslash \mathcal{H} \), is bounded there. In other words, \( f(z) \) is a cusp form of weight \( m/2 \). The problem of bounding \( a(n) \) from above is the problem of bounding a Fourier coefficient of a cusp form.

The mere boundedness of \( y^{m/4}|f(z)| \) is enough to give the estimate \( a(n) \ll n^{m/4} \), which is also the trivial bound from the circle method. It was found independently by Rankin, Selberg, and Petersson that there is an elegant reformulation of the circle method based on Poincaré series and simple \( L \)-theory which encompasses the re­
finement made by Kloosterman. It gives the fol­
lowing estimate, which invites comparison with the singular series (1):

\[
|a(n)|^2 \ll n^{m/2-1} \sum_{c \mid n} c^{-1} K(n, c) J(n/c).
\]

Here \( K(n, c) \) is the Kloosterman sum

\[
K(n, c) = \sum_{\xi \mod{c}} \chi(y)e(n(a + d)/c),
\]

the sum being over \( y \in \Gamma \) with \( 0 < a, d < c \), and \( J \) is a Bessel function, of which the Kloosterman sum is a finite version. Now the Kloosterman sum is over roughly \( c \) terms, and any bound of the form \( K(n, c) \ll c^{1-\delta} \) with \( \delta > 0 \) yields, upon splitting the sum in (2) at \( c = n \) and using \( J(x) \ll \min(x^{m/2-1}, x^{-\delta/2}) \), the estimate \( a(n) \ll n^{m/4-\delta/2} \). For even \( m \) the multiplier \( \chi = 1 \) and each Kloosterman sum which occurs in (2) can be written

\[
K(n, c) = \sum_{d \mod{c}, (c, d) = 1} e(n(d + d)/c)
\]

where \( d \) is the multiplicative inverse of \( d \) mod­
ulo \( c \). For its estimation Kloosterman showed that one may take any \( \delta < 1/4 \), and later Weil showed that one may take any \( \delta < 1/2 \) as a consequence of the Riemann Hypothesis for curves, this result being best possible. For \( m \) odd the multiplier \( \chi \neq 1 \) and this circumstance actually allows any \( \delta < 1/2 \) to be obtained rather easily, as Salie observed.

Another way to get a nontrivial bound for \( a(n) \) is by the Rankin-Selberg method [20]. For even \( m \) (i.e., integral weights) the problem of es­
timating \( a(n) \) was completely solved by Deligne.
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It is perhaps less well known that for odd \( m \)-that is, for the half-integral weight \( m/2 \)-the same bound is conjectured to hold for square-free \( n \). This half-integral weight Ramanujan conjecture is open, but it does follow from the Riemann Hypothesis for certain global \( L \)-functions. Until 1987 the best-known estimate for odd \( m \) was that corresponding to Weil's bound for Kloosterman sums:

\[
a(n) \ll n^{m/4-1/4+\varepsilon}.
\]

Any improvement of this is precisely what is needed for the representation problem for ternary forms, since the exponent \( m/4 - 1/4 = 1/2 \) just fails to beat the lower bound of Siegel for the singular series.

In 1987 a breakthrough was made by Iwaniec [12] in the half-integral weight case. In this paper he succeeded in reducing the exponent \( m/4 - 1/4 \) for odd \( m \geq 3 \) and square-free \( n \). Shortly thereafter, his methods were extended to cover the case \( m = 3 \), and applications to ternary quadratic forms, both definite and indefinite, were made [6, 7]. An excellent exposition of Iwaniec's method is given by Sarnak in [18].

In fact, there exist cusp forms of weight 3/2 that attain the bound \( |a(n)| \geq cn^{1/2} \), but they are supported on finitely many square classes. This new difficulty was discovered in the context of the quadratic forms by Jones and Pall [13]. The concept of spinor genus was used to identify these pseudo-cusp forms locally in [19], and a spinor genus version of the representation theorem for ternary forms is given in [10]. The following is an easily stated corollary.

**Theorem.** Every sufficiently large square-free integer that is represented by a ternary form \((mod D^2)\) is integrally represented.

To reiterate, there is no known way to estimate effectively the largest possible exception without assuming certain Riemann hypotheses. This result was conjectured by Ross and Pall [17] and also by Watson [23]. Watson established several interesting results about the integers that are locally represented but not integrally represented by a ternary form.

As alluded to earlier, a rather different approach to the ternary representation problem is possible by relating the Fourier coefficients to special values of \( L \)-functions. After the fundamental work of Shimura and Waldspurger, reducing the Weil exponent for the Fourier coefficients amounts to breaking convexity for a twisted automorphic \( L \)-function. In this context, breaking convexity means reducing the estimate provided by the functional equation and the Phragmén-Lindelöf theorem for the size of the \( L \)-function at the central critical point in terms of the twist. The papers [8] do break convexity for these \( L \)-functions as well as others and thus yield new proofs of the ternary representation theorems. Yet another approach has been given in [9].

The third aspect of the problem of representation entails understanding the way in which the representing vectors \( x \) are distributed on the ellipsoid \( Q(x) = n \) and in arithmetic progressions to a fixed modulus. This is what is needed, for example, to prove results about representing numbers as sums of polygonal numbers. The methods described in this article also apply to this distribution problem, for the appropriate harmonics needed to detect such distribution may be built into the theta series. Roughly speaking, the general result is that, even when restricted to certain progressions, the representing vectors become uniformly distributed on the ellipsoid \( Q(x) = n \) as \( n \) gets large, provided they are numerous enough. For references on the distribution aspect of the representation problem and details on the ternary case, the reader may consult [10].

**Acknowledgments**

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**References**

The Emergence of the American Mathematical Research Community, 1876–1900:
J. J. Sylvester, Felix Klein, and E. H. Moore
Karen Hunger Parshall, University of Virginia, Charlottesville, and David E. Rowe, University of Mainz, Germany

...fine and extensive account of the growth of mathematics in the United States...completed by a fine bibliography and index...

In an excellent way this book gives an incredible amount of details never losing sight of the whole. Thirty tables and a subject index make information easy...many photos, some of them being published for the first time...a sound and high quality investigation.

—Zentralblatt für Mathematik

This fascinating book is a contribution to the history of American science...For those of us who have made our careers in American mathematics and are interested in understanding our intellectual heritage, it is essential reading.

—Mathematical Reviews

This volume traces the transformation of the United States from a mathematical backwater to a major presence during the quarter-century from 1876 to 1900. Presenting a detailed study of the major figures involved in this transformation, it focuses on the three most influential individuals and the principal institutions with which they were associated: British algebraist James Joseph Sylvester, Johns Hopkins University; German standard-bearer Felix Klein, Göttingen University; and American mathematician Eliakim Hastings Moore, University of Chicago. This book further analyzes the research traditions these men and institutions represented, the impact these had on the second generation of American mathematical researchers, and the role of the American Mathematical Society in these developments. This is the first work ever written on the history of American mathematics during this period and one of the few books that examines the historical development of American mathematics from a wide perspective. By placing the development of American mathematics within the context of broader external factors affecting historical events, the authors show how the character of American research was decisively affected by the surrounding scientific, educational, and social contexts of the period. Aimed at a general mathematical audience and at historians of science, this book contains an abundance of unpublished archival material, numerous rare photographs, and an extensive bibliography.

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[22] W. T. Tarnatowsky, Die Gesamtheit der Zahlen, die durch eine quadratische Form \( F(x_1, x_2, \ldots, x_n) \) darstellbar sind, Bull. Acad. Sci. URSS 7 (1929), 111–122.


This is the third in a series of articles composed from responses of mathematicians, mathematics educators, and teachers of mathematics to a set of questions on secondary education in mathematics. The present article contains responses primarily from high school mathematics teachers. The questions posed were:

1. When you consider what high school graduates should understand about mathematics, what do you care about most?
2. What do you think should be essential features of every high school mathematics curriculum?
3. How would we know when high school mathematics education is working well?
4. What do you think is most important in the mathematical background, attitude towards mathematics, and pedagogical approaches of high school mathematics teachers?
5. What are your expectations of higher education in mathematics (a) for your own students as they go on to colleges and universities and (b) for prospective mathematics teachers?

The articles are inspired by the efforts of Al Cuoco and Wayne Harvey of Education Development Center, Inc., to increase the involvement of mathematicians in high school mathematics education. Their work has resulted in a project funded by the National Science Foundation and entitled "Building on Strengths: Stimulating Cooperation among Mathematicians and Mathematics Educators". The highlight of the project is a national meeting to be held in the spring. For further information on the project, visit the Web site http://www.edc.org/LLT/BOS/.


The names of the respondents and their affiliations are: Joshua Abrams, Massachusetts Academy of Mathematics and Science, Worcester, MA; Judith Broadwin, Jericho High School, Jericho, NY; Maureen Burkhart, John Marshall High School, Los Angeles, CA; Janice A. Bussey, Tracy High School and Merrill F. West High School, Tracy, CA; Carol Castellon, University Laboratory High School, Urbana, IL; Loring Coes, Rocky Hill School, East Greenwich, RI; Arnie Cutler, Geometry Center, Minneapolis, MN; Margaret DeArmond, East Bakersfield High School, Bakersfield, CA; Walter R. Dodge, New Trier High School, Winnetka, IL; Boyd E. Hemphill, John Cooper School, The Woodlands, TX; Diana Herrington, Clovis High School, Clovis, CA; Jo Ellen Hillyer, Newton North High School, Newton, MA; Dan Kennedy, Baylor School, Chattanooga, TN; Cynthia Lanius, Milby High School, Houston, TX; John R. Lassen, Mountain Pointe High School, Phoenix, AZ; Catherine Latham, Lynn English High School, Lynn, MA; Johnny W. Lott, SIMMS Project, University of Montana, Missoula; Philip R. Mallinson, Phillips Exeter Academy, Exeter, NH; Eleanor Palais, Belmont High School, Belmont, MA; Stephanie J. Peterson, Chandler High School, Chandler, AZ; Susan S. Roosendaal, Northfield High School, Northfield, MN; Michael Sherman, Belmont Hill School, Belmont, MA; Jackie Sullivan, Clovis High School, Clovis, CA; Wendy Tokumine, Farrington High School, Honolulu, HI; Zalman Usiskin, University of Chicago School Mathematics Project, Chicago, Illinois.

— Allyn Jackson and Hugo Rossi
1. When you consider what high school graduates should understand about mathematics, what do you care about most?

DAN KENNEDY: I want my students to understand that mathematics is widely applicable, quite beautiful, and very much a work in progress. I want them to recognize that creativity plays a role and that the connections between models are as important as the models themselves. I want them to know how to use technology to explore, logic to verify, and language to explain their ideas. I also want them to believe that mathematics is accessible. I am much less concerned than I used to be about computational skills and the necessity of having them before doing anything significant.

JO ELLEN HILLYER: I care most that high school graduates understand that mathematics is accessible. I want students to know that they can “do” mathematics. Currently, such self-confidence is shared by a painfully small minority of our high school population. Large numbers of students dutifully go through the paces, earning quite acceptable grades. Yet when they are confronted with a problem that bears little resemblance to problems they have seen before, there is a nearly universal conviction that the solution is a mystery that cannot be cracked by ordinary mortals such as they....

JOHN R. LASSEN: Considering the range of students’ abilities, interests, and plans for post-high school activities, I suppose it would have to be “problem solving”. I think all students, whatever their level, should be able to solve problems. I am not referring to the traditional method of students mimicking a method for types of problems that a teacher has shown them “how to do”. I’m talking about a systematic approach used to solve problems that they have not seen before.

JUDITH BROADWIN: High school graduates should be able to apply the mathematics that they have learned to the solution of problems. Even at this date, more than five years after the publication of the NCTM Standards, many students still think that algebra is mathematics. Students should be able to solve problems algebraically, graphically, numerically, and verbally. They should understand that a problem does not solve itself at a glance and that they must think through a solution, applying all the mathematics that they have learned. Most important, they should be encouraged to collaborate with other students in the solution of problems and the creation and completion of projects.

PHILIP R. MALLINSON: I would hope that having studied mathematics for twelve years, a student would face a completely unfamiliar problem with equanimity. He (my hypothetical high school graduate is male for purely literary reasons) would have developed a toolkit of mathematical and problem-solving strategies that would enable him to weigh the problem thoughtfully; to walk around the problem, surveying it, getting to understand it, prodding it, looking for possible entry points, trying out simpler versions, comparing it to similar problems solved in the past, asking friends, breaking it down into manageable chunks rather than tossing it back like a grenade. I hope that our hypothetical graduate would understand that mathematics is not a collection of tricks and formulas, but is a process that has been refined for thousands of years by some of the finest intellects of the age....

BOYD E. HEMPHILL: I care about what each kid is planning to do with what I teach.

For college-bound students I try to serve the needs of their majors. If I have a student who plans to be a doctor, I pull questions from biology. If I have students who will major in business, I pull questions from mathematical finance.

For the non-college-bound, I do essentially the same thing. If a kid plans to sell cars, we compute interest, tax, commission, etc. Depending on the kid we may even write a simple computer program to keep track of these things.

In short, what is most important is that they understand that real mathematics exists in their future and that the particular topic of the curriculum I am teaching at the time is connected to that mathematics in some way.

SUSAN S. ROOSENRAAD: (a) All students should be able to work with numbers and be reasonably adept at arithmetic. Many years in the classroom show me that students who have mastered the multiplication tables have a much easier time mastering algebra techniques because they “see” the arithmetic relationships present in the problem. Students without good arithmetic skills are forced to do algebra as a rigid set of rules applied in an arbitrary manner. These arithmetic skills of the students should include fractions, decimals, percents, and the ability to move between forms with ease and accuracy. I would want all students to have a well-developed number sense.

(b) High school work should reinforce these number skills while building algebra skills. There are certain skills (lists vary from teacher to teacher) that all students with a high school diploma should have. In addition to being able to perform various algebraic techniques, the student should understand what he/she is doing and why.
2. What do you think should be essential features of every high school mathematics curriculum?

LORING COES: A good high school must offer a diverse mathematics program that leads toward the fundamentals of calculus, discrete mathematics, and statistics. A high school should not be measured by how many of its students take Advanced Placement calculus. All schools must start with the assumption that all citizens—all future voters—need to understand more mathematics than in decades past. Therefore, all students need to see a higher standard of mathematics than we have had in the past. I am not advocating that all students be in the same courses, only that there be an appropriate, rich program for students at all levels of ability and background. In theory, tracking is a good idea because it can group people who can work at the same level. In practice, however, we have in too many instances a success track, taught by strong teachers to strong students, and a failure track, taught by weaker teachers to underachieving students. We need the strong courses obviously, but we also need to create programs that can spark the underachievers and that can position those students to take the strongest courses in their turn. We cannot have curricular deadends.

WENDY TOKUMINE: a) Know how to use a calculator (either scientific or graphing).

b) Have estimation skills for distances, weights, and time. Many students cannot make comparisons between two numbers because of weak estimation skills. Examples: weight of a head of cabbage, length of a room, time to drive from town to another place.

c) Develop a willingness in students to attempt new problems, using problem-solving skills.
skills learned and/or developed in the mathematics curriculum (guess/test, look for patterns, working backwards, etc.). Many students often give up too easily. They read a problem, decide it is too hard, and will not attempt it because they feel they will not succeed.

d) Develop decision-making skills based on data gathered and analyzed. Students should learn probability and statistics (on a very concrete level with models they can understand) and apply what they learn to make good decisions.

e) Develop a "joy of mathematics". So many students are turned off to math, feel they are dumb when it comes to math, and, even worse, feel that it is okay to feel this way. The curriculum should provide students opportunities to be successful in math and to enjoy doing math.

f) Develop mental math skills so that students can do simple calculations in their heads without the use of pencil and paper. Estimation is part of this area.

JOHNSON ABRAHAM: The only way to become good at solving real problems (problems which are unfamiliar) is to have continual practice. The only way to get good at posing new and interesting problems is to be required to do so. The best way to learn the mechanical skills of mathematics is to use them repeatedly in the service of answering questions which you want to resolve. (Dewey said that you do not learn the basics by studying the basics, but by engaging in projects that require the basics.) My students are usually engaged in projects or problem sets of one to four weeks in duration. They invariably pose questions far more difficult than I ever would for them. They care about these creations and become far better at basic algebra and geometry in the process than they would if we focused on rote exercises.

JOHNNY W. LOTT: The mathematics that all students should know is not what many normally get in a traditional secondary mathematics program. That mathematics should include a basic understanding of probability and statistics, especially statistics at a level where graphs and charts in common newspapers—yes, even USA Today—can be understood. The probability should be at a level where students can understand odds and probabilities so that they can understand lotteries and probabilities of baseball players getting hits in at bats. These involve very different types of expectations than those usually discussed. Further, students should understand some basic geometry and trigonometry at least of the triangular variety. By basic geometry I do not mean traditional proofs. I do expect all students to be able to present logical arguments for why they do what they do mathematically. In addition, I feel that every high school graduate should be familiar with technological tools that they will use outside school. The technological tools are just that. They aren't a substitute for mathematics, but students should know that just as word processors made writing somewhat easier, the technology can make some mathematics easier.

ZALMAN USISKIN: Any answer must include more than high school, because what is done before grade 9 has great impact on what happens in grades 9 through 12. It also must be general, because every school has its own mix of students, teachers, and community, and what works in one place may not work in another.

Every high school mathematics curriculum should prepare students not only for calculus but for college-level statistics and discrete mathematics, which may be taken by students before or along with calculus. For this, there needs to be a balance of work with algebra, geometry, functions, trigonometry, probability, statistics, discrete mathematics, and introductory analysis. The curriculum should have a balance of work studying algorithms, mathematical theory, applications, and representations; it should give students exposure to large numbers of routine exercises and nonroutine problems; and it should balance questions with short answers with those with longer answers, and some opportunity to work on projects that take more than an evening or two to complete. It should ensure that all students are familiar with the latest in calculator and computer technology for doing mathematics and exploring mathematical ideas.

Fifty years ago, even without teaching any applied mathematics and with only a smattering of mathematical theory, the first course in college was typically analytic geometry, not calculus. The evidence is that, except for the very best and most interested students, this cannot be done if the study of algebra begins in ninth grade, because we expect much more of students today than we did then. Algebraic ideas should begin in the early elementary grades, and a concentrated study of algebra should begin at seventh grade for better students and at eighth grade for average students.

Even courses for the best high school students should not be designed to weed out students, nor should they be designed with mathematics contests in mind...

DAN KENNEDY: I think that every high school curriculum should follow the four-year precalculus sequence, but with less emphasis on computational subtleties and more emphasis on modeling, problem solving, connections, and applications of technology. The algebra and the geometry should probably be integrated, but not before teachers and textbooks are ready. A healthy majority of students should begin the se-
from society at large to support education in a variety of ways. Family support is the initial condition. Adequate resources to support a quality education is next. Job opportunities for successful students must be available. The work of mathematics and mathematics-related careers must be understood and valued by society. The role of mathematics in being a productive citizen and understanding things like voting and budgeting must be advanced. When these factors are present, students will have motivation to be successful mathematics students. In effect, high school mathematics will be as successful as the society which surrounds the high school.

MARGARET DEARMOND: We never will know unless we agree on what is important and how we should hold the system accountable. If I teach my students problem-solving skills, topics other than algebra and geometry, and I require the use of graphing calculators, and then these students take placement tests at college that are based on the "old" curriculum, we will never know if the programs are working. We could show increased numbers of students taking more high school mathematics courses, but there is always going to be a cry that we have only lowered the standards. We—again, the entire mathematics education community—need to agree on what is important to teach and how we are going to measure student performance.

STEPHANIE J. PETERSON: When students demonstrate success (i.e., tests, grades, taking advanced courses, etc.) and when we can compete on an equal plane with other countries.

ZALMAN USISKIN: This is a difficult question with no simple answer. One criterion for success with an individual student coming out of school is that the student would want to take more mathematics even if it is not required by the field of study. Without wanting to take more mathematics, virtually everything is lost.

A related criterion is that the student have a realistic view of what mathematics is needed for certain areas of study. For instance, a student who thinks that the study of business requires little mathematics beyond introductory algebra has been poorly educated. As another example, a student who does not realize that political scientists should know a great deal about statistics and sampling is similarly deficient.

The criterion many people would put first is that the student be competent in the mathematics needed for the student’s field of study. This seems like an obvious criterion, but what is needed is not universally agreed upon, particularly in today's technology-rich environment. Is a student who uses a symbol manipulator such as Derive or Mathematica to factor polynomials worse off or better off than a student who relies on paper-and-pencil algorithms? Is a
student who uses a geometry-drawing program to explore the concurrency of bisectors of interior or exterior angles of a triangle spending time as productively as one who is proving that the bisector of the vertex angle in an isosceles triangle is also an altitude? One of the distinguishing features between high school and college mathematics is that there is almost always a time crunch, and the priorities may be more determined by philosophy than able to be determined by research studies....

JOHNNY W. LOTT: We would know that high school mathematics is working well if we have industry telling us that their new employees easily adapt to the mathematics that is necessary to do jobs. I would not base how well mathematics education is doing on how high school graduates do in college or university freshmen classes, because many of those are so antiquated that they are of no consequence in real mathematics. For example, many freshman classes are based upon what I call a junior high mathematics mentality of ten years ago. In the past, junior high mathematics was two more years of doing what you had done for the past six years with almost nothing new. That is the same type of mathematics in most freshman college classes. Also, the majority of college entrance tests and placement tests cannot be used as the judge and jury to evaluate high school programs. Virtually all of those are based upon algorithmic computation with little understanding of what should be in high school classes. A true evaluative instrument would be one that would pose a real problem that could be attacked with mathematics and technological tools where all assumptions have to be shown and where assessment takes into account those assumptions and the logical reasoning used to reach conclusions. Students should be able to write a summary of all the processes used to reach the solution.

JOSHUA ABRAMS: a) When all of our high school math teachers like math enough to study it independently, use some of their time at home to read about new math, play with mathematical problems, etc. No one would accept an English teacher who never read novels, but it is the norm for math teachers to have no connection to mathematics outside of the classroom.

b) When we can provide portfolios of our students' work that demonstrate their ability to use math productively.

JANICE A. BUSSEY: If all students of the high school population are completing the core mathematics sequence with passing grades, regardless of ethnicity, gender, or prior math experience, then the program is working well. If students are enjoying mathematics, seeing mathematics as important and relevant, and considering taking more mathematics than what is required, then the program is working even better. I am continually suspicious when I see mathematics programs which allow less able students to complete their high school math requirement by taking only general arithmetic courses and which never force them to get into the main-stream core mathematics sequence. I am suspicious when I see girls and minorities overwhelming some math classes, while white males are predominant in the higher math classes.

CYNTHIA LANIUS: Good question... when university professors say, "Wow, these students are brilliant; I can't believe how much they know...." Just kidding.... An accumulation of evidence, I suppose: test scores, universities not doing remediation, employers no longer having to retrain the work force.

ELEANOR PALAIS: Truly, not until you have some comparative data, i.e., some sort of national exam à la Europe.... What my colleagues and I have noticed is that our students are less good than they were five years ago and much less good than ten years ago. We measure our feelings by looking at our expectations of what they could or couldn't do on tests and assignments we used to give. In addition there is more pressure on teachers to pass students (pressure from parents to administrators). In the end, although we are not able to assert our professional expertise as to how to teach students, we are being held accountable for the outcomes of methods which some of us do not believe will work well. In our school we want empowerment to teach students in the very best way. We used to have four levels of math; for example, we taught our Algebra I in levels 2 and 3—the same material, but taught in very different ways. Now we have all these students together. It becomes impossible to teach the top (too many will fail), so both groups get the short end if we teach to the middle. Incidentally, in grading these students it still is very clear that they are made up of two distinct ability levels. We are also concerned with "algebra for all eighth-graders". We find many eighth-graders fail their first time through and aren't really ready to deal with the abstractions of algebra until they take it or retake it in ninth grade, when they often then end up with an A or a B.

CATHERINE LATHAM: I wish I knew the answer to this question. Traditional testing seems inadequate to measure this. I would think that a student's enthusiasm to elect mathematics courses when entering college would reflect a level of competence, comfort, and interest which would indicate high school mathematics is working well. When my daughter recently went to college, various tables were set up with members of academic departments available for ques-
4. What do you think is most important in the mathematical background, attitude towards mathematics, and pedagogical approaches of high school mathematics teachers?

DIANA HERRINGTON: I believe that high school mathematics teachers should have degrees in mathematics or equivalent degrees, with supplementary work in areas that utilize mathematics extensively: i.e., physics, biology, chemistry, computer programming, business, etc. As a district mathematics mentor teacher I am always amazed at how few of the mathematics teachers have actual degrees in mathematics and, of those with degrees in mathematics, how little they can apply mathematics. I know mathematics teachers with degrees in mathematics who have never seen a vector or a reason for teaching this concept. It surprises and bothers me that colleges/universities do not require courses to be taken that utilize mathematics even for the high school student. Science and mathematics teachers should work hand-in-hand to create the strongest students. Mathematics teachers should enjoy children as well as mathematics. With this attitude the pedagogical approach to teaching would become student centered and extremely interactive....

LORING COES: Mathematics teachers need to be experts in their field. They need mechanical skill and conceptual understanding. They need most of all to be mathematics enthusiasts, people who always show interest in mathematics problems and concepts. As teachers they need in some way to transfer their enthusiasm to students. I believe in the model of the teacher as a coach, on the sidelines with leadership, advice, strategies, and ideas, but where the students themselves really do the mathematics. On another level, teachers need to keep changing what they do and the courses they teach. There are too many teachers, I believe, who have been teaching the very same courses for a great many years. Doing so may be comfortable, but it must also be mind-deadening for both the teachers and for the students. Teachers must also have a sense of the culture and history of mathematics. I am bothered, for example, by teachers who are experts at simplifying radicals (say, changing the square root of 60 to 2 times the square root of 15) but who cannot explain why it was once important to do so. Teachers need perspective so they can better judge what is really important to know.

ZALMAN USISKIN: At Chicago we only train prospective mathematics teachers at the master's degree level, and we require a bachelor's degree or its equivalent. A broad mathematical background is essential...

Teachers must have a positive attitude toward their subject and toward what students can learn. They must also have a broad view of the subject; for example, teachers who think that geometry is worthless or that algebra is merely a bunch of rules or that everything is functions or that calculators should not be allowed in classrooms hurt students by distorting their education and narrowing their vistas. Teachers must also be tolerant of the differences among students that will affect student interest, student performance, and the amount that a student can work in the class.

We do not know what pedagogy or pedagogies work best for a given student, but we do know that students learn most when they are actively involved in their learning, when they are doing mathematics and talking about it rather than passively listening. Like adults, students need variety, so lecturing all the time or discussing all the time or putting students in groups all the time will not be as effective as variety. Furthermore, some mathematical topics lend themselves to lecture (e.g., definitions and summaries), others to group work (e.g., analyses of data), still others to discussion (e.g., alternate proofs), so it is not wise to think of only one approach as being paramount.

MAUREEN BURKHART: Teachers need to be able and willing to let go of their "control" in the classroom and let the students be in the spotlight. The learning has to be centered around the student rather than the teacher showing the way. Students need to learn how to enter a problem and figure out what the problem is asking, rather than be told. Then, the students have to figure out ways to solve the problem and also share them with the class. In this way, students (and the teacher!) will see the rich variety of problem-solving strategies available for arriving at the same answer. I feel a teacher's attitude toward mathematics has to have a sense of newness and wonder. Otherwise, how else will the students be able to show new ways of solving problems? In the past, teachers have been too willing to say, "This is the way to do the problem." There are too many other ways to solve a problem that oftentimes lead to bigger con-
cepts never realized before. So the teacher, as well as the students, has to have that sense that there is going to be something new for them to learn (I’m speaking from personal experience).  

DAN KENNEDY: High school teachers need first of all to want to reach all their students. It may sound corny, but all sorts of problems arise when this prerequisite is either lacking to begin with or else sublimated to achieve other goals. Second, they need a broad mathematical background that will enable them to guide their students through wide seas rather than narrow channels. Third, they must appreciate, use, and do mathematics in their own lives so that they can inspire their students to do the same. Fourth, they must be willing to look beyond their own mathematical upbringing to find more effective ways of getting their students to learn mathematics (such as group learning, student discovery, and alternate assessments). Finally, for sanity’s sake, they must understand children well enough to rise above their own emotions when dealing with those of their students.

JACKIE SULLIVAN: I’m a good one to answer this one, in my humble opinion! My math background consists of one year of calculus before I switched majors to accounting. I have a clear math credential because I passed the NTE in math. Despite my lack of college math courses, however, I feel I do a good job in my teaching, the reason being I have good math sense. I can often think through a problem better than some of my colleagues who have math degrees. I also have an intense interest in what math to use for solving which type of problem, and I try to develop that same interest in my students. A good math teacher should try to get his or her students excited about solving complex problems using the math they have learned. That will not happen unless the teacher is excited about it in the first place. The high school math teacher, however, also needs to realize that math is an extremely difficult subject for most kids, so there needs to be a lot of patience on the teacher’s part and willingness to try other approaches in teaching a concept.

ELEANOR PALAIS: ...[A] teacher must be perceived by society and, in particular, by school committees and administration as a strong and important member in a team and not a scapegoat or “low man on the totem pole”. In addition, I would like high school math teachers to be mathematicians first and education students second. … I would want teachers all to have the equivalent of a master’s course in pure mathematics. What many education schools now offer teachers for their credits toward postgraduate teaching are packaged quickie courses on discipline or cooperative learning, often a series of tapes, which offer little pedagogical enrichment in pure mathematics, which is necessary to pass on a love of or the ability to do good mathematics. Society should expect more of their teachers and in return should elevate them to positions of economic and professional power in their fields of expertise. Only then will mathematics in schools shine again.

WALTER R. DODGE: Number 1 is the total package of content to which our students are exposed. If there is no exposure, there is no possibility of the student acquiring the necessary mathematical knowledge. Beyond this, though, comes the very important ideas of attitude and pedagogy. All the content thrown at students is worthless if the students believe this content is not important for them to know. All the content is also worthless if students are not encouraged by teachers to reflect on the ideas, generalize them, use them in meaningful ways, and begin to see how they as students are capable of doing mathematics. Pedagogy is very important to the learning process and cannot be divorced from the content of mathematics. Again, though, pedagogy devoid of meaningful mathematics is also worthless. It is the interplay of a strong content base presented in an interesting and meaningful manner that creates the strongest curriculum possible.

MICHAEL SHERMAN: I have been teaching math in various settings for twenty-five years, and I think the most important quality of a math program, a math teacher, a math curriculum, and a math student is enthusiasm! If one’s natural love for math shines through, then one will be eager to find the best new ways to teach math, the best applications of math in the real world that are relevant to one’s students, the best explanations for math, and the best conveyance of a positive attitude that one’s students can really learn this stuff! The three most important things in real estate are location, location, location, and in math teaching it’s enthusiasm, enthusiasm, enthusiasm. When I hear stories of adults who look back on their math careers, inevitably they point not to a particular course and its content, but to a teacher who either turned them on or turned them off to math. Math is, in my opinion, a deeply teacher-dependent subject, so teachers have to be gifted, talented, able, knowledgeable, sensitive, caring, demanding, relevant, but above all enthusiastic. A teacher’s influence is eternal, and let us hope that we are continuing the many centuries of fine work that the great minds of the ages have handed down to us.

CAROL CASTELLON: First, the teacher has to have a solid background in higher math—an analogy would be that a bookkeeper and an accountant can both do the same job, but the accountant has the “big picture”. Second, teaching
is a skill that either comes naturally or must be learned—you have to know what questions to ask during class and when to ask them. You have to invent creative approaches in teaching or the students "tune out". Third, a teacher must go to class with excitement every day, no matter how he/she feels—excitement about math is contagious. Fourth, you have to be alert to students who are "lost" and know how to help them understand—this country is run by "C students".

5. What are your expectations of higher education in mathematics a) for your own students, as they go to colleges and universities and b) for prospective mathematics teachers?

BOYD E. HEMPHILL: a) I expect higher education to speak with one voice. One of my biggest frustrations as a teacher of college-bound students is that I have no basis to judge what pedagogical challenges my students will face once they enter college. The best example of this is technology.

If I send a kid to Texas A&M, they will be expected to learn Maple along with the standard calculus. They will also be expected to be adept at the use of a graphing calculator. On the other hand, if I send a kid to Rice University, the calculator is all but banned from their possession in most cases. In many cases, different professors at the same institution have varying tolerances for technology. How am I to prepare a college-bound student who could go to a traditional calculus, a reform calculus, or some other variation? Higher education needs to set some basic guidelines.

b) I expect teachers coming from college to have a better command of mathematics than I do. I expect them to be able to communicate it effectively, and I expect colleges to raise their expectations for teachers in general.

I expect new teachers to be up to date on the latest teaching and assessment strategies and be well versed in the use of different forms of media and technology for communicating mathematics.

CAROL CASTELLON: I wish college teachers/professors had the same pressure that high school and elementary teachers have in thinking about how to teach. The image of college professors is totally "teacher-centered" (lecture, explain, prove, test on details), with sleepy students sitting quietly writing notes for an hour. No wonder prospective math teachers often have so much trouble—they are just teaching as they were taught!

JOSHUA ABRAMS: That professors stop lecturing. That they stop seeing techniques as the essence of mathematics. That they acknowledge that creativity plays a role in doing mathematics and believe that their students are capable (at some level) of exhibiting that creativity. That they emphasize learning skills of immediate utility at least as much as those that will be preparation for some other course of delayed gratifications.

I believe there are common cores of experience and content that would serve math majors and teachers equally well. As matters currently stand, neither group is comfortable exploring and posing their own questions. Traditionally taught math is too rote and soulless an activity for all concerned.

JUDITH BROADWIN: I expect that my students will continue to learn in college as they have been taught by me in high school and that they will be expected to solve problems graphically, numerically, and verbally as well as algebraically. As I write this, there are still freshman math courses in college that are taught in the same way that I learned. Assessment is still often composed of students performing rote algorithms, and cooperative learning and assessment are not there.

It is vital that prospective mathematics teachers be taught in the spirit of the NCTM Standards and calculus reform. Recently, when I was an adjunct at a university, I had a student in a graduate course finishing her last course for her master's degree in mathematics education. She had never touched a graphing calculator in any of her courses until she took my course. I do not know what is happening at that university in math education, but it seems to me that she should have been better prepared for her entry into the teaching profession.

PHILIP R. MALLINSON: When my students graduate, I hope they will be equipped with the tools to make sense of the mathematics they meet. I expect they will find classrooms with a very different flavor from their high school—much larger, more regimented classes. They will probably find it less easy to have access to their teachers, who may well be graduate students or

"I would hope that all of my students might experience mathematics as an adventure, not an obstacle course. Given how wonderful the field is, it seems a reasonable wish."

February 1997

Notices of the AMS

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American Mathematical Society

Assistantships and Graduate Fellowships in the Mathematical Sciences, 1996–1997

This publication is an indispensable source of information for students seeking support for graduate study in the mathematical sciences. Providing data from a broad range of academic institutions, it is also a valuable resource for mathematical sciences departments and faculty.

Assistantships and Graduate Fellowships brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada. Information on the number of faculty, graduate students, and degree awarded (bachelor's, master's, and doctoral) is listed for each department when provided. Stipend amounts and the number of awards available are given, as well as information about foreign language requirements. Numerous display advertisements from mathematical sciences departments throughout the country provide additional information.

Also listed are sources of support for graduate study and travel, summer internships, and graduate study in the U.S. for foreign nationals. Finally, a list of reference publications for fellowship information makes Assistantships and Graduate Fellowships a centralized and comprehensive resource.

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The Combined Membership List (CML) is a comprehensive directory of the membership of the American Mathematical Society, the American Mathematical Association of Two-Year Colleges, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

There are two lists of individual members. The first is a complete alphabetical list of all members in all four organizations. For each member, the CML provides his or her address, title, department, institution, telephone number (if available), and electronic address (if indicated), and also indicates membership in the four participating societies.

The second is a list of individual members according to their geographic locations. In addition, the CML lists academic, institutional, and corporate members of the four participating societies providing addresses and telephone numbers of mathematical sciences departments.

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NOTICES OF THE AMS
VOLUME 44, NUMBER 2
Requiem for the Skillful

Saunders Mac Lane

Recently I chanced to examine a National Research Council (NRC) report (1992) on the subject "Educating Mathematical Scientists: Doctoral Study and Postdoctoral Experience in the United States". On page 11, I found the following:

World War II provided new opportunities for mathematicians including the newly immigrated mathematicians... (the war) brought technology to weapons. However, very few mathematicians—American or foreign born—had the applied skills needed for the tasks at hand.

The NRC was established to present documented advice to the U.S. government, but in this case and for this last NRC assertion there was no documentation. However, I do not now need to answer this egregious piece of arrant nonsense ("...had the applied skills"), because I have already written and published an answer in my article "The Applied Mathematics Group at Columbia (AMG-C) in World War II", which appears on pages 495–512 in Part III of the volume A Century of Mathematics in America, Amer. Math. Soc., Providence, RI, 1989. This AMG-C group was one of the largest wartime groups in WWII involved in mathematical war research. I was a member from 1943, and I was its "technical representative" (i.e., its director) in 1994–95.

Since the publication of my 1989 article, the Notices of the Society has adopted an active practice of publishing articles which describe and celebrate the various achievements of recently deceased mathematicians. Some of my valued coworkers at the then AMG-C are no longer with us; their number is perhaps too large to allow for individual "in memoriam" articles. I thus wish to record briefly here some of their names with a quick summary of their work.

My task as director was to assemble able mathematicians and to deploy their varied talents to the urgent but confusing problems arising in wartime. I can report to the present NRC that each and every one of them "had the applied skills needed for the tasks at hand." And I am no longer required to classify this document "Top Secret. Eyes only. Burn before reading!"

For AMG-C the "tasks at hand" revolved around fire control devices for machine guns mounted on bombers.

Hassler Whitney, then at Harvard, was the leading American algebraic topologist of his generation. His work at AMG-C was also deep, involving the understanding of skid (of fighter planes) and the adaptation of rocket sights for fighters. In later years Whitney moved to the Institute for Advanced Study and after retirement developed a passionate interest in the education of young children.
Leon W. Cohen, trained as a point-set topologist, applied his skills to calculation of the “pursuit curves” followed by fighters attacking bombers. His insights were used in later years in his work as program director for mathematics at the NSF.

Magnus Hestenes (Ph.D. Chicago; Bliss) had the solidity and the skills to apply basic ballistic theory to inaccurate ballistic tables. He was later a wise chairman at UCLA; his wartime research informed his later book on optimal control.

Leon Brillouin brought knowledge of classical theoretical physics to the group; he knew how to refudge a faulty fudge factor in physicists’ formulas. After the war he wrote on information theory.

Walter Leighton, expert in continued fractions and on differential equations, was quickly able to arrange methods for calibrating gunsights. He subsequently administered a new AMG-N at Northwestern University and after the war was a decisive department chairman.

Adrian Albert, the ambidexterous algebraist, became involved in fire control at AMG-N, to return after the war to his beloved University of Chicago and the advance of algebra and of division algebras on all fronts.

Edgar Lorch, like many of us, found at AMG-C dandy and necessary uses of trigonometry—and even spherical trig. We did not previously know it, but it was easy to learn. After the war Lorch returned to the mathematics department at Columbia.

Paul Smith, then and later professor at Columbia, provided our “fixed point” connection to the University, which was our nominal employer at AMG-C. After the war he brought Eilenberg, one of our members, to the permanent Columbia faculty.

Arthur Sard came to AMG-C fresh from his proof of Sard’s theorem about critical points of maps. His judicious judgments kept AMG-C on a straight course, as in his later work at Queens College, New York City.

Harry Pollard, as with many of us, knew how to use the calculus—nothing beyond the second derivative was needed for our work! He later landed at Purdue, where he worked, inter alia, on algebraic numbers.

Warren Weaver, our wise upstairs boss (head of the Applied Mathematics Panel), gave us a good start on the analysis of lead computing sights, as used for those machine guns on bombers. He had left applied math at Wisconsin to become vice-president of the Rockefeller Foundation. Several years later he became well known because he had so wisely distributed Rockefeller funds to the rising sciences of biochemistry.

Mina Rees, technical aide to Weaver and our supervisor, had written her Ph.D. in 1931 on linear algebra with Dickson at Chicago. Thereafter she was subjected to the then fixed fate for female math Ph.D.s: to teach at a women’s college—in her case, Hunter College, NYC. The war work opened new opportunities. She became the first program director for mathematics (at the Office of Naval Research), then member of the National Sciences Board, then president of the City University (NYC). At last report she was in execrable health.

Betty Amitin, my devoted secretary at AMG-C, was later killed with her husband in an auto crash. Her son, Thomas Heppenheimer, is a science writer and now and then tackles mathematics.

By comparison, there were very few mathematicians at Los Alamos: Jack Calkin, C. J. Everett, Paul Olum, Stan Ulam, and John von Neuman. Their decisive contributions there are generally known.

To these and many others who in 1943-45 excelled in vigorous uses of the skills needed in wartime, hail and fond farewell.
Poland was partitioned in 1795 by Russia, Austria, and Prussia. It became a country after the First World War in 1918. In 1945 it moved: its eastern part, including the city of Lwów, was annexed by the USSR; in the south and west it acquired territory from Germany, including Breslau (now Wrocław) and Danzig (now Gdańsk). The parts in the south had been Polish a few centuries ago, were still inhabited by Polish-speaking peasants, and were referred to after the war as the “recovered territories”.

In 1946 I had returned to Harvard after military service and was crazy to see the destruction caused by the war in Europe and, if possible, help in the reconstruction. I had taken a little German and French. Graduation was approaching, and my best efforts produced no way to cross the ocean.

In college I had spent much time browsing in the mathematics library and even in the stacks, and I found Fundamenta Mathematicae and Studia Mathematica of special interest. There were magic names in them: Sierpiński, Steinhaus, Kuratowski, Ulam, Ostrwowski, Szegő, Borsuk, Tarski, of course Banach, and a name that appeared in two forms, sometimes as Szpilrajn and sometimes as Szpilrajn-Marczewski, which I could not explain. Many papers seemed related, many were joint work, all quite short. I could not understand most of them, but I tried. My tastes were real variables and topology, and I didn’t know much; I had studied Hilbert space, but hadn’t taken linear algebra. (Despite the illogicality, this way of learning mathematics is not all bad.)

Nobody took my Wanderlust seriously, least of all my father, whose recent ancestors had escaped from pogroms in Eastern Europe and who considered Europe a waste of time, if not much worse. No support there. But on the eve of my graduation in spring 1947, I was awarded a traveling fellowship by Harvard. The most desperate place in Europe seemed to be Poland, and there were mathematicians in Poland. That is why I went to the Polish consulate in Washington, was interviewed by the cultural attaché there named Czesław Miłosz, and got a Polish visa.

The “student ship” was filled with Slavs of several sorts, mostly working people apparently going home. Bed was a bunk in a large dormitory; food came off a chow line in abundance. Gossip was abundant too. Where to stay, how to change money, dangers and opportunities galore.

I came ashore at Southampton after seeing the incredible green English countryside from the ship for the first time. There are some basic experiences in life: a German potato salad, a French cheese, the Parthenon, and the English green. The world would be much poorer without any one of these. The pound was convertible at $5.50, and a decent seat at the theater or even the opera was a couple of shillings. A long bus ride cost tuppence. London was badly bombed. Now, two years after the end of the war, there was some
rebuilding and cleaning up, but there was plenty of rubble left. The city was gray; no unnecessary lights because electricity was scarce. Serious rationing. It was the age of equality and fairness, very bracing to a young person like me who considered himself a socialist. I saw London—all of it—on foot and made friends with students and libraries. I attended the first music festival in Edinburgh, where I learned to drink tea.

On to Paris, where every corner had an illegal moneychanger who also sold feelthy pec­cures. The opera was flooded with light every night, even though electricity was hard to come by elsewhere, and seats were so expensive that you had to buy a cheap one behind a monstrous column and couldn’t see the opera. Some food was rationed, but nobody paid any attention. I thought the scene was terrible and liked the British way much better. Quite a few years later I changed my mind, and gave up socialism. In Paris I saw Fréchet, an old man, coming out of the Institut Henri Poincaré, and I learned to drink wine.

I had now joined a college friend who had learned Czech and was going to spend the year in Czechoslovakia. We continued together to Prague, crossing Germany in a “sealed” carriage, but actually we bartered cigarettes for water through the window. You could get Leica cameras the same way. Prague was a wonderland. It had food, normaly, civilized people, and it is a magnificent city. I tramped all over, heard splendid chamber music, met Edouard Čech, and learned to drink beer.

Two weeks later I got on a train at midnight and started north. When we crossed the border, my car was empty. On the other side, with daylight beginning, peasants came on at each village, and pretty soon my compartment was full. I was scared, afraid that somebody would steal my navy seabag with all my belongings in the rack above. Everybody was talking furiously, and after a while I was obliged to explain myself in rudimentary German. Pretty soon we were all friends.

I was met at the Warsaw station by the brother of a Polish college friend, who took me to his mother’s flat. Since she belonged to the Sejm, the parliament, she had a nice little flat and hot water. I slept on a couch. The first morning she took me to Sierpiński’s apartment. In this ruined city it was a restored habitation on an upper floor at the end of a long walkway that ran endlessly upwards through rubble. When you got there, it seemed spacious and nice. I had a cordial meeting with Sierpiński, and he sent me away with an armful of his reprints. Later I attended his weekly Sunday afternoon social occasions, where his wife’s excellent baked products made the event memorable. Thirty Sunday-clad visitors climbing through the rubble to this occasion make an odd memory.

Soon I was inscribed as a student at the university, and I moved to a little room in a dormitory with a French and a Canadian student. No more hot water. I attended lectures that I did not understand; talked with Kuratowski, who gave me a problem in topology to think about; got to know Borsuk, Mostowski, and Wanda Szmirlew; and learned to live in this city of rubble. One day the exchange rate changed from 100 zlotych to the dollar to 400. Then I could eat enough again, and I have never felt so rich. Roman Sikorski was finishing his thesis, and I edited his English. He was considerably older than I, but was delayed by the war. We remained friends until he died. I met hardly any Polish students my age, because all schools in Poland had been closed by the Germans, and young people were coming through the educational system older than normal. I learned that I could work in my sleeping bag down to about 55 degrees, but not below. The natives needed to be harder than that. I got an intestinal sickness three times that was awful, and the third time someone called a doctor. I recovered.

There is something shameful about feeling nostalgia for such a terrible time. I am not nostal­gic about the periods that most people remember: my childhood or my military service. But there was something beautiful about the ruined city. The church in the Plac Trzech Krzyży has been reconstructed now, but as a ruin it was lovely, on a smaller scale than the cathedral of Coventry. Lights coming out of a partly reconstructed shop in the dark, cold gloom of a November afternoon (it gets dark early up in the North) were warmer than other lights. People scurrying back to some kind of home with something that would do for supper seemed happy. There was hope for the future. Political differences had been suppressed by the enormity of the catastrophe. There was still a public spirit of joy in liberation. Poland was going to rebuild itself. The present was much, much better than the past, and the future was coming. People then did not know the future.

The past was atrocious. I heard hundreds of stories of brutality on the part of the Germans, and some about Russians too. The Poles had a long history of antipathy toward the Russians, but even the Russian connivance in the de­struction of Warsaw was minor compared with the German occupation. Stanisław Saks died like many Poles in the following way. German soldiers barricaded two ends of a street and shot everybody between. There was, however, a possibility of escape from this recurrent problem. The Germans needed a great quantity of lice in order to produce a vaccine against typhoid and other
War makes atrocities, but this was different. The occupation was a continuous stream of inhuman acts. The stories I heard were not about statistics. They were not either about how hard life was, although it was terrible. They were about individual acts of sadism. In Kraków I heard about a Polish child playing in the street who was doused with gasoline and set on fire by German soldiers. In Kraków also I attended the war crimes trial for a day, and a group of German prison camp guards was on trial. Much was said about the institutional barbarity of the place, but what I remember is how one guard liked to shoot his pistol out his open window at prisoners for target practice. War is terrible, but many of the people in war are worse still. During the occupation German professors came to steal books from Polish libraries to take back to Germany, with their Polish colleagues looking on. Can anything be said in their defense?

After Christmas in Kraków I went with my friend from Prague to Vienna. We were directed on arrival to Colonel Williams, who oriented us in our status as guests of the army. He told us that we were the first civilians to obtain permits to visit the city after the war, aside from people who had a need to be there. In our interview of ten minutes we learned painfully that the Colonel was a rabid anti-Semite, posted evidently to the appropriate place. Vienna was in a sulk, on account of its hardships. Nevertheless, it was untouched physically by the war, public services were normal, there seemed to be enough food, and people were smartly dressed. To a visitor from Warsaw it seemed a very fortunate place. All this made a bad impression on me, and I have disliked the city ever since, particularly because I have friends who tell me what it was like in 1938. I alternated evenings between theater and opera, and that was all marvelous. At that moment, when Austria was reconstituting itself as a country, it was established by economists that the country was impossible; it could not survive economically. I debated with myself the question whether the world should support this place just to hear Mozart done right. In the course of time Austria has confounded the economists, Mozart is still done right, and I still dislike it (in spite of the fact that I have friends there whom I like and respect very much).

In the spring I went to Wrocław. The center of the city had been badly damaged, but I was assigned to an apartment with two Polish roommates in a nice block of flats built by the Germans just before the war. One of the roommates had been a partisan fighter during the war, when he was 16. Once they had intercepted a German radio message and had been able to bring down a helicopter with a German general on board. Staroszak told me that if he had to do it over again, he wouldn't. I heard later that he had become a judge. In Wroclaw I met a lovely girl, whose father had been murdered by the Russians in the Wood of Katyn (she had no doubts about it), and she introduced me to vodka.

Szpilrajn had become Marczewski by this time. In Polish law you had to keep both names for a while if you wanted to change. I suppose that Szpilrajn was a Jewish name. Marczewski took me in hand and gave me good problems in analysis to work on. I solved two of them, and they made my first publications, and he was pleased. (So was I.) One day he came to my flat for some reason and was incensed by the filth and disorder. In his next lecture, to a big class, he chastised Polish students generally for being so uncouth in the presence of an impressionable foreigner. Next day I had a message that Steinhaus would like me to move to the upper story of his house, which I did. (The topologist Knaster lived on the ground floor, Steinhaus and his wife on the second, the maid and I on the third.) Everyone lived close together in this little intact community. Afternoons I walked along the Oder River with Steinhaus, just across a field from his house, and got to know him. It was spring, I worked very hard, it was a lovely time.

Steinhaus told me this story about the war. He had to live incognito in a village and had no access to any sort of news except a journal published by the Germans for their troops. This newspaper reported a steady stream of German triumphs. But it also published death notices inserted by families that had lost a son. It was the time of the Battle of Stalingrad, and everything depended on the outcome. Steinhaus pieced together bits of statistical information from the notices over a period of time and concluded that the German losses were huge. He was very proud of this achievement; like Wiener, he was at heart an applied mathematician.

Marczewski was a saint. He was inspiring, generous, and a wonderful person. I met him a last time in London—coming back from, I think, the Congress at Edinburgh—in a little Polish hotel in South Kensington that Steinhaus had introduced me to. He had a long and painful last illness, which he endured with humor and grace. He died in 1976.

I had a problem when I was in Wrocław. My visa had run out, and I was living without valid documents. I had left my passport in Warsaw for the visa to be extended, but received no news
about it. Mazur was a professor in Warsaw, and I had met him, but he came to the Institute only rarely; I don’t know why. He was the liaison between the mathematics community and the party. He was appealed to, probably by Kuratowski. I was summoned to an interview with a nice man with a little beard in the appropriate ministry. Soon I got my extension and was able to leave the country. This seemed urgent, because it was the moment of the Berlin airlift, which was going on much too close to Wroclaw. I took the good ship _Batory_ home from Gdynia the day after my twenty-first birthday.

All this does not seem to be History of Analysis. But perhaps there is history here. Steinhaus told me the story, now well known, of how he “discovered” Banach, reading on a park bench. The _Scottish Book_ from Lwów was still a fresh memory in Wroclaw in 1948; Banach still an almost-living figure. The university at Lwów had been transplanted, to the extent possible, to Wroclaw. I found there a humanistic view of mathematics that I have always admired. Polish mathematics, even when it is very serious, has an amateurish quality. Steinhaus himself, dedicated and hard-working, exuded the question: If it isn’t fun, why should we do it? Banach was a man proud of his work, contemptuous of dilettantes, but his papers and his famous book are simple, lucid, careful, full of esthetic content as well as mathematical.

The seminar at Wroclaw at that time was universal. Each weekly séance lasted several hours and had two or three talks. The subjects were various; for example, I remember Jerzy Łoś speaking about logic. But the talks were carefully prepared, and everybody expected to follow. If someone didn’t, the speaker had to try again. This tradition may be why Polish mathematicians from different fields often collaborated. I have mentioned the fact that Polish papers were usually short. They solved a problem or presented an idea that was intended to be clear and interesting, not encyclopedic. I remember the simplicity, elegance, and power of Sierpiński’s little papers in _Fundamenta Mathematicae_; it would be hard to find anything comparable in our journals. These pieces of evidence depict a mathematical culture different from ours. It was lots more fun. Must progress deprive us of that?

It is only a bit more than a century since the idea surfaced in Prussia of universities devoted to teaching and research in equal and independent parts. The idea spread quickly over Europe and then to the United States. Some of my teachers were among the first American-trained mathematicians, although even Saunders Mac Lane, who was one of them, did the trip to Göttingen. The speed with which professionalism has overwhelmed us is remarkable. I once met a man who had been a colleague of Weierstrass in Berlin. It was not so long ago.

Ease of traveling and now e-mail have homogenized our profession. Our talent is ranked in a hierarchy, not locally but over the whole world. Mathematics is a business, a competitive one, whose product is theorems, priced too much by weight. Instead of having fun, we write and read promotion letters. Our teaching is evaluated on a 7-point scale in a popularity poll; the question whether we have given our students anything to think about is hardly raised.

Of course Poland wants to be like the rest of the world. Now Polish mathematicians go abroad to study, and their connections by way of e-mail are to other specialists wherever they may be, not to their colleagues. They produce theorems of the proper weight. Since Poland is now on the way to becoming a prosperous country at last, it can afford to neglect its universities to a pitiful degree. Polish professors have to take second jobs. There is no more Polish school in mathematics.

When I came home from Poland in June 1948, I was full of news about Eastern Europe and information and ideas from this extraordinary adventure. Naturally friends asked about it. I discovered quickly that I couldn’t tell them anything. In 1948 Poland was too far away; its experiences were beyond the imagination of my friends.
Introduction
During the first several months of 1996 anecdotal reports of a significant drop-off in the number of and, in some instances, quality of applicants to various graduate programs in mathematics circulated within the mathematics community. In response to the concerns raised by these reports, the American Mathematical Society (AMS) conducted a tightly focused survey whose aim was to provide more reliable information on the nature of this problem. This report describes the results of that survey.

In late May the survey form was sent by e-mail to the directors of graduate programs of 71 departments randomly selected from the 176 Ph.D.-granting mathematics departments that are routinely surveyed by the AMS.

The sample was drawn so as to support separate projected estimates for four groupings of the departments. These groupings are based on the reputational ranking of mathematics programs in a 1995 report of the National Research Council. These groupings are updates of those traditionally used in the AMS-IMS-MAA Annual Survey. A more complete description of these groupings and a listing of the departments appeared in the January 1997 issue of Notices.

Results of the Survey
Question 1 asked the sampled departments to report the number of applications they received for admission to graduate school in the fall of 1993, 1994, 1995, and 1996. They were also asked to report separately the number of applications by U.S. citizens and permanent residents and by non-U.S. citizen temporary residents. These results are reported in Table 1.

For all groups combined, the size of the pool of applications for admission in fall 1996 declined 30% from the fall 1994 figure. The declines vary among the different groups. The least decline was for Group I Private, 19%; the greatest decline for Group III, 37%.

For all groups combined, the pool of applications by U.S. citizens for admission in fall 1996 declined 32% from the fall 1994 figure. Group I Public departments reported a decline of 43%, while Group I Private reported a decline of 20%.

Applications by noncitizens declined 29% from fall 1994 to fall 1996, with Group III reporting the largest decline, 38%.

James W. Maxwell is the AMS's associate executive director for Professional Programs and Services and an ex-officio member of the AMS-IMS-MAA Data Committee.

Don O. Loftsgaarden is professor of mathematics at the University of Montana and also a member of the Data Committee.

Editor's Note: A copy of this report, including explanatory appendices, may be obtained by contacting James W. Maxwell at jwm@ams.org.
Table 1. Changes in the numbers of applications to graduate school, fall 1994 to fall 1996.

*The Total Pool may not equal the sum of the U.S. Pool and the Int. Pool. Since some departments were unable to provide numbers of applications broken out by citizenship or visa status, the projections may be based on slightly different sets of respondents.

<table>
<thead>
<tr>
<th></th>
<th>Group I Public (25)</th>
<th>Group I Private (23)</th>
<th>Group I Combined (48)</th>
<th>Group II (56)</th>
<th>Group III (72)</th>
<th>All Groups Combined (176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Pool 1996*</td>
<td>4,293 (25)</td>
<td>3,073 (23)</td>
<td>7,366 (48)</td>
<td>5,034 (56)</td>
<td>4,116 (72)</td>
<td>16,516 (176)</td>
</tr>
<tr>
<td>Total Pool 1994</td>
<td>6,316</td>
<td>3,804</td>
<td>10,120</td>
<td>6,897</td>
<td>6,528</td>
<td>23,545</td>
</tr>
<tr>
<td>Percent decrease</td>
<td>32%</td>
<td>19%</td>
<td>27%</td>
<td>37%</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. Pool 1996</td>
<td>1,757</td>
<td>1,351</td>
<td>3,108</td>
<td>1,949</td>
<td>1,234</td>
<td>6,291</td>
</tr>
<tr>
<td>U.S. Pool 1994</td>
<td>3,082</td>
<td>1,687</td>
<td>4,769</td>
<td>2,653</td>
<td>1,848</td>
<td>9,270</td>
</tr>
<tr>
<td>Percent decrease</td>
<td>43%</td>
<td>20%</td>
<td>35%</td>
<td>27%</td>
<td>33%</td>
<td>32%</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Pool 1996</td>
<td>2,546</td>
<td>1,748</td>
<td>4,295</td>
<td>3,210</td>
<td>2,882</td>
<td>14,537</td>
</tr>
<tr>
<td>International Pool 1994</td>
<td>3,236</td>
<td>2,262</td>
<td>5,498</td>
<td>4,360</td>
<td>4,680</td>
<td>10,387</td>
</tr>
<tr>
<td>Percent decrease</td>
<td>21%</td>
<td>23%</td>
<td>22%</td>
<td>26%</td>
<td>38%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Table 2a. Quality comparisons of all applicants for admission to graduate school, fall 1996 to fall 1995.

<table>
<thead>
<tr>
<th></th>
<th>Group I Public (25)</th>
<th>Group I Private (23)</th>
<th>Group I Combined (48)</th>
<th>Group II (56)</th>
<th>Group III (72)</th>
<th>All Groups Combined (176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996 much better than 1995</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.5%</td>
<td>0.0%</td>
<td>1.8%</td>
</tr>
<tr>
<td>1996 somewhat better than 1995</td>
<td>22.4%</td>
<td>22.6%</td>
<td>22.5%</td>
<td>11.1%</td>
<td>38.9%</td>
<td>25.6%</td>
</tr>
<tr>
<td>1996 about the same as 1995</td>
<td>62.0%</td>
<td>51.7%</td>
<td>57.1%</td>
<td>38.9%</td>
<td>36.1%</td>
<td>42.7%</td>
</tr>
<tr>
<td>1996 somewhat poorer than 1995</td>
<td>6.8%</td>
<td>25.7%</td>
<td>15.8%</td>
<td>44.5%</td>
<td>19.4%</td>
<td>26.4%</td>
</tr>
<tr>
<td>1996 much poorer than 1995</td>
<td>8.8%</td>
<td>0.0%</td>
<td>4.6%</td>
<td>0.0%</td>
<td>5.6%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

Assuming individuals have not significantly increased the number of applications they submit to graduate school over the past two years, the results in Table 1 indicate a substantial drop in the number of individuals submitting applications.

Question 2 asked the sampled departments to compare the quality of the pool of applicants for admission in fall 1996 with the quality of the pool of applicants for admission in fall 1995. They were also asked to make the same comparison independently for U.S. citizens and permanent residents and for non-U.S. citizen temporary residents. The results are reported in Tables 2a, 2b, and 2c. The reader should be especially cautious in interpreting the trends reported due to the subjective nature of the judgment asked for in this question.

For all groups combined, there appeared to be no upward or downward shift in the quality of the pool of applicants. Among the various groups of departments, Group II reported a downward trend in quality, while Group III reported an upward trend in quality.

For U.S. citizen and permanent-resident applicants there was an upward trend in quality from fall 1995 to fall 1996 for all groups combined. This upward trend was strongest for Group I Public and Group III.

For non-U.S. citizen temporary residents there was no significant change in quality over all groups combined. Group I Public and Group I Private reported a slight upward trend in quality, while Group II reported a slight downward trend in quality.
1996, the fall '96 class, with the quality of those admitted for fall 1995, the fall '95 class. They were also asked to make the same comparison independently for U.S. citizens and permanent residents and for non-U.S. citizen temporary residents. The results are reported in Tables 4a, 4b, and 4c. The reader should be especially cautious in interpreting the trends reported due to the subjective nature of the judgment asked for in this question.

Group I Public and Group I Private each reports a decidedly upward trend in the quality of the fall '96 class over the fall '95 class, Group III somewhat less so. Only Group II reports a downward trend.

The upward trend in quality reported by Group I Public and Group I Private holds independently for U.S. citizens and permanent residents and for non-U.S. citizen temporary residents. Likewise the downward trend reported by Group II holds independently for both citizenship groupings.

**Next Year**

The AMS hopes to conduct a second survey in the late spring of 1997 along the lines of this survey. Those responsible for graduate admissions within their department are encouraged to set up mechanisms for tracking key characteristics of the pool of applicants for admission. Characteristics that might be considered key include: gender, citizenship/visa status, standardized test scores, and previous mathematical sciences degrees.
<table>
<thead>
<tr>
<th></th>
<th>Group I Public (25)</th>
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<th>All Groups Combined (176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996 much better than 1995</td>
<td>15.5%</td>
<td>0.0%</td>
<td>8.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>1996 somewhat better than 1995</td>
<td>31.1%</td>
<td>51.7%</td>
<td>41.0%</td>
<td>17.9%</td>
<td>40.4%</td>
<td>33.4%</td>
</tr>
<tr>
<td>1996 about the same as 1995</td>
<td>37.8%</td>
<td>48.3%</td>
<td>42.8%</td>
<td>29.1%</td>
<td>32.9%</td>
<td>34.4%</td>
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<tr>
<td>1996 somewhat poorer than 1995</td>
<td>15.5%</td>
<td>0.0%</td>
<td>8.1%</td>
<td>53.3%</td>
<td>20.3%</td>
<td>27.4%</td>
</tr>
<tr>
<td>1996 much poorer than 1995</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>6.4%</td>
<td>2.6%</td>
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</tbody>
</table>

Table 4a. Quality comparisons of incoming classes, fall 1996 to fall 1995.

<table>
<thead>
<tr>
<th></th>
<th>Group I Public (25)</th>
<th>Group I Private (23)</th>
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<th>All Groups Combined (176)</th>
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<tr>
<td>1996 much better than 1995</td>
<td>15.5%</td>
<td>11.3%</td>
<td>13.5%</td>
<td>6.4%</td>
<td>0.0%</td>
<td>5.7%</td>
</tr>
<tr>
<td>1996 somewhat better than 1995</td>
<td>22.3%</td>
<td>40.4%</td>
<td>31.0%</td>
<td>12.3%</td>
<td>36.1%</td>
<td>27.1%</td>
</tr>
<tr>
<td>1996 about the same as 1995</td>
<td>53.4%</td>
<td>37.0%</td>
<td>45.5%</td>
<td>37.3%</td>
<td>42.6%</td>
<td>41.7%</td>
</tr>
<tr>
<td>1996 somewhat poorer than 1995</td>
<td>8.8%</td>
<td>0.0%</td>
<td>4.6%</td>
<td>37.5%</td>
<td>13.9%</td>
<td>18.9%</td>
</tr>
<tr>
<td>1996 much poorer than 1995</td>
<td>0.0%</td>
<td>11.3%</td>
<td>5.4%</td>
<td>6.4%</td>
<td>7.4%</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

Table 4b. Quality comparisons of U.S. citizen and permanent resident incoming classes, fall 1996 to fall 1995.

<table>
<thead>
<tr>
<th></th>
<th>Group I Public (25)</th>
<th>Group I Private (23)</th>
<th>Group I Combined (48)</th>
<th>Group II (56)</th>
<th>Group III (72)</th>
<th>All Groups Combined (176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996 much better than 1995</td>
<td>8.8%</td>
<td>11.3%</td>
<td>10.0%</td>
<td>6.1%</td>
<td>0.0%</td>
<td>4.7%</td>
</tr>
<tr>
<td>1996 somewhat better than 1995</td>
<td>22.4%</td>
<td>25.7%</td>
<td>24.0%</td>
<td>6.4%</td>
<td>27.8%</td>
<td>19.9%</td>
</tr>
<tr>
<td>1996 about the same as 1995</td>
<td>55.2%</td>
<td>63.0%</td>
<td>59.0%</td>
<td>50.2%</td>
<td>39.3%</td>
<td>48.1%</td>
</tr>
<tr>
<td>1996 somewhat poorer than 1995</td>
<td>13.6%</td>
<td>0.0%</td>
<td>7.1%</td>
<td>18.9%</td>
<td>32.9%</td>
<td>21.4%</td>
</tr>
<tr>
<td>1996 much poorer than 1995</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>18.4%</td>
<td>0.0%</td>
<td>5.9%</td>
</tr>
</tbody>
</table>

Table 4c. Quality comparisons of non-U.S. citizen incoming classes, fall 1996 to fall 1995.
Albert Leon Whiteman died on December 9, 1995, after a lengthy struggle with cancer. He is survived by his devoted family: his wife Sally, his brother and sister-in-law, Irvin and Shirley, and nieces and nephews.

Al, as he was known to his colleagues at USC, was born February 15, 1915, in Philadelphia, PA. Sally and Al met on September 1, 1944, while they were serving in the Navy. They were married on June 3, 1945.

Al came from a poor family who wanted his education but did not have the financial resources. Even at school he loved number theory and wished it to be his life's work. When he was given a Harrison Scholarship, he was able to pursue his dream. He was elected to Phi Beta Kappa, Sigma Xi, and Pi Mu Epsilon, and was a Harrison Fellow, 1936-38. The interim scholarship he received before being awarded the Harrison Scholarship and Fellowship had a proviso that the recipient must not drink, smoke, or become a minister of religion. Al upheld these provisions throughout his life. Al received his B.A., M.A., and Ph.D. (1940) from the University of Pennsylvania, completing his dissertation under the supervision of Hans Rademacher. (He was Rademacher's first American student.)

After holding an instructorship at the University of Pennsylvania, 1938-40, he was a Benjamin Peirce instructor at Harvard, 1940-42, a highlight of his life. He then served as a lieutenant in the U.S. Naval Reserve from 1942-46, where he taught navigation. After serving as a mathematician in the Navy Department (he was proud of his still-classified contributions), he came to USC in 1948 as an assistant professor of mathematics, retiring as Professor Emeritus in 1980. He had several visiting appointments: at the Institute for Defense Analyses, at UCLA, and three at the Institute for Advanced Study in Princeton. He was a member of the American Mathematical Society, the Mathematical Association of America, and the American Association of University Professors, and in 1990 was elected a Foundation Fellow of The Institute of Combinatorics and Its Applications. His main specialty was the theory of numbers and combinatorics, on which he wrote more than forty published papers.

He served as editor of the Pacific Journal of Mathematics, editor of Theory of Numbers (an American Mathematical Society Symposium volume), associate editor of the Duke Mathematics Journal, and member of the editorial board of the Journal of Combinatorial Theory. He was a member of the American Mathematical Society, the Mathematical Association of America, and the American Association of University Professors, and in 1990 was elected a Foundation Fellow of The Institute of Combinatorics and Its Applications. His main specialty was the theory of numbers and combinatorics, on which he wrote more than forty published papers.

Solomon Golomb is university professor and Theodore Harris is professor emeritus and lecturer, both at the University of Southern California. Jennifer Seberry is professor of computer science, head of the Department of Computer Science, and director of the Centre for Computer Security Research at the University of Wollongong, Australia.
The Mathematical Family Tree of Hans Rademacher
(with A. Whiteman branch)
Rademacher himself paid Al the highest compliment, saying his work was, "not cheap...each paper was a serious contribution to the literature." He leaves behind an impressive array of achievements, and through his students (shown on page 218 of this article) is still contributing to the mathematics of the next generation. Sally Whiteman has established the Albert L. Whiteman Memorial Lecture, an annual lecture series honoring research in mathematics, at the University of Southern California Mathematics Department. Contributions to the lecture fund and suggestions for possible guest speakers will gladly be accepted. For more information, please contact the chair of the Mathematics Department, University of Southern California, Los Angeles, CA 90089-1113; telephone 213-740-1717; or e-mail: info@math.usc.edu.

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13. Optimal designs, supplementary difference sets and multipliers (with C. Koukouvinos, Jennifer Seberry, and Ming-yuan Xia), J. Statist. Plann. Inference (accepted).
Doctoral Degrees Conferred

1995–1996

ALABAMA

Auburn University (4)

MATHEMATICS

University of Alabama at Birmingham (3)

BIOSTATISTICS
Alghamdi, Abdullah, Quantitative theories of carcinogenesis with applications.

MATHEMATICS

University of Alabama-Huntsville (3)

MATHEMATICAL SCIENCES

University of Alabama, Tuscaloosa (5)

APPLIED STATISTICS

MATHEMATICS

ALASKA

University of Alaska Fairbanks (1)

MATHEMATICAL SCIENCES
Humphrey, Patricia B., Martingales in capture-recapture experiments with constant survival and recruitment.

ARIZONA

Arizona State University (8)

MATHEMATICS

University of Arizona (10)

APPLIED MATHEMATICS
Blayneh, Kbenesh W., A hierarchical-sized structured population model.

MATHEMATICS

MATHEMATICS

University of Wisconsin-Madison (1)

MATHEMATICAL SCIENCES
Inprasit, Utith, Equilibria in size-structure populations of mass action.

ARKANSAS

University of Arkansas at Fayetteville (4)

MATHEMATICAL SCIENCES

CALIFORNIA

California Institute of Technology (6)

APPLIED MATHEMATICS
Ardalan, Kayvan, Complex vortex arrays.
Claremont Graduate School (2)

**Mathematics**

Graham, Christopher Giles, Cooperative solution concepts for multi-sided assignment games.

Tran, Phuong Yen Thi, Asymptotic reliability of the hypercube and the D-octahedral networks.

**Stanford University (9)**

**Mathematics**

Betz, Martin Scott, Operad representations in Morse theory and Floer homology.

Cardon, David Alan, Zeros of Fourier coefficients of metaplectic Eisenstein series.

Harris, Joe Thomas, Some properties of a Sessile drop in a potential field of Newtonian form.


Klute, Annette, Inverse spectral recovery of a damped oscillator and hyperbolic geometry.

Overton, Christopher Wall, Classical solution concepts for multi-sided assignment games.

Cook, David, Minimal coding of a subset of \( S^2 \) into a real.

Cotner, Carl Frank, The nesting depth of radical expressions.

Cox, Andrew Michael, Hydrodynamic limit for two particle systems with non-constant speed parameter.

Drorsky, Alexander, Generic representations of parabolic subgroups of the classical group.

Ensor, Andrew James, Templates and worlds for interpretations.

Hillion, Steven J. P., The dimensions of spaces of modular forms.

Kaskel, Bruce Ephraim, The image of the adele Galois representation of \( J_0(37) \).

Kemp, In-Kang, Geometric structures on manifolds and the marked length spectrum.

Li, Ren-Cang, Raising the orders of unconventional schemes for ordinary differential equations.

Lefebvre, Richard Lyle, Classification of space curves using initial ideals.

Milne, Roger Brent, Directed level sets.

Covert, Paul Paul, Adiabatic limits for Schr"odinger operators and Jacobi matrices with slowly oscillating potential.

Covert, Paul Paul, Restrictions of parabolic subgroups of the classical group.

Frenkel, Michael Edward, Classification and divisor class groups of normal cubic surfaces in \( p^3 \).

Robertson, Leanne Davina, Power bases in cyclotomic integer rings.

Russo, Giuseppe, Continuous time models of the reporting and cost process of insurance claims.

Ugarte, Armando, Coordination mechanisms for high-tech manufacturing organizations (HTMOs).

**University of California, Davis (14)**

**Mathematics**

Alenov, Igor, Matrix models with non-holomorphic potentials.

Alexandrov, Mikhail Dmitrievich, On some problems of quantum field theory and theory of integrable systems.

Beggs, Jerome, Gaussian spacetime models: Markov field properties.

Dong, Xiaopeng, Estimating density functions: A constrained maximum likelihood approach.

Kavinoky, Richard, The non-applicability of the Hawking singularity theorem to the Smoller-Temple cosmological model.

Lang, Lynelle Melisa, Hyperbolicity of abelian varieties.

Liu, Kejian, A generalization of Massy products with applications to deformation theory.

Shi, Kejian, Effect of spatial heterogeneity on the probability of failure of the sterile insect technique.


Vedantham, Ram, Wave propagation in random media.

Wang, Xiaojun, Global and local optimization using linear bounding functions.

**University of California, Irvine (4)**

**Mathematics**

Sorouri, Mohammad Javad, A numerical conformal mapping.

Van Ly, Hung, Finite dimensional aspects of nonlinear dissipative systems and their applications.

Viers, Frederi G., Almost-sure exponential behavior of scalar- and vector-valued stochastic parabolic equations.

Wu, Ting, Reflecting diffusion processes and its application to ATM network with feedback control.

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Ugarte, Armando, Coordination mechanisms for high-tech manufacturing organizations (HTMOs).

Wu, Zhang, The triple dqds algorithm for complex eigenvalues.

Xu, Feng, A new series of subfactors.

Zhou, Hong, Numerical analysis of slender vortex motion.

Zieve, Michael Ernest, Cycles of polynomial mappings.
University of California, Riverside (6)  
**MATHEMATICS**
Griffith, Cheryl, Numerical computation and computer visualization of the eigenfunctions for the Koch snowflake drum.  
He, Qi Christina, Generalized Minkowski content, vibrations of fractal drums, fractal strings and the Riemann zeta-function.  
Sodedjak, Heroe, Asymptotic properties of bispectral density estimators of harmonizable processes.

University of California, Santa Cruz (4)  
**MATHEMATICS**  
Allen, Nancy, On the spectra of certain graphs arising from finite fields.  
Ehlers, Kurt, The geometry of swimming and pumping at low Reynolds number.  
Goetz, Thomas, On a cubic Shimura integral for a rank two symplectic group.  
Haverl, Carl, A metric on moduli spaces of projective hypersurfaces.

University of Southern California (5)  
**MATHEMATICS**  
Boca, Ioana, Filtrations and projective representations of Hopf algebras to quantum groups.  
Fung, Chin-Pang Alex, New numerical algorithms for nonlinear filtering.  
Glezen, Paul, Compact Poincaré duals of Chern classes over moduli spaces induced by canonical line bundles of the universal curve.  
Li, Qingnan, Mathematical and numerical analysis of biological neutral networks.  
Pop, Horia, Quantum group constructions in a symmetric monoidal category.

**COLORADO**  
Colorado School of Mines (2)  
**MATHEMATICAL AND COMPUTER SCIENCES**
Hoscheit, Gregory Charles, A tabu search genetic algorithm hybrid heuristic for solving a master production schedule with sequence dependent changeover times.  
Jin, Hong-Sung, Uniformly superconvergent interpolation schemes for solutions of first order systems for two point boundary value problems.

Colorado State University (4)  
**MATHEMATICS**
Robertson III, Alexander, A class of Lagrangian relaxation algorithm for the multidimensional assignment problem.  
Symms, John, Deformations of configurations of planes.

**STATISTICS**
Fayyad, Rana, Confidence intervals for variance components in unbalanced models.  
Hartel, Gunter F., Distribution free tests of the sub-model hypothesis in multiple regression and a Monte Carlo comparison with robust alternatives.

University of Colorado, Boulder (4)  
**APPLIED MATHEMATICS**
Sholl, David, Lattice gas models of surface chemistry.
Mathematics

Ahlgren, Scott, Equations of polynomial-exponential type.

Bonan-Hamada, Edward, A bounded compactness theorem for $L^1$ embedding in $R^2$.

Moretti, Christopher Paul, Degrees of abelian subvarieties of powers of elliptic curves over $C$.

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Jones, Jim E., A mixed finite volume element method for accurate computation of fluid velocities in porous media.

Merz, Sarah, The competition graphs of hamiltonian, interval, strongly connected and symmetric digraphs and tournaments: Elimination orderings, competition inverses, chromatic number and domination.

Parker, Mark, A set covering approach to infeasibility analysis of linear programming problems and related issues.

Phipps, Eric, Factor rank of Boolean matrices.

Van Iwaarden, Ronald, An improved unconstrained global optimization algorithm.

Zullo, Holly, Feasibility flows in multicommodity graphs.

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Mathematical Sciences

Hsieh, Dannie, A comparison of the thinking processes of mathematically advanced and average students, age 10 and 11, engaged in mathematics problem solving.

Phonwichal, Thanavath, A comparison of inconsistent and consistent least squares estimation methods for a simultaneous econometric model of the Colorado economy.

Soto-Johnson, Hortensia, Technological vs. traditional approach in conceptual understanding of series.

Van Dressar, Vickie, Relationships of a mathematics content course for elementary/middle school teachers with preservice teachers' attitudes/beliefs about mathematics and the teaching of mathematics.

Razaflinjatovo, Haja-Nirina, Irregular sampling with derivatives.

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Bonetti, Marco, Geometric methods in data analysis.

Chang, Hong, Model determination using predictive distributions.

Datta, Sujay, Multistage parametric inference procedures: The fine-tuning aspect and the distribution free scenario.

Sison, Maria Cristina Irene Pena, Simultaneous confidence intervals, sample size determination and testing procedures for multinomial proportions.

Wesleyan University (3)

Mathematics

Erdélyi-Szabó, Miklós, Decidability in the constructive theory of reals as an ordered $Q$-vector-space.

Liu, Guoyang, Free groups and free products in $SL_2(\mathbb{Z})$ and $SO_3(\mathbb{Q})$.

Olberding, Bruce Michael, Torsion-free modules over Prüfer domains.

Yale University (10)

Mathematics

Chen, Jiang-Ping, Local factors, central characters, and the representations of the general linear group over non-Archimedean local fields.

Fastenberg, Lisa Alexandra, Mordell-Weil groups in procyclic extensions of a functional field.

Hrycak, Tomasz Wieslaw, An improved fast multiple algorithm for potential flows.

Kleinbock, Dmitry Yanovich, Nondense orbits of nonquasiunipotent flows and applications to diophantine approximation.

Kotlov, Andrew Valeri, Rank and combinatorial structure of graphs.

Papageorgiou, Yannis Vorgos, $SL_2(\mathbb{C})$, the cubic and quartic.

Raghunathan, Ravi, Converse theorems for Dirichlet series with poles.

Voss, Karl Alvin, Self-similar solutions of the Navier-Stokes equations.

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Iversen, Edwin, A spatial and temporal Markov random field model with application to real estate price indices.

Yang, Yuhong, Minmax optimal density estimation.


Wanz, Kenneth, Unital embedded in finite projective planes.

District of Columbia

George Washington University (2)

Mathematics

Ramamurti, Sita, Dynamics near the essential singularity for zero-free entire vector fields of finite order.

Statistics

Lent, Janice, Probabilistic analysis of some searching and sorting algorithms.

Florida

Florida Atlantic University (2)

Mathematics

Fischer, Bernd, On the geometric quantization of symplectic Lie group actions.

Winkowska-Nowak, Katarzyna, Topologizing Boolean algebra.

Florida Institute of Technology (2)

Mathematics

Kovach, Todd, Quasilinearization and interval analysis.

Yin, Yunfeng, A unified study of differential equations with antiperiodic boundary conditions.

Florida State University (8)

Mathematics

Ruane, Kim E., Boundaries of groups.

Wen, Fengping (John), Topics in quantum groups.

Young-Kyun, Yang, An analysis of Mush-Chimney structures.

Zhang, Liang (Peter), On analytic and algebraic properties of Jacobian varieties of Riemann surfaces.

Statistics

Amirsehi, Kourosh, Testing for a time-dependent covariate effect in the linear risk model.

Dorado, Crisanto, Estimation of the survival function from data on units which are repaired upon failure.

Subramanian, Sundarraman, Estimation of survival functions when failure indicators are missing completely at random.

Yang, Jie, Likelihood ratio based confidence bands in survival analysis.
University of Florida (8)

INDUSTRIAL AND SYSTEM ENGINEERING
El Hafsi, Mohsen, Real-time production and setup scheduling of deterministic and stochastic manufacturing systems.
Rayco, Maria Brenda R., Algorithmic approaches to demand point aggregation for location models.

MATHEMATICS
Pulapaka, Hari, Non-revisiting paths and cycles in polyhedral maps.

Statistics
Kang, Taewoon, Bivariate probit models in multivariate regression analysis with spatial dependence.

University of Miami (1)

MATHEMATICS AND COMPUTER SCIENCE
Avila, Eric, Permanence in seasonal ecological models with spacial heterogeneity.

University of South Florida (4)

MATHEMATICS
Lu, Guoqi, Markov processes with random transition probabilities.

Statistics
Yoder, Margaret, String rewriting applied to problems in the braid groups.

Zhou, Yanmu, Arrangements of points on the sphere.

GEORGIA

Emory University (5)

BIOSTATISTICS
Kolczak, Margarete Smith, Assumptions and variance estimates in evaluating vaccine efficacy using the household secondary attack rate.

MATHEMATICS AND COMPUTER SCIENCE
Carroll, Blayne, Subgraph transformations: A generalization of line graphs.
De Malo, Joseph, The embedding of a 2 - (5, 2, 1) design in a projective plane of even order n.
Harris, John, Forbidden triples of subgraphs and traceability.
Wysocka, Beata, Some results in anti-Ramsey theory.

Georgia Institute of Technology (8)

MATHEMATICS
Bussian, Eric Richard, Bounding the edge cover time of random walks on simple graphs.
Eidenschink, Michael, Exploring global dynamics: A numerical algorithm based on the Conley index theory.
Leiva, Hugo, Skew-product semiflows and time-dependent dynamical systems.
Meddin, Mona, Genetic algorithms: A Markov chain and detailed balance approach.
Mendivil, Franklin, Compactifications and function spaces.
Rahcek, Jan, Ergodic billiards and mechanism of defocusing in n dimensions.
Rufeger, Waltraud, An analysis of the oregonator.
Thomas, Diana Maria, Dynamics of lattice systems.

University of Georgia (5)

MATHEMATICS
Cheng, Fred Yuanyou, An explicit upper bound of the Riemann zeta function in the critical strip and a conjecture of Graham.
Kresic-Juric, Sasa, Loop groups, integrable systems of classical mechanics and discretizations.
Peng, Chunang, Relative projectivity, relative cohomology and the ideals in cohomology rings.
Srinivasan, Anitha, Computations of class numbers of quadratic fields.

Statistics
Datta, Susmita, Dynamics of cytonuclear disequilibria and related statistical tests for the neutrality of mitochondrial DNA makers for hybrid zone data.

HAWAII

University of Hawaii at Manoa (1)

MATHEMATICS
Huang, Guoqiang, Automated reasoning and machine learning.

IDAHO

Idaho State University (3)

MATHEMATICS
Simon, Rick, Reconstructing multivariable isotonic functions in L1 via discrete approximation.
Tiffin, Timothy L., Enumeration of Hamiltonian cycles and paths in m × n grid graphs.

University of Idaho (1)

MATHEMATICS
Meerink, Kenneth, An unavoidable tangential approach to the Kawachi-Nakanishi conjecture.

ILLINOIS

Illinois State University (2)

MATHEMATICS
Lewis, Raynold, The knowledge of equivalent fractions that children in grades 1, 2 and 3 bring to formal instruction.
Stump, Sheryl, Secondary mathematics teachers: Knowledge of the concept of slope.

Northern Illinois University (4)

MATHEMATICAL SCIENCES
Huang, Guoqiang, Problems in the theory of block induction.
Marzano, Frank, Periodic differential equations with singularity.
Talarico, Susan, Non-definite eigenvalue problems.

Northwestern University (12)

INDUSTRIAL ENGINEERING AND MANAGEMENT SCIENCE
Barnes-Schuster, Dawn, Supply chain management and the use of long term supply contracts.
Cheudhury-Irwin, Sania, A packet switched data concept for mixed traffic CDMA cellular system.
Felli, James C., The expected value of perfect information as an alternative to sensitivity analysis in multiparametric decision problems.
Kuo, Yar-Lin, Scheduling aircraft engine maintenance: Modeling and optimization.
Monteiro, Brian L., Airline yield management origin-destination seat inventory control.
Tibben-Lembke, Ronald S., Essays in logistics.
Watson, Michael S., A standardization analysis process applied to steel coils in the automotive industry.

Mathematics
Bendel, Christopher P., Support varieties for infinitesimal algebraic groups.
Cogswell, Kurt, Volume growth in unstable submanifolds.
McDonald, John, Fractional power series and resultants.
McDougall, Jane, A study of a family of non-linear functionals.
Southern Illinois University, Carbondale (5)

Mathematics
Bonn, Jeffrey T., Combinatorial objects from ordering the elements of a finite field.
Brown, Robert Alan, Decomposition of dual-extending modules.
Haile, Davit, Extremal results on critical edge-chromatic graphs.
Li, XinMin, Sampling expansions and uniform bounds for the corresponding truncation errors.
Raffoul, Youssef N., Stability, boundedness, and periodic solutions of Volterra type difference equations.

University of Chicago (20)

Mathematics
Adler, Jeffrey Daniel, Refined anisotropic K-types and supercuspidal representations.
Anspsch, Peter H., The unramified discrete spectrum of PSp(4) over a rational function field.
Benveniste, Elie Jerome, Rigidity and deformations of lattice actions preserving geometric structures.
Cole, Michael, Complex oriented RO(G)-graded equivariant cohomology theories and their formal group laws.
Consani, Caterina, Double complexes and Euler L-factors on degenerations of algebraic varieties.
Johnston, Heather Marie, Transversality for non-manifolds.
Kley, Holger Philipp, Rigid curves in quintic threefolds.
Korey, Michael B., Ideal weights: Doubling and absolute continuity with asymptotically optimal bounds.
Lauter, Kristin Estella, Ray class field construction of curves over finite fields with many rational points.
Mundel, Trevor, A model of edge detection in the primary visual cortex.
Resnick, Sergei, Dynamical problems in non-linear additive partial differential equations.
Wolbert, Jerome Joseph, Classifying modules over K-theory spectra.

Statistics
Ambrosius, Walter Thomas, Deformable templates and image compression.
Barnard, John, Cross-match procedures for multiple-imputation inference: Bayesian theory and frequentist evaluation.
Collins, Linda, Inter-event distance methods for the statistical analysis of spatial point processes.
Dong, Liming, Adjustment for covariates in the analysis of clinical trials.
Frigge, Michael, Some Monte Carlo methods in linkage analysis.
Hung, Hui-Nien, Average likelihood.
van Dyk, David A., Construction, implementation and theory of algorithms based on data-augmentation and model reduction.

University of Illinois at Chicago (12)

Mathematics, Statistics, and Computer Sciences
Bardoe, Matthew, Universal embedding for the involution geometries of U(3), SU(3) on CO_3.
Cheng, Hon-Wing, On-line computations of the You filtering system.
Ganesan, Venkatesh, On the characters of and parabolic unipotent subgroups of finite general linear groups.
Goetz, Arkadiusz, Dynamics of piecewise isometries.
Kim, Mijung, Multivariate survival analysis with general extreme value model.
Mathias, John Franklin, A diagrammatic approach to calculating knot invariants of finite type.
Monroe, Laura, Greedy codes over binary and non-binary fields.
Rainbolt, Julienne, On the Gelfand-Graev and generalized Gelfand-Graev representations of U(3,q).
Rasoulian, Azad, Some theorems on the structure of finite dimensional estimation algebras.
Tang, Chungyu, Nonparametric regression analysis for repeated measured data using wavelets.
Umland, Kristin, The Mod-2 cohomology of the Lyons group.
Vatan, Farrokh, On the analog computation of Boolean functions.

University of Illinois, Urbana-Champaign (25)

Mathematics
Axel, Ralph, The interaction of shock waves and dispersive waves.
Bae, Jaegug, On subset-sum-distinct sequence of positive integers.
Boeckle, Gebhard, Universal deformations of even Galois representations and relations to mass wave forms.
Cavagnero, Catherine Elizabeth, A homotopy reciprocity law for ribbon disc complements.
Choi, Changsun, Inequalities for the differential subordinates of meromorphic functions, and ito processes.
Gies, Paul, Efficient algorithms in Coxeter groups of large type.
Harnish, Stephen, A non-well-founded set theory (GST).
Kerofsky, Louis, Harmonic forms under metric and topological perturbations.
Kim, Eunsang, Fokations and exotic index theory.
Knox, Steven, The number of facets of a projection of a convex polytope.
Laframboise, Thomas, The Grothendieck-Cousin complex on G/B x G/B.
Lee, Si-Chang, Some special cases of Chow groups of complete ramified regular local rings.

Statistics
Chen, Huann-Sheng, Estimation in random field models for noisy spatial data.
Choi, Kyungmo, Nonparametric multivariate multisample tests of the location problem and multivariate regression based on directions of data.
Douglas, Jeffrey Alan, Theory and applications of nonparametric regression in item response theory.
Ge, Niansheng, Contributions to classification and calibration with high-dimensional data.
Xie, Minge, Regression modeling: Latent structure, theories and algorithms.
Zhao, Quanshui, Estimation and inference for conditionally heteroscedastic models.

Indiana University (4)

Mathematics
Ding, Hongyu, Group actions on noncompact surfaces.
Letsche, Carl, Eta invariants and the knot-slice problem.
Pearson, Kimberley, Algebraic K-theory of two-dimensional crystallographic groups.
Zhan, Met-Qin, Existence theory for the Landau system from plasma physics.

Indiana University-Purdue University, Indianapolis (2)

Mathematical Sciences
Alvis, Pradeep, Asymptotic morphisms on contact manifolds.
Wang, Yinpeng, Unified frequentist and Bayesian testing of precise hypothesis; in fixed samples and sequential settings.

Purdue University (31)

Industrial Engineering
Lee, Julien, Integration of the steel and electricity industries using price and load information exchange.
Mehta, Sanjay V., Predictable shop scheduling in the presence of machine breakdowns.
Morris, Sarah E., Simultaneous wide-area and local-access network design.
Venkatadri, Uday, Fractal layout for job shops.
Wood, Demet, Variances and quantiles in dynamic-system performance: Point estimation and standard errors.
Zhang, Zaili, Topics in linear, dynamic and multi-objective optimization.

**Mathematics**

Capogna, Luca, Optimal regularity for quasilinear equations in nilpotent stratified Lie groups of step two.
Dougherty, Michael Matthias, Higher gradient integrability of minimizers for functionals with polyconvex local energies.
Elek, Gabor, Combinatorial heat kernels and $L^2$-topological invariants.
Fu, David Edward, Valuations of maximal rational rank and local weak simultaneous resolution.
Hummelsheim, Klaus Willi, Universal classes and the Lefschetz formula for holomorphic differential operators.
Hurst, Paul Rollins, Linear fractional composition operators on weighted Hardy spaces.
Kim, Seongjai, Domain decomposition methods for contaminant transport in fractured porous media.
Lai, Yung-Hui, On the relation type of systems of parameters and on the Poincare series of systems of parameters.
Li, Hua-Lun, The stability of embeddings of Cauchy-Riemann manifolds.
Mohan, Radha, Cores, Rees valuations and indecomposable modules over a two-dimensional regular local ring.
Ren, Hongliang, Numerical solution of the continuation problem for the hyperbolic differential equations.
Rhoads, Gregory, Applications of complex function theory to minimal surfaces.
Smits, Robert George, Conditioned Brownian motion, spectral gaps and rates to equilibrium for diffusions.
Sun, Li-Chuan, Growth of Betti numbers, and cohomology operators defined by a deformation.
Tang, Jing, Probabilistic analysis of digital search trees.
Waidyaratne, Ajith, Extensions of almost CR vector bundles.
Yang, Deqin, Parallel non-overlapping domain decomposition algorithms for elliptic partial differential equations.
Ye, Seongan Lim, Solutions of Cauchy Riemann equations on a pseudocovex domain with nonsmooth boundary.
Yue, Rong, Optimal feedback control and value functions.
Zhang, Zhuoyuan, I. Differential games with maximum cost; II. The decomposition of initial space of RFDE.

**Statistics**

Abate, Marcey L., The use of historical data in statistical selection and robust product design.
Dmochowski, Jacek, Properties of intrinsic Bayes factors.
Ruff, Dustin Dean, Minimum Cramer-von Mises estimation of a distribution.
Varshavsky, Julia A., On the development of Intrinsic Bayes factors.

**University of Notre Dame**

Byun, Yanghwan, The unstable tangent vibration of Poincare complex.
Chocholáski, Wójciech, Functionals $C_w$ & $P_w$.
DeCataldo, Mark, Codimension of two subvarieties of quadrics.
DiRocco, Sandra, A higher order embedding of surfaces.
Michalski, Grzegorz, On foundations of recursion theory.
Nakamura, Shu, The classification of the third reduction with a spectral value condition.
Sandersen, John, Intrinsic pseudodistances.
Wang, Tzu-Yueh (Julie), The truncated second main theorem and diophantine problems of function fields.
Wraith, David, Exotic spheres with positive Ricci curvature.
Yu, Chern-Yih, The connective real $K$-theory of elementary Abelian $R$-groups.

**Iowa**

**Iowa State University**

Hsu, Feng-Luan, Coding theory and discrete transforms.
Lai, Ruey-Gang, Practical feedback stabilization of nonlinear control systems and applications.
Lin, Shan, Analysis and synthesis of nonlinear systems.
Ou, Chung-Ming, Global aspects of control systems: Perspectives from control Lyapunov functions.
Wang, Rong, Modulation of $\gamma$-aminobutyric acid (GABA) type A receptor-mediated responses in spinal dorsal horn neurons by $\mu$-opioid receptor agonists and Ca$^{2+}$ calmodulin-protein kinase and Monte Carlo simulation of the GABAergic synaptic transmission.

**Statistics**

Emir, Birol, Nonparametric procedures for comparing the performance of repeated markers used to predict a survival endpoint.
Lei, Dean Ding-Hwa, The LRT method of constructing a two-sided "variables" acceptance region and its comparison with other methods.

**University of Iowa**

Byun, Yanghwan, The unstable tangent vibration of Poincare complex.
Chocholáski, Wójciech, Functionals $C_w$ & $P_w$.
DeCataldo, Mark, Codimension of two subvarieties of quadrics.
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Nakamura, Shu, The classification of the third reduction with a spectral value condition.
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Wraith, David, Exotic spheres with positive Ricci curvature.
Yu, Chern-Yih, The connective real $K$-theory of elementary Abelian $R$-groups.

**Statistics**

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**Kansas**

**Kansas State University**

Al-Agha, Khaled, On the involutory dimension of involution posets.
Goeckel, Gregory, On nonaxisymmetric entry flow in a semi-infinite circular tube at very low Reynolds numbers.
Mitchell, Patrick, Algorithms for finding small solutions.
Ravindran, Kuppusami, On a structure theory of effect algebras.
Yan, Chuntao, Nonlinear wave equations and solitary waves.
Statistics
Curriero, Frank Charles, The use of non-euclidean distances in geostatistics.
Khamis, Imad H., Multiple step-stress accelerated life testing.
Njoku, Peter M., Using mixed models to analyze data from on-farm trials.
Wickremasinghe, Nimal, Testing subhypotheses in the nonreplicated three-way multiplicative interaction model.

University of Kansas (2)
Mathematics
Chen, Zhisheng, Some applications of adaptive control: Diffusion approximation and hierarchical approximation schemes.
Chu, Yi, An equivariant Toeplitz C*-algebra over SL(2, R).

Wichita State University (3)
Mathematics
Aguilar, Valentina, The range of the exponential Radon transform.
Hu, Chenglie, Application of computational complex analysis.

KENTUCKY
University of Kentucky (7)
Mathematics
Bronstein, Albert, On representations of quivers.
Liu, Zhounong, Orthogonal spline collocation for biharmonic problems.
Roper, Kevin, Convexity properties of holomorphic mappings of the unit ball in C^n.
Wells, Clark, An improved method for sampling of molecular conformation space.

Statistics
Hinkle, John, Reciprocal components, reciprocal curves and partial least squares.
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Galb, Joseph H., Jr., Robustness and power of likelihood ratio tests applied to data distorted by floor effects.
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Canas da Silva, Ana M., Multiplicity formulas for orbifolds.
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Izhikevich, Eugene, Bifurcations in brain dynamics.
Jin, Ming, Quasi-Laguerre iteration and its application in solving symmetric tridiagonal eigenvalue problems.
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Roitgen, John, A new framework for supervisory control of discrete event systems. 
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Yang, Fan, Network optimization with time window constrained routing and scheduling. 
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Matison, Thor, A rational interval of rotation numbers of periodic points for certain non-separating plane continua.
Paz-Cuentas, Miguel, Analysis of a mixture of fixed and random effects in a mixed model.
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University of Montana (2)

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Keck, Heidi, The discrete calculus of variations.

NEBRASKA

University of Nebraska-Lincoln (7)

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University of New Hampshire (1)

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NEW JERSEY

Princeton University (3)

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MATH SCIENTISTS
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Horntrup, David J., Monte Carlo simulation of turbulent transport.
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Costin, Ovidiu, Generalized asymptotic expansions for ODE's and applications.
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Narasimhan, Partha, QoS based bandwidth allocations in wireless networks.
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Phillips, Jonathon, Problems in biometrics and biomedical imaging.
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Iglehart, Patricia Ann, A multivariable asymptotic expansion of the general second order linear differential equation.

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MATH SCIENTISTS
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Gasparim, Elizabeth Terezinha, Holomorphic vector bundles on blow-ups.
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Gilde, Ernest, On some problems concerning anti-Wick operators.
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Kennedy, Juliette Cara, On embedding models of arithmetic into reduced powers.
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Liu, Qiming, Generalized conditional symmetries, asymptotic integrability and integrable surfaces.

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Feng, Tat Sang, Immersions in knot theory.
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Ng, Ka-Yi, Groups of ribbon knots.
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Romano, Alexandre, A multilevel self-adaptive version of the immersed boundary method.
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**DECISION SCIENCES AND ENGINEERING SYSTEMS**
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Caldwell, Cathy, A reconstruction algorithm for electrical impedance tomography in an annulus.
Capirol, Paul, A parallel computing paradigm for nonlinear optimization with applications in the numerical solution of differential equations and parameter determination.
Haider, Masanori, Analytic approximations for the indentation of a thin linear elastic layer and a viscoelastic formulation in finite strain with applications to the mechanics of biological soft tissues.
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Grossi, Ana Cristina, Dispersion of tracer stugs for flow in porous media.
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Ning, Yu-Ming, Simulation study of Skunmix algorithm: A research on skewness-mixture problem.
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Richard, Simon, Hofer's geometry on compact surfaces.

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Yun, Gaohui, Fundamental groups of Riemannian manifolds, sigma constant and scalar curvature.

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Celik, Halil Ibrahim, Pointwise singularities of pluriharmonic functions.

Khouri, Han Q., Exploring perspectives about mathematics within the cultural context of a college algebra class at a community college: A case study.

McGraw, Colleen K., Exploring the mathematical paths students follow in high school and college.

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Royle, Jeffrey Andrew, Statistical inference for heterogeneous random fields.

Tsai, Kuenhui, Survival analysis for telemetry data in animal studies.

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University of North Carolina, Chapel Hill (15)

BIOSTATISTICS

Chaudhary, Asraf Mohammad, Asymptotic inference from unequal probability multi-stage samples.

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Glueck, Deborah H., Power for a generalization of the GLMM with fixed and random predictors.

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Smith, Melissa, Robust hierarchical Bayes methodology for clinical studies.

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MATHEMATICS

Barnes, Julia, Applications of noninvertible ergodic theory to rational maps of the sphere.

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PENNSYLVANIA

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—Percy Delft, New York University-Courant Institute, NYC, C. David Levermore, University of Arizona, Tucson, and C. Eugene Wayne, Pennsylvania State University, University Park, Editors

This volume contains some of the lectures presented in June 1994 during the AMS-SIAM Summer Seminar at the Mathematical Sciences Research Institute in Berkeley. The book serves as an ideal introduction to the varied and interesting topics covered.

Lectures in Applied Mathematics, Volume 31; 1996; 268 pp.; Softcover; ISBN 0-8218-0669-9; List $29; All AMS members $23; Order code LAM/31NA

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Lifting Solutions to Perturbing Problems in $C^*$-Algebras
Terry A. Loring, University of New Mexico, Albuquerque

The nature of $C^*$-algebras is such that one cannot study perturbation without also studying the theory of lifting and the theory of extensions. Approximation questions involving representations of relations in matrices and $C^*$-algebras are the central focus of this volume. A variety of approximation techniques are unified by translating them into lifting problems: from classical questions about transitivity of algebras of operators on Hilbert spaces to recent results in linear algebra.

The techniques of universal algebra are applied to the category of $C^*$-algebras. An important difference, central to this book, is that one can consider approximate representations of relations and approximately commuting diagrams. Moreover, the highly algebraic approach does not exclude applications to very geometric $C^*$-algebras.

$K$-theory is avoided, but universal properties and stability properties of specific $C^*$-algebras that have applications to $K$-theory are considered. Index theory arises naturally, and very concretely, as an obstruction to stability for almost commuting matrices.

Multiplier algebras are studied in detail, both in the setting of rings and of $C^*$-algebras. Recent results about extensions of $C^*$-algebras are discussed, including a result linking amalgamated products with the Busby/Hochschild theory.

Fields Institute Monographs, Volume 8; 1997; 165 pages; Hardcover; ISBN 0-8218-0302-9; List $44; Individual member $22. Order code FIM/8NA

Monotone Operators in Banach Space and Nonlinear Partial Differential Equations
R. E. Showalter, University of Texas, Austin

The objectives of this monograph are to present some topics from the theory of monotone operators and nonlinear semigroup theory which are directly applicable to the existence and uniqueness theory of initial-boundary-value problems for partial differential equations and to construct such operators as realizations of these problems in appropriate function spaces.

A highlight of this presentation is the large number and variety of examples introduced to illustrate the connection between the theory of nonlinear operators and partial differential equations. These include primary semilinear or quasilinear equations of elliptic or of parabolic type, degenerate cases with change of type, related systems and variational inequalities, and spatial boundary conditions of the usual Dirichlet, Neumann, Robin or dynamic type.

Mathematical Surveys and Monographs, Volume 49; 1997; 278 pages; Hardcover; ISBN 0-8218-0692-2; List $75; Individual member $45. Order code SURV/49NA

Nonlinear Evolutionary Partial Differential Equations
Xia-Xi Ding, Academia Sinica, Beijing, China, and Tai-Ping Liu, Stanford University, CA, Editors

This volume contains the proceedings from the International Conference on Nonlinear Evolutionary Partial Differential Equations held in Beijing in June 1993. The topic for the conference was selected because of its importance in the natural sciences and for its mathematical significance. Discussion topics include conservation laws, dispersion waves, Einstein's theory of gravitation, reaction-diffusion equations, the Navier-Stokes equations, and more. New results were presented and are featured in this volume.

Titles in this series are co-published with International Press, Cambridge, MA.

AMS/IP Studies in Advanced Mathematics, Volume 3; 1997; 637 pages; Hardcover; ISBN 0-8218-0661-0; List $99; All AMS members $55. Order code AMS/IP/3NA

Proceedings of the Norbert Wiener Centenary Congress, 1994
V. Mandrekar, Michigan State University, East Lansing, and P. R. Masani, University of Pittsburgh, PA

One of the great mathematicians of this century, Norbert Wiener, was a universal thinker of colossal proportions. This book contains the proceedings of the Norbert Wiener Centenary Congress held at Michigan State University on November 27-December 2, 1994. The aim of the Congress was to reveal the depth and strong coherence of thought that runs through Wiener's legacy, and to exhibit its continuation in ongoing research.

This volume brings together the great minds who have furthered Wiener's ideas in physics, stochastics, harmonic analysis, philosophy, prostheses and cybernetics. The presentations coherently lay out the developments of the subjects from their inception. This volume provides an excellent pathway for new investigators who may wish to pursue these developments by following the footsteps of world experts.

There is no other book available in which experts in the various fields in which Weiner worked have presented his thoughts and contributions in such a coherent and lucid manner.


Spectral Graph Theory
Fan R. K. Chung, University of Pennsylvania, Philadelphia

This monograph is an international tale of eigenvalues and their use in unlocking a thousand secrets about graphs. The story will be told—how the spectrum reveals fundamental properties of a graph, how spectral graph theory links the discrete universe to the continuous one through geometric, analytic and algebraic techniques, and how, through eigenvalues, theory and applications in combinatorics and computer science come together in symbiotic harmony.

—from the Preface

Beautifully written and elegantly presented, this book is based on 10 lectures given at the CBMS workshop on spectral graph theory in June 1994 at Fresno State University. Chung's well-written exposition is the equivalent of a conversation with a good teacher—one who not only gives you the facts, but tells you what is really going on, why it is worth doing, and how it is related to familiar ideas in other areas.

The monograph is accessible to the nonexpert who is interested in reading about this exciting area of mathematics.

CBMS Regional Conference Series in Mathematics, Number 92; 1997; 207 pages; Softcover; ISBN 0-8218-0315-8; List $25; All individuals $20. Order code CBMS/92NA

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EMS Awards Prizes

At the European Mathematical Congress, held in Budapest in July 1996, the European Mathematical Society awarded a number of prizes for outstanding contributions to mathematics. The prize winners are listed below, together with brief descriptions of their work.

ALEXIS BONNET works on a broad spectrum of problems in applied analysis. His results on the Mumford-Shah conjecture in the theory of computer vision constituted a breakthrough. This problem deals with a variational problem with a singular boundary set and proposes a finite representation of the optimum solution. Bonnet obtained the first finiteness result under additional assumptions, which is a major step in understanding this difficult free boundary value problem. In a different direction, his results on partial differential equations, in particular on flame propagation and combustion, are very significant.

WILLIAM TIMOTHY GOWERS'S work has made the geometry of Banach spaces look completely different. Here are some of his spectacular results. He solved the notorious Banach hyperplane problem, to find a Banach space which is not isomorphic to any of its hyperplanes. He gave a counterexample to the Schroeder-Bernstein theorem for Banach spaces. He proved a deep dichotomy principle for Banach spaces which, if combined with a result of Komorowski and Tomczak-Jaegermann, shows that if all closed infinite-dimensional subspaces of a Banach space are isomorphic to the space, then it is a Hilbert space. He gave (jointly with Maurey) an example of a Banach space such that every bounded operator from the space to itself is a Fredholm operator. His mathematics is both very original and technically strong. The techniques he uses are highly individual; in particular, he makes very clever use of infinite Ramsey theory.

ANNETTE HUBER developed a difficult and important theory, the theory of the derived category of mixed motivic realizations. The theory of motives was discovered by Alexandre Grothendieck in the 1960s. This important topic is still largely conjectural. The definition of mixed motives is one of the central problems of this theory. Annette Huber defines a derived category of the category of mixed realizations defined by Jannsen. She constructs a functor from the category of simplicial varieties to this derived category, whose cohomology objects are precisely the mixed realizations of the variety. She then defines an absolute cohomology theory, over which the usual absolute theories—absolute Hodge-Deligne and continuous étale cohomology—naturally factorize.

AISE JHAN DE JONG has produced a large variety of deep results on various aspects of arithmetic algebraic geometry. His personal influence on the work in the field is impressive. His work is characterized by a truly geometric approach and an abundance of new ideas. Among others, his results include the resolution of a conjecture of Vays and the answer to a long-standing question of Mumford on moduli spaces. Resolution of singularities by modification is difficult and unknown in most cases; in a recent outstanding work, de Jong found an elegant method for the resolution of singularities by alterations, which is a slightly weaker question but sufficient for most applications. This basic method combines geometric insight and technical knowledge.

DMITRI KRAMKOV has important results in statistics and the mathematics of finance. He did fundamental work in filtered statistical experiments. In particular, he obtained a deep result on the structure of Le Cam's distance between two filtered statistical experiments and proved very general theorems about the structure of the limit experiments which cover many results in the asymptotic mathematical statistics of stochastic processes. Recently he proved a remarkable "Optional decomposition of supermartingales", which is an extension of the fundamental Doob-Meyer decomposition for the case of many probability measures. This unexpected result is rather difficult and refined technically and, from the conceptual point of view, very important. In the direction of mathematical finance, Kramkov obtained impressive results on pricing formulas for certain classes of "exotic" options based on geometric Brownian motion. He succeeded in computing explicit solutions.
for "Asian options" where the payoff is given by a time-average of geometric Brownian motion.

JIRI MATOUSEK's achievements have combinatorial and geometric flavor; his research is characterized by its breadth, by its algorithmic motivation, as well as by the difficulty of the problems he attacks. He gave constructions of epsilon-nets in computational geometry, which provide tools for derandomization of geometric algorithms. He obtained the best results on several key problems in computational and combinatorial geometry and optimization, such as linear programming algorithms and range searching. He solved several long-standing problems (going back to the work of K. F. Roth) in geometric discrepancy theory, in particular on the discrepancy of half-planes and of arithmetical progressions. He solved a problem by Johnson and Lindenstrauss on embeddings of finite metric spaces into Banach spaces. He also obtained sharp results on almost isometric embeddings of finite-dimensional Banach spaces using uniform distributions of points on spheres. In mathematical logic, he found a striking example of a combinatorial unprovable statement.

LOIC MEREL proved an absolute bound for the torsion of elliptic curves, thereby giving a solution to a long-standing problem which was open for more than thirty years and which has resisted the efforts of the greatest specialists in elliptic curves. The group of torsion points of an elliptic curve over a number field is finite. Merel found a bound of the order of this group in terms of the degree of the number field; such a bound was known only in a very few cases: the case of the rational numbers (Mazur 1976), number fields of degree less than 8 (Kamienny-Mazur 1992), and number fields of degree less than 14 (Abramovitch 1993).

GRIGORY PERelman's work played a major role in the development of the theory of Alexandrov spaces of curvature bounded from below, giving new insight into the extent to which the results of Riemannian geometry rely on the smoothness of the structure. Now, mainly due to Perelman, the theory is rather complete. His results include a structure theory of these spaces, a stability theorem (new even for Riemannian manifolds), and a synthetic geometry à la Alexandrov. He proved a conjecture of Gromov concerning an estimation of the product of weights and the Cheeger-Gromov conjecture. This last problem attracted the attention and efforts of many geometers for more than twenty years, and the method developed by Perelman yielded an astonishingly short solution.

RICARDO PEREZ-MARCO solved several outstanding problems and obtained basic results in the theory of dynamics of nonlinearizable germs and nonlinearizable analytic diffeomorphisms of the circle and in the theory of centralizers, a natural complement of nonlinearity. He discovered a new arithmetic condition under which a germ without periodic orbits is linearizable. He gave a negative answer to a question of Arnold on the linearizability of analytic diffeomorphisms of the circle without accumulating periodic orbits. Perez-Marco developed a theory of analytic nonlinearizable germs based on an important and useful compact invariant.

LEONID POLTEROVICH contributed in a most important way to several domains of geometry and dynamical systems, in particular to symplectic geometry. Polterovich ties together complex analytic and dynamical ideas in a unique way, leading to significant progress in both directions. In particular, he brings complex analysis into the realm of Hamiltonian mechanics, which marks a principally new step in this classical field. Among other results, he established (with Bialy) an anti-KAM estimate in terms of the Hofer displacement of a Hamiltonian flow. Polterovich found the first nontrivial restriction on the Maslov class of an embedded Lagrangian torus and (with Eliashberg) completely solved the knot problem in the real 4-space.

—EMS

**CAREER Grants Awarded**

The National Science Foundation (NSF) honored 346 outstanding faculty in fiscal 1996 with Faculty Early Career Development (CAREER) grants. The awardees were selected from nearly 1,865 applicants. NSF established the awards to help scientists and engineers develop simultaneously their contributions to research and education early in their careers. CAREER funds are awarded to junior-level faculty at colleges and universities. These awards are for 4–5 years and range from $200,000 to $500,000 each.

The names of the awardees in mathematics, their institutional affiliations, and the titles of their research projects are:

- **MIHIR BELLARE**, University of California, San Diego, Cryptography Proof Checking and Approximation;
- **TASSO KAPER**, Boston University, Dynamical Systems Theory Motivated by Bubbles Accelerators and Split-Operator Numerical Schemes;
- **PETER SMEREKA**, University of Michigan, Effective Equations for Bubbly Flow;
- **KAREN SMITH**, University of Michigan, Interactions of Commutative Algebras with Analysis, Geometry, and Computer Science; and
- **BONNIE RAY**, New Jersey Institute of Technology, Bayesian and Nonparametric Methods for Time Series Analysis with Environmental and Economic Applications.

—from NSF Announcement

**Erratum**

The December 1996 issue of the *Notices* (page 1530) carried an announcement about the awarding of the Morgan Prize to Manjul Bhargava. The announcement erroneously stated that the prize was conferred during the Seattle MathFest in August 1996. The prize was given at the Joint Mathematics Meeting in San Diego in January 1997.
Summer Institute for Women Students

The Summer Institute for the Mathematical Sciences (SIMS) will be held at the University of California, Berkeley, from June 14 to July 26, 1997. This six-week program is designed to encourage talented undergraduate women to pursue advanced degrees in the mathematical sciences.

Applicants must be U.S. citizens or permanent residents who have by June 1997 completed with distinction the equivalent of at least two years of collegiate-level mathematics, including a course in real analysis or modern algebra. About twenty women will be selected. Each will receive a travel allowance, campus room and board, and a stipend.

SIMS offers intensive seminars designed to give students a deep understanding of mathematical concepts and to teach them how to do independent work and express mathematical ideas orally and in writing. All faculty are women who are active research mathematicians and excellent teachers. Seminar assistants are women who are graduate students in the mathematical sciences. In addition to the seminars, there are many colloquium talks given by renowned mathematicians and site visits to organizations where mathematical research is conducted in a nonacademic environment. Students are given information about applying to and obtaining funding for graduate school and about careers in the mathematical sciences.

Instructors are urged to bring this announcement to the attention of their students. For information and application materials, please send e-mail to sims@stat.berkeley.edu, send a fax to SIMS at 510-642-7892, or write to: Project Coordinator, Summer Institute for the Mathematical Sciences, University of California, 367 Evans Hall #3860, Berkeley, CA 94720-3860.

The SIMS World Wide Web site at http://www.stat.berkeley.edu/users/sims/ contains more information about the program, as well as application materials.

—SIMS Announcement

Travel Grants for fSU Scientists

The U.S. Civilian Research and Development Foundation for the Independent States of the Former Soviet Union (CRDF) will provide up to $2,500 for short-term travel to the United States. The grants will be made on a competitive basis to promising applied scientists and engineers from the non-Russian countries of the former Soviet Union. Travel must be for the purposes of participating in meetings of industry associations or scientific and engineering professional societies and also [of] visiting research facilities to initiate collaboration with U.S. scientists. The program is limited to first-time visitors to the U.S. Travel related to degree programs or attendance in courses is not eligible. Travel to attend meetings related to the basic sciences, social sciences, or public policy issues is not eligible.

CRDF must receive requests for travel support at least eight weeks prior to the intended date of travel. Travel must be completed by December 31, 1997. CRDF plans to award up to 160 travel grants. Applications will be accepted until
October 31, 1997, or until the 160 grant limit has been reached. The CRDF may at its option decide to extend the program beyond this date.

Further information may be found on the CRDF Web site, http://www.crdf.inter.net/. The mailing address is: US Civilian Research and Development Foundation for the Independent States of the Former Soviet Union, 1800 North Kent Street, Suite 1106, Arlington, VA 22209. The telephone number is 703-526-9720, the fax number is 703-526-9721, and the e-mail address is information@crdf.org.

—from CRDF Announcement

IAS/Park City Mathematics Institute

Each summer the Institute for Advanced Study/Park City Mathematics Institute (PCMI) offers an integrated set of programs for researchers, postdocs, graduate students, undergraduates, and teachers. The topic for the 1997 PCMI Summer Session is symplectic geometry and topology, and it will be held at the Inn at Prospector Square in Park City, Utah, from June 29 to July 19, 1997.

Women undergraduate and graduate students who are accepted into the PCMI Summer Session are also invited to take part in the Mentoring Program for Women in Mathematics, to be held at the IAS in Princeton, New Jersey, May 12-22, 1997. The two-week workshop provides a combination of lectures, seminars, working problem groups, mentoring, and networking sessions in addition to the opportunity to meet and converse with mathematicians in residence at the Institute for Advanced Study.

For applications and more information, contact pcmi@math.ias.edu or consult the Web site http://www.admin.ias.edu/ma/parkcity.htm.

—from PCMI Announcement

AWM Workshop and Travel Grants

The Association for Women in Mathematics (AWM) has two programs with fast approaching deadlines.

AWM Workshop, Stanford, July 1997: For the past eight years the AWM has held, in conjunction with major mathematics meetings, workshops for graduate students and recent Ph.D.s. With funding from the Office of Naval Research, the next workshop will take place at the Society for Industrial and Applied Mathematics Annual Meeting at Stanford University, Stanford, California, July 14-18, 1997. This workshop will be held July 14-15, with an introductory group discussion and dinner on July 13.

The workshop will consist of a poster session by graduate students, four minisymposia, a group discussion on careers, a panel on government funding, and a dinner with a keynote speaker. One minisymposium will focus on written communication skills, and the other three will explore the research areas of mathematical modeling, optimization, and partial differential equations and applications.

The AWM also seeks volunteers to lead discussion groups and to act as mentors for workshop participants. Those interested in volunteering should contact the AWM office.

Applications for the workshop must be received by AWM by March 1, 1997.

AWM Travel Grants: The AWM travel grants program, which is sponsored by the National Science Foundation (NSF), enables women to attend research conferences in their fields, thereby providing a valuable opportunity to advance their research activities and their visibility in the research community.

The grants provide full or partial support for travel and subsistence for a meeting or conference in the applicant's field of specialization. A maximum of $1,000 for domestic travel and of $2,000 for foreign travel will be available.

These travel funds are provided by the Division of Mathematical Sciences (DMS) of NSF, and the research conference must be in an area supported by DMS. For example, this includes certain areas of statistics, but excludes most mathematics education and history of mathematics. An individual who has been awarded an AWM-NSF travel grant in the past two years, or who has other sources of external funding, such as any type of NSF grant, is ineligible. Partial support from the applicant's institution or from a non-governmental agency does not, however, make the applicant ineligible.

For the travel grants, there are three award periods per year, with applications due February 1, May 1, and October 1.

For further information about the workshop or the travel grants program, contact: Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone 301-405-7892; e-mail awm@math.umd.edu.

—from AWM
International Study of Mathematics and Science Achievement

The first installment of results from the Third International Mathematics and Science Study (TIMSS) was released on November 20. This first batch of data pertains to achievement of eighth-graders; later releases will focus on fourth- and twelfth-graders. The study found that U.S. eighth-graders performed below the international average in mathematics but slightly above average in science. The U.S. was among thirty-three countries in which there was no statistically significant difference between the performance of eighth-grade boys and girls in mathematics. The study also found that one of the most important factors in high achievement was students' home environment. This result was found consistently in the forty-one countries participating in the study.

The report may be found on the Web site http://www.ed.gov/NCES/timss/.

—Allyn Jackson

NAS and NSF Launch Studies of Mathematics

This fall the National Academy of Sciences (NAS) began planning an assessment of mathematical sciences research intended to lay the groundwork for decisions about how to structure federal support. The study is part of a larger effort at the Academy to gauge where the U.S. stands internationally in scientific research. The motivation comes from a 1993 report by the Committee on Science, Engineering, and Public Policy (COSEPUP), which set forth strategies for making decisions about how best to use federal research funds. COSEPUP is a committee of the NAS, the National Academy of Engineering, and the Institute of Medicine. The COSEPUP report recommended that the U.S. aim to be the world leader in certain critical fields and to be among the leaders in other areas. The report urged field-by-field assessments by independent panels of researchers in the field, researchers in closely related fields, and users of the research. The mathematical sciences study is the first such assessment. If this project is successful, the Academy will follow suit with other areas. The ultimate goal is to provide a basis for federal decisions about support of scientific research.

A separate but similar study will also be carried out by the National Science Foundation (NSF). The NSF study differs from the NAS study in that it is for internal management use within the NSF's Division of Mathematical Sciences (DMS). The study is motivated by the Government Performance and Results Act (GPRA), which requires agencies to link their budgets to their strategic plans, spelling out specific goals and ways to measure progress toward achieving them. One of the goals in the NSF Strategic Plan is to enable U.S. science to hold a world leadership position in most if not all areas of science. The NSF study will be a pilot project to allow the Foundation to explore how to do this kind of "benchmarking" study and whether it would be an effective tool for GPRA purposes. The NSF will be conducting other pilots in other divisions that might also be
used for the GPRA. When it submits its fiscal year 1999 budget in the fall of 1997, the NSF must include plans to meet the GPRA requirements.

The NAS committee members are listed at the end of this article. The names of the members of the DMS committee had not been announced at the time of this writing. The DMS committee is expected to include the presidents of the major organizations in the mathematical sciences. The committee will also draw upon consultants as they see fit. In order to avoid any appearance of conflict of interest, the bulk of the DMS committee members will be individuals who are not current DMS grantees. The DMS study should take about a year. For the NAS study, the plan is to make the report public only after parallel studies have been completed for other disciplines.

The mathematical sciences community is welcome to contribute comments and suggestions to either committee. For the NAS committee, contact Deborah Stine, Study Director, dstine@nas.edu; the mailing address is National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418. For the NSF committee, contact D. J. Lewis, DMS Director, d1ewis@nsf.gov; the mailing address is Division of Mathematical Sciences, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

National Academy of Sciences International Benchmarking of U.S. Research Fields—An Experimental Project

Mathematics Panel
  Peter D. Lax, Director, Courant Mathematics and Computing Laboratory, New York University;
  Spencer J. Bloch, Professor, Department of Mathematics, University of Chicago;
  Joseph B. Keller, Professor, Department of Mathematics, Stanford University;
  Jacques-Louis Lions, Professor, Collège de France;
  Yuri I. Manin, Director, Max-Planck Institute für Mathematik;
  Rudolph A. Marcus, A. A. Noyes Professor of Chemistry, California Institute of Technology;
  Gary C. McDonald, Head, Consumer Operations Research Department, GM NAO Research and Development Center;
  Cathleen S. Morawetz, Professor Emeritus, Courant Institute of Mathematical Sciences, New York University;
  Peter Sarnak, Chair, Department of Mathematics, Princeton University;
  I. M. Singer, Institute Professor, Department of Mathematics, Massachusetts Institute of Technology;
  Margaret H. Wright, Distinguished Member, Technical Staff, Bell Laboratories/Lucent Technologies.

——Allyn Jackson
From the AMS

1996 Election Results

In 1996, the Society elected a Vice-president, a Trustee, five Members-at-large of the Council, two members of the Editorial Boards Committee and three members of the Nominating Committee. Terms for these positions are three years, beginning on February 1, 1997, and ending on January 31, 2000, except for the Trustee, whose term is for five years ending on January 31, 2002. Members elected to the Nominating Committee begin serving immediately. Their terms end on December 31, 1997.

Suggestions for elections to be held in the fall of 1997 are solicited by the 1997 Nominating Committee. Send electronic mail to: noncomm@sol.math.uiuc.edu. The Nominating Committee will be meeting during the Annual Meeting in San Diego in January.

Positions to be filled in the 1997 election are:

President-elect
Vice-president
Trustee
Five Members-at-large of the Council
Nominations for election for two positions on the Editorial Boards Committee and three positions on the 1998 Nominating Committee are also welcome and can be sent to the Secretary at: r-fossum@uiuc.edu.

Vice-President
Elected as the new Vice-president is **H. Blaine Lawson Jr.** from the State University of New York, Stony Brook.

Trustee
Elected as the new Trustee is **Andy R. Magid** from the University of Oklahoma, Norman.

Member-at-large of the Council
Elected as new Members-at-large of the Council of the Society are

- **Francis Bonahon** from the University of Southern California
- **Frederick Gardiner** from City University of New York
- **Gail Ratcliff** from the University of Missouri St. Louis
- **Joel H. Spencer** from New York University
- **Karen Vogtmann** from Cornell University

Editorial Boards Committee
Elected as new members of the Editorial Boards Committee are

- **Eric Bedford** from Indiana University, Bloomington, ID
- **Richard S. Palais** from Brandeis University

Nominating Committee
Elected as new members of the Nominating Committee are

- **John C. Polking** from Rice University
- **Barbara L. Osofsky** from Rutgers University
- **James D. Stasheff** from the University of North Carolina

—**Robert M. Fossum**

Secretary
There will be a number of contested seats in the 1997 AMS Elections. Your suggestions are wanted by:

The Nominating Committee for vice-president, trustee, and five members-at-large of the council

and by

The President for three Nominating Committee members and two Editorial Boards Committee members.

In addition

The Editorial Boards Committee requests suggestions for appointments to various editorial boards of Society publications.

Send your suggestions for any of the above to:

Robert M. Fossum
American Mathematical Society
Department of Mathematics
University of Illinois
1409 West Green Street
Urbana, IL 61801
e-mail: r-fossum@uiuc.edu
1997 AMS Election

Nominations by Petition

Vice-President or Member-at-Large

One position of vice-president and member of the Council *ex officio* for a term of three years is to be filled in the election of 1997. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

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 at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

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 support of a candidate for the position of vice-president or of member-at-large of the Council must have at least fifty valid signatures and must conform to several rules and operational considerations, which are described below.

Editorial Boards Committee

Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

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, described below, should be followed.

Nominating Committee

Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

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, described below, 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 and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert M. Fossum, Secretary, P.O. Box 6248, Providence, Rhode Island 02940, and must arrive by 28 February 1997.

2. The name of the candidate must be given as it appears in the *Combined Membership List* (CML). 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 next 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 Robert M. Fossum is that of a member. The name R. Fossum appears not to be.)

7. When a petition meeting these various requirements appears, the secretary will ask the candidate to indicate willingness to be included on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving consent.
Nomination Petition for 1997 Election

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

as a candidate for the position of (check one):

☐ Vice President
☐ Member-at-Large of the Council
☐ Member of the Nominating Committee
☐ Member of the Editorial Boards Committee


Name and address (printed or typed)

__________________________
Signature

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Signature

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Signature

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Signature

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Signature

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Signature

__________________________
Signature
Add this Cover Sheet to all of your Academic Job Applications

How to use this form

1. Using the facing page or a photocopy, (or a TeX version which can be downloaded from the e-math "Employment Information" menu, http://www.ams.org/committee/profession/employ.html), fill in the answers which apply to all of your academic applications. Make photocopies.

2. As you mail each application, fill in the remaining questions neatly on one cover sheet and include it on top of your application materials.

The Joint Committee on Employment Opportunities has adopted the cover sheet on the facing page as an aid to job applicants and prospective employers. The form is now available on e-math in a TeX format which can be downloaded and edited. The purpose of the cover form is to aid department staff in tracking and responding to each application.

Mathematics Departments in Bachelor's, Master's and Doctorate granting institutions have been contacted and are expecting to receive the form from each applicant, along with any other application materials they require. Obviously, not all departments will utilize the cover form information in the same manner. Please direct all general questions and comments about the form to:
emp-info@ams.org
or call the Professional Programs and Services Department, AMS, at 800-321-4267 extension 4105.

JCEO Recommendations for Professional Standards in Hiring Practices

The JCEO believes that every applicant is entitled to the courtesy of a prompt and accurate response that provides timely information about his/her status. Specifically, the JCEO urges all institutions to do the following after receiving an application:

(1) Acknowledge receipt of the application—immediately; and
(2) Provide information as to the current status of the application, as soon as possible.

The JCEO recommends a triage-based response, informing the applicant that he/she
(a) is not being considered further;
(b) is not among the top candidates; or
(c) is a strong match for the position.
# Academic Employment in Mathematics

## AMS STANDARD COVER SHEET

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Middle Names</th>
<th>Address through June 1997</th>
<th>Home Phone</th>
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<th>Current Institutional Affiliation</th>
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<tr>
<th>Highest Degree and Source</th>
<th>Year of Ph.D. (optional)</th>
<th>Ph.D. Advisor</th>
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**If the Ph.D. is not presently held, date on which you expect to receive**

Indicate the mathematical subject area(s) in which you have done research using the 1991 Mathematics Subject Classification printed on the back of this form. If listing more than one number, list first the one number which best describes your current primary interest.

<table>
<thead>
<tr>
<th>Primary Interest</th>
<th>Secondary Interests optional</th>
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Give a brief synopsis of your current research interests (e.g. finite group actions on four-manifolds). Avoid special mathematical symbols and please do not write outside of the boxed area.

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**Most recent, if any, position held post Ph.D.**

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<tr>
<th>University or Company</th>
<th>Position Title</th>
<th>Dates</th>
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**Indicate the position for which you are applying and position posting code, if applicable**

If unsuccessful for this position, would you like to be considered for a temporary position?

- [ ] Yes  - [ ] No  
  If yes, please check the appropriate boxes.

  - [ ] Postdoctoral Position  - [ ] 2+ Year Position  - [ ] 1 Year Position

List the names, affiliations, and e-mail addresses of up to four individuals who will provide letters of recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.

- [ ]
- [ ]
- [ ]
- [ ]
1991
Mathematics Subject Classification

00 General
01 History and biography
03 Logic and foundations
04 Set theory
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General mathematical systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra, matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 K-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
39 Finite differences and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations, optimal control
51 Geometry

52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
73 Mechanics of solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
85 Astronomy and astrophysics
86 Geophysics
90 Economics, operations research, programming, games
92 Biology and other natural sciences, behavioral sciences
93 Systems theory, control
94 Information and communication, circuits
The prize is awarded each year to an undergraduate student (or students having submitted joint work) for outstanding research in mathematics. Any student who is an undergraduate in a college or university in the United States or its possessions, or Canada or Mexico, is eligible to be considered for this prize.

The prize recipient's research need not be confined to a single paper; it may be contained in several papers. However, the paper (or papers) to be considered for the prize must be submitted while the student is an undergraduate; they cannot be submitted after the student's graduation. The research paper (or papers) may be submitted for consideration by the student or a nominator. All submissions for the prize must include at least one letter of support from a person, usually a faculty member, familiar with the student's research. Publication of research is not required.

The recipients of the prize are to be selected by a standing joint committee of the AMS, MAA, and SIAM. The decisions of this committee are final. The 1997 prize will be awarded for papers submitted for consideration no later than March 31, 1997, by (or on behalf of) students who were undergraduates in December 1996.

Nominations and submissions should be sent to:
Morgan Prize Committee
c/o Robert M. Fossum, Secretary
American Mathematical Society
University of Illinois
Department of Mathematics
1409 West Green Street
Urbana, IL 61801-2975

Questions may be directed to the chairperson of the Morgan Prize Committee:
Martha J. Siegel
Department of Mathematics
Towson State University
Towson, MD 21204-7097
telephone 410-830-2980
e-mail: siegel-m@towson.edu
Call for Nominations

The selection committees for these prizes request nominations for consideration for the 1998 awards. Further information about these prizes is included with the Bylaws, which can be found in the November 1995 Notices, pp. 1317-1332 (also available at http://www.ams.org/notices; then go to November 1995, “From the AMS” section, and then to “Bylaws of the AMS”).

Three Leroy P. Steele Prizes are awarded each year in the following categories: (1) the Steele Prize for Lifetime Achievement: for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students; (2) the Steele Prize for Mathematical Exposition: for a book or substantial survey or expository-research paper; and (3) the Steele Prize for Seminal Contributions to Research: for a paper, whether recent or not, that has proved to be of fundamental or lasting importance in its field, or a model of important research.

The Award for Distinguished Public Service is presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession during the preceding five years.

The George David Birkhoff Prize is awarded every five years for an outstanding contribution to applied mathematics in the highest and broadest sense. The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

Nominations with supporting information should be submitted to the Secretary, Robert M. Fossum, Department of Mathematics, University of Illinois, 1409 West Green Street, Urbana, IL 61801. For Steele and Birkhoff Prizes, include a short description on the work that is the basis of the nomination, including complete biographic citations. For Public Service Award, include a short description of the pertinent activities of the nominee. A curriculum vitae should be included for all nominees. The nominations will be forwarded by the Secretary to the appropriate prize selection committee, which will, as in the past, make final decisions on the awarding of prizes.

Deadline for nominations is March 31, 1997.
Position
The present Treasurer of the Society, Franklin P. Peterson, has announced his intention to resign on January 30, 1999, after 26 years of service. Therefore, the American Mathematical Society is seeking applications and nominations for candidates for the position of Treasurer of the Society. The Treasurer is an officer of the Society and is appointed by the Council of the Society for a term of two years, beginning on 01 February of each odd-numbered year. The newly appointed Treasurer will take office formally on 01 February, 1999, but should be appointed by the Council as early in 1998 as possible to permit a smooth transition. All necessary expenses incurred by the Treasurer in the performance of duties for the Society are reimbursed, including travel and communications.

Duties
The primary responsibility of the Treasurer is the overview of the financial and business activities of the Society—the work of the Trustees. The Treasurer monitors the financial condition of the Society and advises the Board of Trustees concerning the financial consequences of its decisions. The Treasurer works in close cooperation with the Associate Treasurer and the Executive Director of the Society. The Treasurer is a member of the Board of Trustees, Council, Agenda and Budget Committee, Audit Committee, Investment Committee, Liaison Committee, and Long Range Planning Committee.

The Treasurer should be a research mathematician. While the term of office is two years, it is anticipated that the person filling this office will be reappointed biennially for a number of terms, to ensure continuity.

Applications
Applications and nominations can be sent to the chair of the Search Committee, B. A. Taylor, or the Secretary of the Society, Robert M. Fossum:

Professor B. A. Taylor  Professor Robert M. Fossum
Department of Mathematics  Department of Mathematics
University of Michigan  University of Illinois
Ann Arbor, MI 49109-1109  1409 West Green St.
taylor@umich.edu  Urbana, IL 61801

Applications or nominations received by 31 March, 1997, will be assured full consideration.

The American Mathematical Society is an Equal Opportunity Employer.
Reference

The Reference section of the Notices is intended to provide the reader with frequently sought information in an easily accessible manner. New information is printed as it becomes available and is referenced after the first printing. As soon as information is updated or otherwise changed, it will be noted in this section.

Upcoming Deadlines

January 30, 1997: Nominations for the D. Ray Fulkerson Prize in Discrete Mathematics. Eva Tardos, chair of the Fulkerson Prize Committee, Department of Computer Science, Cornell University, Ithaca, NY 14850; e-mail: eva@cs.cornell.edu.


March 31, 1997: Deadline for nominations for Leroy P. Steele Prizes, Distinguished Public Service Award, George David Birkhoff Prize in Applied Mathematics, Frank and Breinnie Morgan Prize. Robert M. Fossum, Dept. of Mathematics, Univ. of Illinois, 1409 West Green Street, Urbana, IL 61801-2975.


April 15, August 15, 1997: Deadline for applications for NRC Resident, Cooperative, and Postdoctoral Research Associateship Programs. Information and application materials: e-mail: rap@nas.edu; World Wide Web http://www2.nas.edu/rap/welcome.html.


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AMS e-mail addresses
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AMS Ethical Guidelines
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AMS Officers and Committee Members
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AMS Proposed Amendments to the Bylaws
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Army Research Office, program officers
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Mathematical and Physical Sciences (MPS) Advisory Board

http://www2.nas.edu/rap/welcome.html

Www.nsf.gov/mps/dms, or Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230; telephone 703-306-1870.

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Mathematics Education Program Officers at NRC
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Mathematics Research Institutes Contact Information: The Fields Institute, The Geometry Center, Institute for Advanced Study (IAS), Institute for Mathematics and its Applications (IMA), Mathematical Sciences Institute (MSI), Mathematical Sciences Research Institute (MSRI), Center for Discrete Mathematics and Theoretical Computer Science (DIMACS), Centre de Recherches Mathématiques (CRM)
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Librarians, researchers, faculty, and students can use the World Wide Web to access one of the most extensive mathematical databases in the world.

A single search from the office, library, classroom, or home will yield a wealth of information unmatched by any other source, including:

- Works by a given author
- Full journal information
- Tables of contents
- Reviews referenced in an on-screen review
- Reviews that cite the on-screen review
- Institution codes and addresses
- Serial names and abbreviations
- Mathematics Subject Classification
- CMP data (updated daily)
- and more...

How did we live without MathSciNet? It's wonderful!

—MSN subscriber, University of Glasgow

This is a great resource. I am finding it difficult to stop gushing! My research will be significantly enhanced by the online availability of this treasure trove.

—MSN subscriber, Syracuse University

... the faculty here like access from their desktops tremendously ...

—MSN subscriber, Johns Hopkins University

This is great! One of the nicest things I’ve seen on the Web. Real content, not just glitz. Professionally and carefully done with lots of cross-links. Bravo!

—MSN subscriber, Rutgers University

*For more information, contact Senior Service Representative, Jacqueline Giroux at: 1-800-321-4267 or 401-455-4000, extension 4128, e-mail: jgg@ams.org

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For subscription details, or for further information contact: AMS Customer Services Department (cust-serv@ams.org)
800-321-4AMS (4267) or (401) 455-4000 (worldwide)
Mathematics Calendar

February 1997

7-8, Karl Stromberg Memorial Conference, Kansas State University, Manhattan, Kansas.

Program: The conference is in honor to Professor Karl Stromberg—his life and his work. There will be seven one-hour talks on various areas of analysis.

Conference Fee: There is no fee.

Information: For further information contact C. Moore, Department of Mathematics, Kansas State University, Manhattan, KS 66506; e-mail: cmoore@math.ksu.edu.

7-9, Texas Geometry and Topology Conference, Texas Christian University, Fort Worth, Texas.

Speakers: R. Forman (Harvard Univ. and Rice Univ.), C. LeBrun (SUNY Stony Brook), P. Lima-Filho (Texas A&M Univ.), D. McCullough (Univ. of Oklahoma), K. Okikiolu (MIT and Princeton Univ.), J. Rosenberg (Univ. of Maryland), G. Walschap (Univ. of Oklahoma), X. Zhang (Oklahoma State Univ.).

Information: For more information, please see our Web page: http://www.tcu.edu/math/faculty/park/etgtc97.html.

8, Convocation of Faculty, Administrators, and Others Interested in Summer Academic Institutes for High School Students (Math Convocation), Southwest Texas State University, San Marcos, Texas.

Goals: Learn what makes a successful summer program from nationally recognized leaders; share information about what works, what doesn't, and why in breakout sessions; develop and discuss plans to begin and sustain your own program; discuss the impact of these programs on participants and how to gather data; discuss how to write a proposal and find funding; learn about pending legislation to fund these programs in Texas and nationally.

Speakers: M. Berroizabal (Texas Pre-Freshman Engineering Program (PREP)), Filling the Pipeline for Workplace Diversity, Gathering Data, and How to Measure the Impact on Participants; G. Berzsenyi (USA Math Talent Search, Rose-Hulman Institute of Technology), Challenging Problems and a Research Component; J. Clark (Program Director, Young Scholars Program, NSF), New Guidelines for Teacher and Student Research Development Projects; F. Fasanelli (SUMMA and MAA), Planning a New Program, How to Write a Proposal and Find Funding; W. Fleischman (Villanova, Howard Hughes Medical Institute Young Scholars Program), Designing an Interdisciplinary Program; T. McCabe and D. Hazlewood (Southwest Texas State Univ., SWT Honors Summer Math Camp), Mathematics, Number Theory, and Group Interactions; A. Ross (Ross Young Scholars Program, Ohio State Univ.), What Summer Programs Are All About, What Works, What Doesn't, and Why; G. Stevens (PROMYS, Boston Univ.), Developing the Proper Environment, Counselors, Seminars, and Activities; U. Treisman (Executive Director, Texas statewide Systemic Initiative and Charles A. Dana Center), Programs that Nurture Mathematical Talent.

Registration Deadline: Send in registration form by January 17, 1997. Free hotel to first 100 participants.

Program Organizer: M. Warshauer, Department of Mathematics, Southwest Texas State Univ., San Marcos, TX 78666; tel: 512-245-3439; fax: 512-245-3847; e-mail: amv07@swt.edu.

Hotel Information: Rooms have been booked at Aquarena Springs Inn and La Quinta Inn, located at IH 35, Exit 206, in San Marcos. To reserve a room, call Aquarena Springs at 512-245-7590 or La Quinta at 512-392-8800. Ask for a reservation for the Math Convocation. The first 100 people to register will receive free hotel, paid for by the Texas Statewide Systemic Initia-
March 1997

10-15 Workshop on Calogero-Moser-Sutherland Models, Centre de Recherches Mathématicques (CRM), Université de Montréal, Canada.

Organizers: J. F. van Diejen (CRM), L. Vinet (Montréal, CRM).

Keynote Speakers: F. Calogero, J. K. Moser*, B. Sutherland.


Information: Further information, in particular concerning visa requirements and accommodation, can be obtained by e-mail: meetuni-alg.kiev.ua.

17-21 Fields Institute Workshop on Model Theory of Analytic Functions, Toronto, Ontario, Canada.

Information: http://www.fields.utoronto.ca/analytic.html

17-21 Workshop on the Bispectral Problem, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada.


Topics: Bispectral operators and applications; relations to: integrable systems, isomonodromic deformations, W-algebras, Riemann-Hilbert problem, Darboux and Bäcklund transformations, duality.


"-not yet confirmed.

Information: L. Pelletier, Centre de Recherches Mathématiques, Université de Montréal, C.P. 6128, succ. Centre-Ville, Montréal (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMONTREAL.CA; WWW: http://WWW.CRM.UMONTREAL.CA.

13-14 21st SPEEDUP Workshop on Distributed Computing: HPC Capabilities at the Desktop for Everybody, Hôtel Cadro Panoramique, Cadro-Lugano, Switzerland.

Aim: The 21st SPEEDUP workshop aims to provide a forum for members of academic institutions and business enterprises to meet and to discuss and learn about the latest developments related to all aspects of distributed computing and distributed applications. Topics to be covered include but will not be limited to: programming models, tools, and environments; development and management of distributed applications; performance evaluation, tuning, and benchmarking; task distribution and load balancing; application responsiveness and scalability; enabling technologies; distributed information systems; very large databases; resource management and configuration; authentication and security; reliability; cooperative design and development methods; teleworking and collaborative environments.

In 1997 SPEEDUP will become ten years old. Therefore, in conjunction with the 21st SPEEDUP workshop, the 10th anniversary of the SPEEDUP Initiative will be celebrated. Several keynote speakers will address the history, the status, and the future prospects of high-performance computing in Switzerland.


Information: For the latest information on the program, the interested reader is referred to http://www.speedup.ch/Workshops/Workshop21Ann.html. Further information on the SPEEDUP Society can be obtained from http://www.speedup.ch/.

14-16 Fourth IFT Workshop: Moduli Spaces in Geometry and Physics, University of Florida, Gainesville, Florida.

Sponsors: The Institute for Fundamental Theory and the Departments of Mathematics and Physics, The University of Florida.

Invited Speakers: P. Aspinwall (Rutgers Univ.), D. Freed (Univ. of Texas, Austin), W. Goldman (Univ. of Maryland, College Park), B. Greene (Columbia Univ.), R. Jeffrey (McGill Univ. and C.R.M.), T. L. Lam (Univ. de Québec à Montréal), J. Millson (Univ. of Maryland, College Park), D. Morrison (Duke Univ. and I.A.S.), R. Wentworth (Univ. of California, Irvine), E. Witten (I.A.S).

Application Deadline: December 17, 1996.


Advisory Committee: D. Freed (Univ. of Texas, Austin), N. Seiberg (Rutgers Univ.), C. Taubes (Harvard Univ.), G. Zuckerman (Yale Univ.).

Information: Applications may be obtained from: IFT Workshop, Dept. of Physics, P.O. Box 118440, Univ. of Florida, Gainesville, FL 32611-8440; e-mail: iftws@phys.ufl.edu; tel: 352-392-8443. Conference Web page: http://www.mach.ufl.edu/~cw/workshop/.

17-21 Fields Institute Workshop on Model Theory of Analytic Functions, Toronto, Ontario, Canada.

Information: http://www.fields.utoronto.ca/analytic.html

17-21 Workshop on the Bispectral Problem, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada.


Topics: Bispectral operators and applications; relations to: integrable systems, isomonodromic deformations, W-algebras, Riemann-Hilbert problem, Darboux and Bäcklund transformations, duality.


"-not yet confirmed.

Information: L. Pelletier, Centre de Recherches Mathématiques, Université de Montréal, C.P. 6128, succ. Centre-Ville, Montréal (Québec), Canada H3C 3J7; e-mail: pelletier@crm.umontreal.ca; WWW: http://www.crm.umontreal.ca.

18-22 Representation Theory and Computer Algebra Conference, University of Kyiv, Kyiv, Ukraine.

Program: The program will include surveys and research talks both on representation theory and computer algebra applications.


Contributed Papers: Those wishing to present a talk at the conference are invited to send an abstract (as TeX- or pdf-file) before January 31, 1997, either by e-mail or by fax: 38-044-295-7905 or by airmail to the following address: Algebra Meeting, Faculty of Mechanics and Mathematics, Kyiv Taras Shevchenko Univ., Volodymiriska 64, 252033 Kyiv, Ukraine.

Information: Further information, in particular concerning visa requirements and accommodation, can be obtained by e-mail: meetuni-alg.kiev.ua.

20-22 Barrett Lectures on Control Theory and Applications, University of Tennessee, Knoxville, Tennessee.

Program: This conference will feature control of ordinary and partial differential equations and applications.

Lecturers: The two principal lecturers are I. Lasiecka of the Mathematics Department of the University of Virginia and E. Bruce Lee of the Electrical Engineering Department of the University of Minnesota. Each principal lecturer will give two lectures. In addition, there are six invited speakers: E. B. Fitzpatrick (North Carolina State Univ.), M. A. Horn (Vanderbilt Univ.), B. King (Oregon State Univ.), D. Russell (Virginia Tech Univ.), S. Sethi (Univ. of Toronto), S. Zak (Purdue Univ.).

Call for Papers: There will be a limited number of short contributed talks. Send abstracts by January 10, 1997.

Organizers: S. Lenhart and P. Schaefer.

Information: S. Lenhart, Univ. of Tennessee, Math Dept., Knoxville, TN 37996-1300; e-mail: lenhart@math.utk.edu; tel: 423-974-4270.
28-30 Higher-Category Theory and Mathematical Physics, Northwestern University, Evanston, Illinois.


Organizers: E. Getzler, M. Kapranov.

Information: Department of Mathematics, Northwestern Univ., Evanston, IL 60208-2730.

20-26 Spring School 97: Boundaries and Convexity in Banach Spaces, Paseky, Czech Republic.

Program: The program will consist of a series of lectures on: convergence problems for equi-continuous sequences of linear operators on Banach spaces; abstract boundaries and Korovkin theory for function spaces; education of neurons and education in mathematics and science; convergence, minimax and monotonicity; boundaries and smoothness in Banach spaces.

Purpose: The purpose of this meeting is to bring together adepts who share a common interest in the field. There will opportunities for short communications and informal discussions. Graduate students and others beginning their mathematical careers are encouraged to participate.

Fee: The conference fee will be US$280. A reduced rate of US$250 will be offered, provided a letter guaranteeing participation reaches the organizers before February 15, 1997. The conference fee includes all local expenses (room and board) and transportation between Prague and Paseky. The fee is the same for accompanying persons. The organizers may provide financial support to a limited number of students. Applications must be sent before February 15, 1997. Payment of the fee should be made in cash at the registration desk in Paseky, or it may be remitted by a bank transfer to Komercni banka, Praha 1, Václavske nam. 42, account No. 38330-021/0100, v.s. 810. (A copy of the transfer should be presented at the registration desk.) Unfortunately, checks cannot be used and will not be accepted.

Organizers: The Faculty of Mathematics and Physics of Charles University.

2-4 British Topology Meeting, Mathematical Institute, Oxford University, England.

Speakers: Main speakers will include: A. Casson (Berkeley), M. Hopkins (MIT), I. Roe (Oxford), G. Segal (Cambridge), S. Stolz (MPI Bonn).

Accommodations: Accommodations will be available at Merton College.

Sponsor: The meeting is supported by the London Mathematical Society.

Information: For further details e-mail the organizer, U. Tillmann, at tillmann@maths. ox.ac.uk.

5-13 Workshop on General Combinatorial Group Theory, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montreal (Quebec), Canada.


Topics: Invariants of infinite groups; profinite groups and constructive aspects of profinite groups; exponential groups; language theory; connections between groups and Lie algebras; group actions on non-archimedean trees.


Information: Please register by March 1, 1997, for attendance and accommodation or by April 1, 1997, for attendance only. L. Pelletier, Centre de Recherches Mathématiques, Université de Montréal, C.P. 6128, succ. Centre-ville, Montreal (Quebec), Canada H3C 3J7; tel: 514-343-2197; fax: 514-343-2254; e-mail ACTIVITE@CRM. UMontréal.CA; Web: http://www.CRM. UMontréal.CA.
Mailing Address: Katedra matematické analýzy, Matematicko-fyzikální fakulta UK, Sokolovská 83, 186 00 Praha 8, Czech Republic; tel/fax: 42-2-232-3390; e-mail: pasek@karlin.mff.cuni.cz; WWW: http://csmat.karlin.mff.cuni.cz/katedry/ksa/ss97/ss97.html.

21-26 Transversal Designs & Orthogonal Arrays Workshop, University of Waterloo, Waterloo (Ontario), Canada.

Sponsor: Centre de Recherches Mathématiques (CRM), Université de Montréal.

Organizing Committee: C. J. Colbourn, R. C. Mullin, A. Rosa, D. R. Stinson.


Information: K. Gingerich, Combinatorics & Optimization, University of Waterloo, Waterloo (Ontario), Canada N2L 3G1; tel: 519-888-4027; fax: 519-725-5441; e-mail: katginge@jeeves.uwaterloo.ca; Web: http://math.uwaterloo.ca/~cjcolbou/cmtd.html.

May 1997

4-7 1997 IEEE Symposium on Security and Privacy, Oakland, California.

Sponsor: Sponsored by the IEEE Computer Society Technical Committee on Security and Privacy in cooperation with The International Association for Cryptologic Research (IACR).

Scope: The Symposium on Security and Privacy has, for sixteen years, been the premier forum for the presentation of developments in computer security and for bringing together researchers and practitioners in the field.

Topics: Topics on which papers and panel sessions proposals are invited include, but are not limited to, the following: commercial and industrial security; network security; security verification; smartcards; security and other critical systems; database security; viruses and worms; auditing; properties; data integrity; security protocols; intrusion detection; secure systems; access controls; authentication; privacy issues; distributed systems; information flow; biometrics; policy modeling; privacy.

Continued Feature: A continuing feature of the symposium will be a session of 5-minute talks from people who are advancing the field in the areas of system design and implementation but may lack the resources needed to prepare a full paper. Abstracts of these talks will be distributed at the symposium.

Author Instructions: This year mechanisms are being instituted for "electronic" submission of papers for the refereeing process. Final papers will still be submitted in hard copy. Papers will be accepted submitted via various forms of mail, but not by fax. Papers should include an abstract, must not exceed 7,500 words, and must report original work that has not been published previously and is not under consideration for publication elsewhere. The names and affiliations of authors should appear on a separate cover page only, as "blind" refereeing is used.

Panel proposals should include a title, an abstract which describes the topic(s) to be discussed, the names of all proposed participants, and assurances that the participants agree to serve on the panel. A proposed length and format for the panel, and any other information that the panel proposer thinks would support the proposal.

Those submitting papers via "hard copy" should send 6 copies of their paper or panel proposal to: G. W. Dinolt, Program Co-chair, Lockheed Martin, Western Development Laboratory, Mail Stop X20, 5200 Zanker Road, San Jose, CA 95134. Please mark the envelope "IEEE Security and Privacy Symposium". Also send separately an electronic, ASCII text version of the abstract to secprv97@dl1.com. The electronic version of the abstract should include the title and the abstract as it appears in the paper.

Authors who wish to submit an electronic version of a paper or panel proposal for evaluation should follow the instructions that will be posted on the Web site at: http://www.id4.nrl.navy.mil/1T1D/5540/ieee or by sending mail to secprv97@dl1.com with the word "Instructions" in the subject line. Instructions will be included in the reply. Papers must be received (however sent) by 6:00 p.m. (PST) on December 2, 1996.

Authors who submit an abstract for a 5-minute talk should include a title, all authors, names and affiliations where appropriate, and text. The whole should fit easily on one 8.5" by 11" page. Abstracts for 5-minute talks should be sent to G. W. Dinolt at the above address to be received no later than April 23, 1997. Please mark the envelope "IEEE Security and Privacy Symposium-5-minute Abstracts".

15-17 DIMACS Workshop on Combinatorial Optimization and Disordered Materials: Recent Progress and Algorithmic Challenges, DIMACS Center, Rutgers University, Piscataway, New Jersey.

Focus: This workshop will focus on the application of methods in combinatorial optimization to problems on disordered materials (e.g., random magnets and glasses). Its purpose is to stimulate communication among physical scientists, mathematicians, and computer scientists, and to motivate work on open problems. Each workshop topic will be introduced with expository lectures by leading researchers on both the physical and mathematical (or computational) issues.

Organizers: P. M. Duxbury, chair; D. S. Franzblau, J. Lebowitz, P. L. Leath.

Invited Speakers: (preliminary listing)

A. Aharoni (Tel Aviv), M. Alzamena (Cortina), M. Alves (Nordita), L. Arrighi (University of Technology, Sydney), K. Binder (Mainz), J. Guernatis (Los Alamos), B. Hendrickson (Sandia), D. Huse, M. Kardar (MIT), A. Middleton (Syracuse), M. Kardar (Porto Alegre), R. Higuer (HRL, Juelich), D. Stein (U. Arizona), M. Thorpe (MSU), W. Whiteley (York).

Local Arrangements: P. Pravato, DIMACS Center, pravato@dimacs.rutgers.edu, tel: 908-445-5929.

Contacts: P. M. Duxbury, duxbury@pa.edu, tel: 517-353-9179; fax: 517-353-0690.


16-17 Symposium in Honour of Professor W. T. Tutte's 80th Birthday, University of Waterloo, Waterloo, Ontario, Canada.

Talks: The symposium will be hosted by the Department of Combinatorics and Optimization. There will be a total of five invited talks by the following mathematicians, each of whom has had a significant association with Professor Tutte: L. Lovasv (Yale Univ.), C. St. J. A. Nash-Williams (Univ. of Reading, England), N. Robertson (Ohio State Univ.), C. Thomassen (Technical Univ., Denmark). In addition, the last talk at the conference will be given by Professor Tutte.

Registration: The registration fee of CDN $35 (or US$25) includes the conference banquet at the Festival Room at the University on the evening of May 17.

Accommodations: Rooms have been reserved at the Conference Centre - Ron Eydt Village at the University as well as at the Waterloo Inn, a hotel located 10 minutes' drive from the University.

Information: For further details and a registration form, please send e-mail to tutte@math.uwaterloo.ca or visit the Web site: http://math.uwaterloo.ca/~tutte/announce.html; tel: 519-886-4567 ext. 3482; fax: 519-725-5441.

19-30 Experimental Mathematics and Combinatorics, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada.

Organizers: F. Bergeron, G. Labelle, P. Leroux.


Information: Please register by May 5, 1997. L. Pelletier, Centre de Recherches Mathématiques, Université de Montréal, C.P. 6128, succ. Centre-Ville, Montréal (Québec), Canada H3C 3J7; tel: 514-343-2197; fax: 514-343-2254; e-mail: ACTIVITES@CRM.Umontreal.CA; Web: http://www.CRM.Umontreal.CA.

27-31 V International Conference of Women Mathematicians: Mathematics, Eco-
**Mathematics Calendar**

**nometrics, Rostov-on-Don, Russia.**

**Aim:** The foundational meeting of Russian women mathematicians held on May 25, 1993, in Souzdal established the Association of Russian Women in Mathematics. The Association was created to render informational, consulting, and social support for women who have chosen mathematics as the sphere of their scientific activity.

**Program:** The program is comprised of lectures, round tables, and poster sessions. Themes and speakers will be selected by the Scientific Committee.

**Sections:**
1. Differential equations and function theory; 2. algebra, topology and geometry; 3. theory of probability and discrete analysis; 4. computing mechanics and mathematical simulation; 5. mathematical models in economics; 6. mathematical models in ecology; 7. modern problems of mathematical education for mathematical, science, technical, and humanitarian specialties.

Round tables will be held on:
1. Women in science and education and 2. economics.

**Organization:**
- Local Organizing Committee: L. Novikova, 344038, Rostov-on-Don, RUJUT, D.2, K.26; tel: 8632-31-15-59, 8632-31-87-10; fax: 8632-64-52-55. V. International Conference of Women Mathematicians; e-mail: novikova@untrd.ac.ru.
- Information: G. Rzizhenko, Dept. of Biophysics, Biological Fac. Moscow State Univ., Voroobievy Gory, 119899 Moscow, Russia; tel: 095-939-19-63; fax: 095-939-19-63, 939-11-15; e-mail: rizhich@biophys.msu.ru; vm@biophys.msu.ru.

**Deadline:** Commitment/tentative title deadline—December 20, 1996; abstract deadline—March 1, 1997.

**Information:** W. O. Bray, Department of Mathematics, Univ. of Maine, Orono, ME 04469; e-mail: bray@gauss.umaine.edu.

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**9-17 Spring School on Analysis, Paseky, Czech Republic.**

**Purpose:** The purpose of this meeting is to bring together accepts who share a common interest in the field. There will be opportunities for short communications and informal discussions. Graduate students and others beginning their mathematical careers are encouraged to participate.

**Lectures:** The program will consist of a series of lectures on approximation and uniqueness properties of harmonic differential forms, delivered by V. Havin (Univ. of St. Petersburg).

**Fee:** The conference fee will be US $280. A reduced rate of US $250 will be offered, provided a letter guaranteeing participation reaches the organizers before March 1, 1997.

**Application:**Applications must be received before March 1, 1997. Payment of the fee must be made in cash at the registration desk in Paseky, or it may be remitted by a bank transfer to Comerico banka, Praha 1, Vaclavske nam. 42, account No. 38330-021-0100, v.s. 810. (A copy of the transfer must be presented at the registration desk at Paseky.) Unfortunately, checks cannot be used and will not be accepted.

**Information:** Katedra matematiky, Matematicko-fyzikální fakulta UK, Sokolovská 83, 186 00 Praha 8, Czech Republic; tel/fax: 42-2-232-3390; e-mail: paseky@karlin.mff.cuni.cz; WWW: http://csat.karlin.mff.cuni.cz/katedry/ka/ces97/ces97.html.

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**9-17 CMS Summer 1997 Meeting, University of Manitoba, Winnipeg, Manitoba.**

**Program:** This meeting will feature plenary speakers from a broad spectrum of mathematics by top mathematicians. It will also feature sessions in various areas of mathematics.

**Plenary Speakers:** H. Bass (Columbia Univ.), D. Evans (Univ. of East Anglia), R. Fenn (Univ. of Sussex), S. Halperin (Univ. of Toronto), R. A. Horn (Univ. of Utah), C. Morawetz (Courant Institute), B. Plotkin (Hebrew Univ. of Jerusalem), A. Street (Univ. of Queensland), W. Watt (Government of Manitoba).

**Prize Lectures:** Coxeter-James Lecturer: S. Halperin (Univ. of Toronto); Krieger-Nelson Lecturer: C. Morawetz (Courant Institute).

**Symposia:** There will be symposia in five areas. The session titles and speakers are:
1. **Model Theory and Permutation Groups** (Organizers: H. Bart and M. Valeriote, McMaster Univ.): A. Chowdhury (Connecticut), B. Hart (McMaster), J. Koshan (Simon Fraser), A. Lachlan (Simon Fraser), Z. Sokolovic (Fields Institute), J. Steprans (York), S. Thomas (Rutgers), R. Willard (Waterloo).
2. **Group Theory and Topology** (Organ: D. Rolfsen, Univ. of British Columbia): S. Boyer (UOA&M), G. Cliff (Alberta), M. Davis (Ohio State), M. Dunwoody (Southampton), S. Gersten (Utah), K. Gupta (Manitoba), N. Gupta (Manitoba), W. Jaco (Oklahoma State), E. Jespers (Memorial), S. Matveev (Chelyabinsk), K. Murasugi (Toronto), A. Nicas (McMaster), I.B.S. Passi (CAS, Chandigarh), A. Rahmatulla (Alberta), P. Shalen (Illinois at Chicago), X. Zhang (Waterloo), J. Zhon (UBC), P. Zvengrowski (Calgary).
3. **Finite Geometries and Applications** (Organ: L. Batten, Univ. of Manitoba): C. Baker (Mount Allison), A. Bruen (Western Ontario), C. Fisher (Regina), J. Key (Clemson, South Carolina), A. Pasini (Naples, Italy), F. Piper (London, England).
4. **Combinatorics** (Organ: N. Shivakumar, Univ. of Manitoba): P. Van Dooren (de Louvain), S. Kirkland (Regina), J. MacDonald (Regina), R. Brader (Wyoming), Q. Ye (Manitoba).
5. **Education-Transitions** (Organ: K. Nicol, Univ. of Brandon, and L. Janssen, Univ. of Manitoba): W. Watt (Government of Manitoba).

**Contributed Papers:** Contributed papers of 15 minutes’ duration are invited, and graduate students are particularly urged to participate. For an abstract to be eligible, the abstract must be received before April 15, 1997. The abstract must be accompanied by its contributor’s registration form and appropriate fees. If you intend to give a paper in this session, please contact R. Pedman abhan at padman@cc.u.umanitoba.ca well before the April 15 submission deadline to state your intent.

**Graduate Student Seminar:** A special session is being organized for graduate students on June 10-11, 1997.

**Joint CMS/ILAS Registration:** The International Linear Algebra Society is also holding a meeting on the University of Manitoba campus on June 6, 7, and 8. Joint registration will be available for those who wish to attend both the CMS and ILAS sessions.

**Information:** Canadian Mathematical Society, 577 King Edward, Suite 109, POB 450, Station A, Ottawa, Ontario, Canada KIN
6NS; tel: 613-562-5702; fax: 613-565-1539; e-mail: meetings@cms.math.ca; http://came1.math.ca/.


Institute, Toronto, Ontario, Canada. Lecturer, and, to allow participants and students an opportunity to present their results, a poster session will be held.

Speakers: E. Bierstone (Univ. of Toronto), O. Bogoyavlenskij (Queen's Univ.), V. E. F. Shadwick (Stanford Univ.), H. Flaschka (Univ. of Arizona), D. Fuchs (Univ. of California at Davis), A. Givental (Univ. of California at Berkeley), M. Golubitsky (Univ. of Houston), M. Gromov (HES), V. Guillemin (MIT), P. Holmes (Princeton Univ.), Y. Ilyashenko (Moscow State Univ.), B. Khesin (Univ. of Toronto), A. Khovanskii (Univ. of Toronto), R. de la Llave (Univ. of Texas), J. E. Marsden (California Institute of Technology), K. Moffatt (Isaac Newton Institute), R. V. Moody (Univ. of Alberta), A. Neishtadt (Space Research Institute, Russia), T. Ratiu (Univ. of California at Santa Cruz), W. F. Shadwick (IMPA), P. Sloydow (Universitaet Hamburg), S. Smale (City Univ. of Hong Kong), S. Tremaine (Univ. of Toronto), C. Taubes (Harvard Univ.), V. A. Vasiliev (Steklov Mathematical Institute), A. Varchenko (Univ. of North Carolina at Chapel Hill), A. Vershik (Russian Academy of Sciences), V. Vladimirov (The Hong Kong Univ. of Science and Technology), S. Wiggins (California Institute of Technology), Y. Yomdin (Weizmann Institute of Science) and V. I. Yudovich (Rostov State Univ.).

Organizing Committee: J. E. Marsden (California Institute of Technology, chair), E. Bierstone (Univ. of Toronto), J. Chadam (Univ. of Pittsburgh), A. Khovanskii (Univ. of Toronto), R. V. Moody (Univ. of Alberta), T. S. Ratiu (Univ. of California at Santa Cruz), W. F. Shadwick (IMPA), A. Varchenko (Univ. of North Carolina at Chapel Hill), V. Vasiliev (Steklov Mathematical Institute).

Information: To receive registration information, please e-mail alrod@fields.utoronto.ca. For more information on activities at The Fields Institute, please visit our Web site: http://www.fields.utoronto.ca.

*16-18 Fifth Bar-Ilan Symposium on Foundations of Artificial Intelligence, Bar-Ilan University, Ramat-Gan, Israel. Focus: The focus of BISFA'97 will be on intelligent agents. The symposium will, however, retain its broad scope and welcomes high-quality research papers in various areas of artificial intelligence, including machine learning, automated reasoning, knowledge representation, neural nets, natural language processing, etc.

The concept of an agent has become important in both artificial intelligence and mainstream computer science. An agent is a hardware or software system that is autonomous, interactive with and reactive to its environment and other agents. An agent can also be proactive in taking the initiative in goal-directed behavior.

Call for Papers: Papers are solicited in all areas of artificial intelligence and in particular in the area of intelligent agents. Agents have a clear and growing importance, both practical and theoretical. Because of their commercial relevance, practitioners from industry are encouraged to submit papers dealing with various practical aspects.

Paper Submission: Submit three hard copies of an extended abstract (4-10 pages) or full paper by February 2, 1997, to: L. Joskowicz, Institute of Computer Science, The Hebrew University of Jerusalem, Givat Ram, Jerusalem 91904, Israel; e-mail: joskowicz@cs.haifa.ac.il or lehmann@cs.haifa.ac.il. Authors will be notified of acceptance by March 20, 1997.

Information: Information on registration, accommodations, etc., will appear in future announcements, or contact bisfa@cs.biu.ac.il. The Web page site is: http://www.cs.biu.ac.il/~schwart/bisfa97.html.

*16-20 Topological Fixed Point Theory and Topological Methods in Nonlinear Analysis, Cortona, Italy. Topics: Nielsen fixed point theory, applications of Nielsen theory to nonlinear analysis, other topological methods in nonlinear analysis such as the Leray index and the Leray-Schauder degree.

Organizing Committee: R. Brown, M. Furi. Information: R. F. Brown, Dept. of Mathematics, Univ. of California, Los Angeles, CA 90095-1555; e-mail: rfb@math.ucla.edu.

*19-21 Lehigh University Conference on Geometry and Topology, Lehigh University, Bethlehem, Pennsylvania. Invited Speakers: S. Ferry, P. Gilkey, R. Gompf, B. Lawson, M. Mahowald, J. Wolfson. Program: In addition to the invited talks, there will be parallel sessions of 40-minute talks related to differential or algebraic geometry or algebraic or geometric topology. Those interested in contributing such a talk should submit a title and brief abstract by April 15.

Organizers: D. Davis e-mail: ddn@lehigh.edu; S. Johnson e-mail: djf0@lehigh.edu, C. C. Hsiung. Information: Contact an organizer or see http://www.lehigh.edu/~djf0/geotop.html.

*23-27 Fields Institute Workshop on Symplectic Geometry, The Fields Institute, Toronto, Ontario, Canada. Goal: This workshop will bring together researchers working on symplectic, contact, and Poisson geometry and topology. Its goal is to foster interaction between different areas of the symplectic world, as well as of its neighboring domains such as dynamical systems, topology, algebraic and complex geometry, quantum field theory, etc. This workshop will immediately follow the Conference in Honour of Vladimir Arnol'd, to be held at The Fields Institute June 15-27, 1997, and is part of the on-going program on singularity theory and geometry.

Information: To receive registration information, please e-mail symple@fields.utoronto.ca. For further information on activities at The Fields Institute, please visit the Web site: http://www.fields.utoronto.ca.

*23-27 Reform Calculus Short Course: Calculus Enhanced with Computer- Algebra and Graphing Using the TI-92, University of Massachusetts, Amherst, Massachusetts. Course Information: Due to the large number of applicants and the great success of last year’s short course, university, college, and high school calculus instructors are invited again to attend the short course sponsored by the UMass Amherst Mathematics and Statistics Department and the Ohio State Univ. and partially funded by Texas Instruments.

Each participant will have loan of a TI-92 for the week. Computer Based Laboratory instruments will also be available for data collection. Real-world applications and other calculus reform pedagogy will be featured.

Continental breakfast, lunch, snacks, and instructional materials will be provided.

Texas Instruments will have reduced prices on the TI-83 and TI-82 ($55), TI-85 ($60), CBL ($110), and TI-92 ($120). Payment may be included with registration fee. Purchases are limited to one calculator and one other item. Cabri Geometry for MAC and DOS ($60) and Graph Link ($30) soft-
ware are also available. (Prices are subject to change.)

**Registration Fee:** There are a limited number of spaces available. Applicants will be accepted on a first-come-first-served basis upon receipt of the $150 registration fee. Please make checks for the $150 registration fee payable to The University of Massachusetts Amherst Mathematics Department.

**Rooms:** Air-conditioned hotel rooms are available at conference rates @ $60—single occupancy, $70—double (2 ppl), and $80—triple/quad (3 or 4 ppl). Please indicate (Block # C2138) when making reservations at the Campus Center Hotel, 413-549-6000.

**Information:** Mail checks to: M. A. Connors, Dept. of Mathematics and Statistics, Lederle Graduate Research Tower, Univ. of Massachusetts, Amherst, MA 01003; tel: 413-577-0717; e-mail: mconnors@math.umass.edu.

*24-30 International Algebraic Conference Dedicated to the Memory of D. K. Faddeev, St. Petersburg, Russia.*

**Purpose:** The conference commemorates the 90th birthday of D. K. Faddeev (1907—1989). D. K. Faddeev significantly contributed to many areas of mathematics. It is expected that many outstanding specialists in algebra and its applications will participate in the conference.

**Topics:** There will be several plenary lectures as well as shorter talks in the following areas: algebraic geometry, algebraic number theory, Galois theory, representation theory, rings and modules, the theory of groups and semigroups, algorithmic and numerical problems of algebra. A special session is planned to be dedicated to the memory of V. N. Faddeeva (1906—1983).

**Committee:** Coordination Committee: A. V. Yakovlev (chair); B. B. Lur'e (secretary).

**Information:** All who wish to participate in the conference should inform the Coordination Committee. The Coordination Committee needs to know at least an approximate list of participants in order to make further plans. Coordination Committee address: 191011, St. Petersburg, Fontanka 27, St. Petersburg Branch of the Steklov Mathematical Institute (POMI) 198904, St. Petersburg, Staryi Petergof, Bibliotecnaya Square, 2, Department of Algebra and Number Theory, St. Petersburg State University, St. Petersburg, Russia; fax: 7-812-310-5377; e-mail: lurje@pdmi.ras.ru.

**July 1997**

*7-11 Harmonic Morphisms, Harmonic Maps and Related Topics, Université de Bretagne Occidentale, Brest, France.*

**Organizing and Scientific Committees:** P. Baird (Brest), J. Eells (Warwick and Cambridge), S. Console (Brest), J. Lemaire (ULB, Brussels), A. Ratto (Brest), J. C. Wood (Leeds). Aim: This will be the first international conference primarily devoted to harmonic morphisms between Riemannian manifolds and related topics.

**Information:** Contact: P. Baird, Département de Mathématiques, Université de Bretagne Occidentale, B. P. 809, 29285 Brest Cedex, France; e-mail: paul.baird@univ-brest.fr; tel: +33-298.01.67.20; fax: +33-298.01.67.90.

*7-13 Symmetry in Nonlinear Mathematical Physics, Kyiv, Ukraine.*

**Topics:** Classical Lie analysis of equations of mathematical physics: reduction and exact solutions of nonlinear partial differential equations, analysis of subalgebras of invariance algebras; conditional, approximate and nonlocal symmetry; symmetry in nonlinear quantum mechanics, quantum fields, theory of gravitation, fluid mechanics; representations of Lie algebras; computer methods in symmetry analysis.

**Organizers:** Institute of Mathematics, National Academy of Sciences of Ukraine; Ukrainian Pedagogical University.

**Deadlines:** Deadline for registration and for submission of abstracts is March 31, 1997.

**Information:** V. Fushchych, Chairman of the Organizing Committee, Institute of Mathematics, National Academy of Sciences of Ukraine, 3 Terseshchenkivska Street, Kyiv 4, Ukraine; e-mail: math nonlinear@kiev.ua, nonlinear@math.univ.kiev.ua; fax: International +380-44-269-90-30 (225 20 10); tel: International +380-44-224-63-22.


**Aim:** The conference is intended to bring together researchers working in various branches of mathematics and will feature both invited lectures and contributed papers.

**Hosts:** This is the third conference of the Forum for Interdisciplinary Mathematics and is hosted by the University of Southern Maine.

**Special Sessions:** Special Sessions in the following areas have been planned: information theory, coding theory, search theory, graph theory, quality improvement and Taguchi methods, design of experiments, linear models, ranking and selection, statistics in health care research, environmental statistics, queueing and networks, stochastic inference, microsimulation in government policy, forecasting, time series modeling, statistical methods. More sessions may be added later.

**Deadlines:** Deadline for regular registration and submission of abstracts is March 31, 1997. Full paper should be submitted before the conference if you wish to have it considered for the proceedings of the conference.

**Information:** For more information, please contact S. Gupta, Chair Local Organizing Committee, Dept. Math./Stat., Univ. of Southern Maine, P.O. Box 9300, Portland, ME 04104-9300; tel: 207-780-4278; e-mail: RK3818@MAINE.EDU; fax: 207-780-4933; or D. Sharma, President of the Forum, Math. Dept., Xavier Univ. of Louisiana, New Orleans, LA 70123; tel: 504-483-7463; e-mail: BSHARMA@XULA.EDU; fax: 504-482-1561.

*22-25 18th IFIP TC7 Conference on System Modelling and Optimization, The Westin Hotel, Renaissance Center, Detroit, Michigan.*

**Organizers:** The 18th IFIP TC7 Conference on System Modelling and Optimization is organized by the School of Engineering and Computer Science and the Department of Mathematics, Oakland University, Rochester, Michigan, and the Department of Electrical and Computer Engineering, Wayne State University, Detroit, Michigan. The conference is co-sponsored by Oakland University and Wayne State University.

**Aim:** The conference will be devoted to all aspects of the theory and applications of modelling, optimization, and control.

**Topics:** Topics may include, but are not limited to: Adaptive systems, manufacturing systems, agile production systems, multicriteria optimization, automotive applications, combinatorial optimization, network optimization, computer networks, neural networks, computer aided geometric design, nonsmooth and variational analysis, discrete event systems, optimal control, distributed systems, optimization software, fuzzy systems, parallel computing, identification and estimation, robotics integer programming, robust control, linear and nonlinear programming, stability and sensitivity, linear and nonlinear systems, stochastic programming.

**Papers:** Prospective authors are invited to send 4 copies of a 500-word summary of the paper, headed by the title, name(s), address(es), affiliation(s), e-mail addresses, and telephone number(s) of author(s), and a 50-word abstract for inclusion in the technical program if the paper is accepted, to: M. P. Polis, School of Engineering and Computer Science, Oakland University, Rochester, MI 48309-4401; e-mail: polis@oakland.edu. Paper summaries and abstracts must be received by December 1, 1996. Notification of acceptance or rejection and author information will be sent by February 15, 1997.

**Invited Sessions:** Proposals for invited sessions are encouraged. These should be submitted to: A. L. Dontchev, Mathematical Reviews, 416 Fourth Street, Ann Arbor, MI 48107; e-mail: a1@math.ams.org.

**Information:** See http://www.ams.org/IFIP18TCC7 for additional information.


**Program:** Topics are group theory and related areas. The invited speakers will give courses of four lectures during the first...
week of the conference. During the second week there will be a special day of lectures dedicated to W. Burtnside and a special day of lectures dedicated to R. Lyndon. A program of seminars and invited lectures will also be arranged in the second week.

**Invited Speakers:** L. Babai (Chicago), M. Bridson (Oxford), C. Brookes (Cambridge), C. Praeger (Western Australia), A. Shalev (Jerusalem).

**Organizers:** C. Campbell, E. Robertson, G. Smith.

**Information:** C. M. Campbell and E. F. Robertson, Mathematical Institute, Univ. of St. Andrews, North Haugh, St. Andrews KY16 9SS, Scotland; e-mail: groups97@dcs.st-and.ac.uk/Website:http://www.math.ac.uk/~maascg/gps97/home.html.

*28-29 Vision Geometry VI, San Diego, California.*

**Aim:** This conference is designed to bring together workers who use geometric theory and techniques to solve computer vision problems. Specific solutions as well as overviews of more general topics are welcome.

**Deadlines:** Abstracts due December 30, 1996; manuscript due June 30, 1997.

**Conference Chairs:** R. A. Melter, A. Wu, L. Latecki.

**Information:** For further information please contact rmelter@umburn.lunet.edu.

**August 1997**

*August-December Microlocal Methods in Geometric Analysis and Mathematical Physics, The Fields Institute for Research in Mathematical Sciences, Toronto, Canada.**

**Program:** The program will include international workshops, graduate courses, and several lecture series and seminars. The participation of graduate students and postdoctoral fellows will be an integral part of the activities. All activities of the Fields Institute are subject to availability of funds. In the fall of 1997 The Fields Institute will be sponsoring a semester-long program in microlocal analysis. It will concentrate on applications of phase space techniques in the study of solutions to partial differential equations to mathematical physics and geometry.

**Organizing Committee:** P. Greiner (Univ. of Toronto), V. Ivrii (Univ. of Toronto), J. Sjöstrand (École Polytechnique), S. Zelditch (The Johns Hopkins Univ.), M. Zworski (Univ. of Toronto).

**Workshops:** Microlocal Analysis and Mathematical Physics: September 8-14, 1997; Microlocal Methods in Geometric Analysis: October 27-November 2, 1997.

**Distinguished Lecture Series:** R. B. Melrose of the Massachusetts Institute of Technology will deliver a series of lectures as part of The Fields Institute Distinguished Lecture Series.

**Information:** If you are interested in participating please e-mail: micro@fields.utoronto.ca. Additional information will be provided on the Web site: http://www.fields.utoronto.ca.

*1-4 MAA Mathfest, Renaissance Atlanta Hotel, Atlanta, Georgia.*

**Program:** Invited lectures, contributed paper sessions, student contributed paper sessions, minicourses, short course, exhibits and book sale.

**Information:** For additional information about the 1997 MAA Mathfest, go to MAA Online at http://www.maa.org.

*12-15 Fourth International Conference on Finite Fields and Applications, University of Waterloo, Ontario, Canada.*

**Theme:** The aim is to bring together workers on all aspects of finite fields, theoretical or applicable. Any contribution in which the nature or properties of finite fields have a significant part would qualify for discussion.

**Topics:** Suitable topics include structures of finite fields (normal bases, primitive elements, polynomials), explicit constructions of finite field objects (algorithms and complexity), arithmetical theory of function fields over finite fields (L-functions), connections with number theory, group theory, algebraic geometry, applications to coding theory, combinatorial designs, geometries, cryptology and connections between these, exponential sums and connections with codes, sequences over finite fields, new applications and connections.

**Call for Papers:** Those wishing to contribute a 15 minute talk are asked to submit by May 5, 1997, two copies of an abstract containing at most 300 words. The collection of accepted abstracts will be given to each participant at registration. A refereed conference proceedings, edited by G. L. Mullen and R. C. Mullin, will be published, and authors of accepted abstracts will be invited to submit a full paper for the proceedings.

**Invited Speakers:** E. Assmus (Lehigh Univ.), R. Baer (University of Oklahoma), V. P. Elkies (Harvard Univ.), L. H. W. Lenstra, Jr. (Univ. of California at Berkeley), H. Niederreiter (Austrian Academy of Sciences, Vienna), V. Shoup (AT&T), H. Stichtenoth (Univ. of Essen).

**Organizing Committee:** I. Blake (Waterloo), S. Cohen (Glasgow), G. L. Mullen (Penn. State), R. C. Mullin (Waterloo), H. Niederreiter (Vienna), C. L. Stewart (Waterloo), and S. A. Vanstone (Waterloo).

**Information:** K. Gingerich, Dept. of Combinatorics & Optimization, Univ. of Waterloo, Waterloo, Ontario, Canada N2L 3G1; e-mail: katiegingerich@math.uwaterloo.ca; fax: 519-725-5441; Web: http://www.math.uwaterloo.ca/CandD_Dept/fq4/registration.html.

**Preliminary Arrangements:** The registration fee has not been fixed but, subject to a measure of sponsorship being obtained, is hoped should not exceed $150 CDN or $110 US (including the cost of the conference dinner on Thursday, August 14, for which additional tickets would be purchasable for $25 CDN).

**Accommodation for participants and accompanying persons who will generally be in single or twin rooms (as required) in the Ron Eydt Residences within walking distance of the conference at an approximate cost of $32 CDN for a single and $52 CDN/person for a double room plus taxes per night. Off-campus motel accommodation will also be available, but at a higher cost. Details will be available in the second announcement.**

**Further Details:** A second announcement, with registration form, will be sent to all recipients of this notice. To ensure you receive one, or to register interest or likelihood of attendance, please e-mail: fq4@math.uwaterloo.ca or contact R. C. Mullin or K. Gingerich, Dept. of Combinatorics & Optimization, Univ. of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

*17-21 Crypto '97, the Seventeenth Annual IACR Crypto Conference, Santa Barbara, California.*

**Organizers:** Crypto '97 is organized by the International Association for Cryptologic Research (IACR), in cooperation with the IEEE Computer Society Technical Committee on Security and Privacy and the Computer Science Department of the University of California, Santa Barbara.

**Call for Papers:** Original papers on all technical aspects of cryptography are solicited for submission to Crypto '97. Please send a cover letter and 18 copies of an anonymous (no names, affiliations, acknowledgments, or obvious references) paper (double-sided copies preferred) to the program chair. The cover letter should contain the title and the names of the authors and should identify the contact author. It must also state: "This submission does not substantially duplicate work that any of the authors have published elsewhere or have submitted in parallel to any other conference or workshop that has proceedings." The paper should be 8-12 pages in length, not including the bibliography and clearly marked appendices. Submissions must be received by the program chair on or before February 13, 1997; late submissions and submissions by fax or e-mail will not be considered.

**Program Chair:** B. Kalinski, RSA Laboratories East, 20 Crosby Drive, Bedford, MA 01730; tel: 617-687-7057; fax: 617-687-7019; e-mail: burt@rsa.com.

**Information:** B. Schneier, General Chair, Crypto '97, Counterpane Systems, 101 E. Minnehaha Parkway, Minneapolis, MN 55419; tel: 612-823-1098; fax: 612-823-1590; e-mail: crypto97@iacr.org.

*20-22 Third Annual International Computing and Combinatorics Conference, Shanghai, China.*

**Aim:** This conference is intended to provide a forum for researchers in theoretical computer science, combinatorics related to computing, and experimental analysis of algorithms.**

**Topics:** Typical, but not exclusive, topics of interest include: algorithms and data struc-
The Conference on Differential Equations and Their Applications (EQUADIFF 9) will be held from 25-29 April 1997 in Brno, Czech Republic. The conference aims to stimulate cooperation among various branches in the theory of differential equations and related disciplines. Topics include computational methods and applications.

EQUADIFF 9 aims to bring together researchers and developers interested in the practical aspects of algorithms and their implementation issues. Additional information and a call for papers can be found online at the EQUADIFF99 website.

September 1997

* 9-12 19th World Conference on the Boundary Element Method, University of Rome, Italy. Conference Secretariat: L. Kerr, REM 19, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK; tel: 44-0-1703-293223; fax: 44-0-1703-292853; e-mail: liz@wessex.witcmi.ac.uk.

Conference Objective: The practical applications of structural optimization techniques which are well recognized by industry offer important advantages in the design of aircraft and are used in the analysis of automotive, civil, and mechanical engineering components. Computer-aided structural design is enhanced by adding optimization software, and its influence cannot be overemphasized. By linking both optimization software, and its influence cannot be overemphasized. By linking both optimization and also to demonstrate how optimization can be applied in engineering practice.

Topics: Elastodynamics, fracture mechanics & fatigue, inelastic problems, composite materials, plates and shells, contact mechanics, geomechanics, material processing and metal forming, soil dynamics, electromagnetics, biomechanics, fundamental principles, computational techniques, refinement methods & adaptive techniques, sensitivity analysis, inverse problems, applications in optimization, industrial applications, heat transfer, fluid dynamics & aerodynamics, compressible & incompressible flow, viscous flow, non-Newtonian flow, groundwater flow, interfacial & free surface flow, transport problems, wave propagation problems, acoustics, high performance computing, algorithms for parallelization & vectorization of BEM, massively parallel processing, expert systems in BEM.

* 10-12 GAMM/IMACS International Symposium on Scientific Computing, Computer Arithmetic and Validated Numerics (SCAN-97), Ecole Normale Superieure de Lyon, France. Local Organization: J. -M. Muller. Purpose: SCAN-97 will provide a forum for the presentation of the latest research and developments in theory, algorithmic and arithmetic design for validated numerics, demonstration of new software available for validated numerics, reporting of interesting case studies in industrial and scientific applications of validated numerics, and for the discussion of new directions in research and development suggested by other advances in scientific computing. Potential new directions are the use of parallel architectures for the implementation of validation algorithms and the use of validation ideas in computer algebra. Furthermore, the conference should help in the dissemination of the ideas and potentials of validated numerics to interested scientists from other areas of scientific computing.

Within the scope of SCAN-97, there is no restriction regarding the mathematical or applied background of the problems to be reported: algebra, analysis, optimization, probability, etc., are equally welcome.

* 11-13 Workshop on Algorithm Engineering, Venice, Italy. Aim: The workshop is devoted to researchers and developers interested in the practical aspects of algorithms and their implementation issues. In particular, it will bring together researchers, practitioners, and developers in the field of algorithm engineering to foster cooperation and exchange of ideas.

Themes: Relevant themes of the workshop are the design, experimental testing and tuning of sequential, parallel, and distributed algorithms to the point where they are readily available for practical deployment.

Sponsor: The workshop will be partly sponsored by ALCOM-IT, a European Union ESPRIT LTR Project.

Submissions: Authors should submit an extended abstract (max 10 pages). Authors are strongly encouraged to submit their extended abstracts electronically. A detailed description of the electronic submission process will be available on the World Wide Web and will be accessible through the WAE 97 Web page listed below. Authors who do not wish to submit electronically are invited to send 6 copies (printed double-sided if possible) of an extended abstract and a cover letter to G. F. Italiano at the address below.

Information: G. F. Italiano, Dipartimento de Matematica Applicata e Informatica, Università "Ca' Foscari" di Venezia, via Torino 155, 30173 Venezia Mestre, Italy; tel: +39-41-2908427; fax: +39-41-2908419; e-mail: wae97@dai.unive.it; http://www.dai.unive.it/wae97/.
17–19 Second International Conference on Simulation and Design of Microsystems and Microstructures (MICROSIM'97), Lausanne, Switzerland.

**Purpose:** MICROSIM 97 is being organized to promote cooperation among scientists and engineers involved in the design and simulation of Microsystems and microstructures.

**Call for Papers:** Papers are invited on any of the topics listed below or others related to the theme of the meeting, with particular emphasis on applications of the techniques proposed. Participants are encouraged to critically review existing ideas and explore new research ideas. Submit 4 copies of your draft paper to the conference secretariat as soon as possible and no later than December 13, 1996. Your paper should not exceed 10 pages including figures, diagrams, and tables, with text size measuring 135 mm wide by 225 mm high in 12 point. The final version of the paper will be due no later than May 16, 1997.

**Topics:** Design, simulation and analysis, optimization, material modeling, fabrication and manufacturing processes, correlation with experimentation, integration, CAD, processes (i.e., etching), measurement problems.

**Application Areas:** Microelectronics, mechatronics, micro-electro-mechanical systems, engineering, automotive and aerospace, medicine and biology, transducers, environmental, computers & information processes.

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13–17 Seventh International Conference on Hyperbolic Problems, ETH Zurich, Switzerland.

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**Information:** More information about the conference can be found on the WWW: http://www.sam.math.ethz.ch/~hyp98/index.html or can be requested by e-mail: hyp98@sam.math.ethz.ch.

**August 1998**

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**Organizers:** The colloquium is organized by the International Federation of Nonlinear Analysts, the Japan Mathematical Society, UNESCO, and other prestigious national and international mathematical institutions.

**Call for Papers:** Abstracts for contributed papers should be received by March 1, 1998.

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18–23 Ninth International Colloquium on Differential Equations, Plovdiv, Bulgaria.


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Contemporary Mathematics

Recent Developments in Optimization Theory and Nonlinear Analysis
Yair Censor and Simeon Reich, Editors

This volume contains the refereed proceedings of the special session on Optimization and Nonlinear Analysis held at the Joint American Mathematical Society-Israel Mathematical Union Meeting which took place at the Hebrew University of Jerusalem in May 1995. Most of the papers in this book originated from the lectures delivered at this special session. In addition, some participants who didn't present lectures and invited speakers who were unable to attend contributed their work.

The fields of optimization theory and nonlinear analysis continue to be very active. This book presents not only the wide spectrum and diversity of the results, but also their manifold connections to other areas, such as differential equations, functional analysis, operator theory, calculus of variations, numerical analysis, and mathematical programming.

In reading this book one encounters papers that deal, for example, with convex, quasiconvex and generalized convex functions, fixed and periodic points, fractional-linear transformations, moduli of convexity, monotone operators, Morse lemmas, Navier-Stokes equations, expansive maps, nonsmooth analysis, numerical stability, products of projections, steepest descent, the Leray-Schauder degree, the turnpike property, and variational inequalities.

Contents
H. H. Bauschke, J. M. Borwein, and A. S. Lewis, The method of cyclic projections for closed convex sets in Hilbert space; A. Ben-Israel, Newton's method with modified functions; A. Björck, Numerical stability of methods for solving augmented systems; D. Butnariu and A. N. Iusem, Local moduli of convexity and their application to finding almost common fixed points of measurable families of operators; F. H. Clarke, Y. S. Ledyaev, and R. J. Stern, Fixed point theory via nonsmooth analysis; Z. Guan and A. G. Kartsatos, Ranges of generalized pseudo-monotone perturbations of maximal monotone operators in reflexive Banach spaces; M. J. Holst and E. S. Titi, Determining projections and functionals for weak solutions of the Navier-Stokes equations; A. Ioffe and
Fields Institute Communications

Special Functions, q-Series and Related Topics
Mourad E. H. Ismail, David R. Masson, and Mizan Rahman, Editors
Volume 14

This book contains contributions from the proceedings at The Fields Institute Workshop on Special Functions, q-Series and Related Topics that was held in June 1995. The articles cover areas from quantum groups and their representations, multivariate special functions, q-series, and symbolic algebra techniques as well as the traditional areas of single-variable special functions.

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Liao Shantao is an outstanding mathematician in China. As a result of his profound and systematic research work, he won the Mathematics Prize in 1985—awarded for the first time by the Third World Academy of Sciences—for his contributions to differentiable dynamical systems and other fields. He also won the National Natural Science Prize of China in 1987.


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Please send a vita and transcripts and arrange for three letters of reference to be sent to: J. Curtis Chipman, Chair, Applied Discrete Mathematics Search Committee, Department of Mathematical Sciences, Oakland University, Rochester, MI 48309-4401; phone: 810-370-3440; fax: 810-370-4184; e-mail: chipman@oakland.edu. Applications should be received by March 1, 1997, to ensure full consideration.

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NORTH CAROLINA STATE UNIVERSITY
Center for Research in Scientific Computation
The Center for Research in Scientific Computation at North Carolina State University, in collaboration with Lord Corporation's Thomas Lord Research Center, Cary, NC, expects to make a University/Industry Cooperative Postdoctoral Research appointment starting August 16, 1997 (availability of the position is contingent upon funding). The appointment will be in the area of applied mathematics and scientific computation. The successful candidate for this position is expected to participate in a collaborative multidisciplinary team carrying out fundamental research investigations to provide a better understanding and predictive capabilities of the overall magnetic and rheological properties of magnetorheological (MR) fluids. The research efforts will involve the modeling, analysis, and computation of the magnetic response of nonlinear MR composites in the presence of magnetic fields and of their viscoelastic behavior when subjected to deformations. Since the project involves knowledge of electromagnetics and rheology, applied partial differential equations, and computational science, candidates who are outstanding in at least one of these areas and willing and able to learn quickly in the others will be given highest priority. This position offers a unique opportunity for multidisciplinary mentored postdoctoral research on a mathematical project arising in an industrial/university collaborative effort.

 Applicants should send a vita and brief description of research interests plus three letters of recommendation to: Search Committee, University/Industry Cooperative Postdoctoral Research Associate, Center for Research in Scientific Computation/Department of Mathematics, Box 8205, NC State University, Raleigh, NC 27695-8205. Applications will be considered at any time after January 15, 1997, as funding becomes available. NCSU is an AA/EEO/ADA. In its commitment to diversity and equity, NCSU seeks applications especially from women, minorities, and the disabled.

NORTH DAKOTA
NORTH DAKOTA STATE UNIVERSITY
Chairperson
Department of Mathematics
Applications and nominations are invited for the chair's position in the Department of Mathematics at North Dakota State University. Rank and salary will depend upon the qualifications of the applicant. Candidates are required to have a Ph.D. in mathematics with a strong research record evidenced by publications, a successful history of grant activity, and a strong teaching record. The person should have proven leadership and managerial ability and be able to work effectively with people. The successful applicant must be eligible for tenure in the College of Science and Mathematics.

The Department of Mathematics has fifteen faculty plus six lecturers. Active research areas include applied mathematics, numerical analysis, commutative algebra, dynamical systems, mathematics education, ergodic theory, graph theory, and number theory. The Department offers the bachelor's, master's, and Ph.D. degrees.

Send a letter of application and complete vita to: Chair, Search Committee, Department of Mathematics, NDSU, Box 5075, Fargo, ND 58105-5075. Applicants should also arrange to have three letters of reference sent to the Search Committee at the above address. To assure full consideration, all material should be received by February 28, 1997; screening will continue until the position is filled. NDSU is an Affirmative Action/Equal Opportunity Employer.

OHIO
OBERLIN COLLEGE
Department of Mathematics
One-year, full-time, noncontinuing positions beginning the 1997-98 academic year. Responsibilities include teaching undergraduate courses in mathematics and/or statistics (5/year), supervising honors projects, guiding independent research, and participating in departmental and college activities. Ph.D. degree (in hand or expected by August 31, 1997) is required. Submit a letter of application, a curriculum vitae, a statement of teaching philosophy, a statement of research interests, and three letters of reference to the Search Committee (Department of Mathematics and Computer Science, Oberlin College, Oberlin, OH 44074, by March 1, 1997). Send all materials to: Committee on the Search for Faculty Positions in Mathematics, Oberlin College, Oberlin, OH 44074, by March 1, 1997. Use of AMS Application Cover Sheet appreciated. Oberlin College has admitted women since its beginning in 1833 and has been historically a leader in the education of blacks. AA/EEO.

CASE WESTERN RESERVE UNIVERSITY
Faculty Positions in Mathematics
The Department of Mathematics at Case Western Reserve University expects to make one or more visits to select potential candidates for faculty positions in mathematics. Inquiries may be made by telephone to the Chairperson of the Department of Mathematics at 216-368-2144. Interested individuals should send a letter of application, a curriculum vitae, a statement of research interests, a statement of teaching philosophy, and three letters of reference directly to the Chairperson of the Department of Mathematics. The Department will begin to consider applications on October 1, 1996. Applications will be considered until the positions are filled. Case Western Reserve University is an Affirmative Action/Equal Opportunity Employer.
The Department invites applications for a faculty position in mathematics beginning August 1997. Applications will be reviewed as they are received and will continue until the positions are filled.

Inquiries may be sent to stef@uakron.edu. Review of completed applications will continue until the positions are filled.

The University of Akron is an Equal Opportunity/Affirmative Action Employer. Women and minorities are encouraged to apply.

SOUTH CAROLINA
WINTHROP UNIVERSITY
Department of Mathematics

Applicants only in the areas of applied mathematics, operational research, or statistics are invited to apply for a tenure-track position at the assistant or associate level. Applicants must state the level of the position sought. Research and scholarly activities must support appointment to the level sought. Documented evidence of teaching excellence, independent of professional references, is required.

A completed application, vita, documentation of teaching excellence, and three letters of reference are required. This process will close March 15, 1997. Applications are to be sent to: Dr. Ron C. Goolsby, Chair, Department of Mathematics, Winthrop University, Rock Hill, SC 29733. Winthrop University is an EOI and an AAE.

Winthrop is a state-supported comprehensive university of South Carolina, located approximately 20 miles south of Charlotte, North Carolina, with an enrollment of 5,200 students.

TEXAS

TENNESSEE

UNIVERSITY OF WISCONSIN-MADISON
Department of Mathematics

The Department of Mathematics invites applications for a tenure-track assistant professor position in mathematics beginning August 1997. Candidates must have a Ph.D. or equivalent degree in mathematics and demonstrate potential for excellence in both research and teaching. Preference will be given to candidates whose research interests are compatible with existing faculty in the area of algebra, analysis/applied math, geometry, and topology. Postdoctoral experience is desirable but not essential. Faculty members normally teach two classes each semester, do research, and contribute university and department service appropriate to their experience. Salary will be commensurate with qualifications and experience.

For full consideration send a completed AMS Cover Sheet, curriculum vitae, and a description of current and planned research, and three letters of recommendation, at least one of which discusses the candidate’s teaching, by January 15, 1997. Applications will be considered until the position is filled. All correspondence should be directed to: Search Committee, Department of Mathematics, University of Tennessee, 410 Ayres Hall, Knoxville, TN 37996-1320; telephone 615-974-0259; fax 615-974-8328; e-mail: search@math.utk.edu.

The University of Tennessee is an Equal Opportunity/Affirmative Action Employer. Minority and women are encouraged to apply.
The Department of Mathematics and Statistics at the assistant professor level startings beginning August 25, 1997. Applicants are for a fixed term of two years. The teaching load for these positions is five courses per academic year involving a coherent sequence of courses using novel pedagogical practices. These will primarily be courses at the elementary level aimed at improving the mathematical education of nonmajors. Training and guidance will be provided. A Ph.D. in mathematics or related areas is required. Ordinarily only those applicants who have received their doctorate since 1995 will be considered. Promise of excellence in both teaching and research is important. Some involvement with the department research program is expected. Salary is competitive.

Applicants should send a completed AMS Standard Cover Sheet, a curriculum vitae, and statements of educational activities and interests, and a brief statement of research plans to:

Hiring Committee
Dept. of Mathematics, Van Vleck Hall
University of Wisconsin-Madison
480 Lincoln Drive
Madison, WI 53706-1388

Applicants should also arrange to have sent to the above address three or four letters of recommendation, preferably two of which discuss the applicant's teaching experiences and capabilities and two of which discuss the applicant's research. Additional evidence of good teaching will be helpful. Applications will be considered until all available positions are filled.

The University of Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

CANADA

SIMON FRASER UNIVERSITY
Vancouver, British Columbia
Department of Mathematics and Statistics
Position in Applied and Computational Mathematics

The Department of Mathematics and Statistics at Simon Fraser University invites applications for a tenure-track position in applied and computational mathematics at the assistant professor level starting September 1, 1997. At this time our emphasis is on complementing current strengths in mechanics (fluids and solids) and scientific computing and developing new expertise in industrial and environmental modelling. Applicants are expected to have completed a Ph.D. degree at the time of appointment, have postdoctoral experience or a proven research record, and be able to demonstrate strong potential in both research and teaching.

Applications, including curriculum vitae and descriptive statements on research plans and teaching activities, should be sent by January 15, 1997, to:

Dr. J. L. Berggren, Chair
Department of Mathematics and Statistics
Simon Fraser University
Burnaby, BC V5A 1S6
Canada

Please arrange for three letters of reference to be sent directly from the referees. The position is subject to final budgetary approval.

Further information on the Department and the University can be found on the WWW site http://www.math.sfu.ca/mast_home.html.

Simon Fraser University is committed to the principle of equity in employment and offers equal employment opportunities to all qualified applicants. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents of Canada.

The Department of Mathematics and Statistics at Simon Fraser University currently has a dozen faculty members working in applied and computational mathematics and has research excellence in solid and fluid mechanics, numerical analysis, relativity, symbolic computation, and optimization. We have approximately 20–25 graduate students (roughly 1/3 of the departmental total) working in these areas, and we offer a graduate degree in applied and computational mathematics. In total the Department has 34 faculty and 5 lab instructors and offers undergraduate programs in applied & computational mathematics, pure mathematics, and statistics and actuarial mathematics. In addition to a high-quality research program, we place a strong emphasis on encouraging innovation in, and commitment to, teaching. We have co-op programs at both the graduate and undergraduate levels. Our first-year mathematics and statistics courses are supported by an excellent workshop system that provides students with one-on-one contact with teaching assistants and instructors and an environment designed to develop a community of learning.

Research and instruction are supported by an extensive university computing network, and the Department itself has a research network of more than forty Sun stations and over a dozen Silicon Graphics machines (many of which are located in the Centre for Experimental and Constructive Mathematics).

Being located atop Burnaby Mountain in Vancouver, one of the most beautiful cities in the world, the University offers a marvelous working environment.

HONG KONG

THE CHINESE UNIVERSITY OF HONG KONG

Applications are invited for Department of Mathematics Senior Lecturer (carrying the academic title of associate professor or professor, as appropriate) or Lecturer (carrying the academic title of assistant professor or associate professor, as appropriate) (Ref. 96/105(047)/2). Applicants should preferably be specialized in applied analysis/scientific computing. Applicants from other fields with outstanding research profiles are also welcome to apply. The appointee is expected to have effective interaction with other faculty members. Appointment will initially be made on a one-year contract to commence from January 1998.

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Senior Lecturer: HK$759,780–$1,020,660 by 8 increments
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Benefits include leave with full pay, medical and dental care, children's education allowance, housing benefit for eligible appointee (with appointee contributing 7.5% of salary towards the provision of housing), and where appropriate a contract-end gratuity (15% of basic salary).

Application Procedure
Please send full resume, copies of academic credentials, a publication list and/or abstracts of selected published papers, together with names and addresses (fax numbers/e-mail addresses as well, if available) of three referees, to the Personnel Office, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong (fax: 852-2603-6852) before March 31, 1997. Applications, however, will still be considered until the position is filled. Please quote the reference number and mark "Recruitment" on cover.
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Dorina Mitrea and Marius Mitrea,
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G. A. Swarup,
On the cut point conjecture

The American Mathematical Society's first electronic-only journal, Electronic Research Announcements of the AMS (ERA-AMS), is available on the World Wide Web at the URL: http://www.ams.org/era/

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"... this edition of Wielandt's collected work is excellent in every respect. No wishes are left unfulfilled. This volume performs a highly valuable service to any mathematics department, in particular to those with some group-theoretical activities. On the other hand this book gives every mathematician a beautiful invitation to the field of group theory."

— Mathematical Reviews

Helmut Wielandt (1910) is one of the few mathematicians who has worked not only in the fields of algebra and analysis but applications as well. His mathematical work is unique since it contains outstanding results in two almost completely unrelated fields: group theory and matrix theory.

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Mimeographed Research Reports, Aerodynamische Versuchsanstalt Göttingen
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Biographical Notes
Appendix: Ausgewählte Fragen über Permutationsgruppen

Previously published:
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The beginning date for the appointment will be July 1, 1997. Nominations & applications from persons holding a Ph.D. should be directed to the Mathematical Sciences Department Head Search Committee, Dept. AMS, Office of Human Resources, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609-2280 or email: human-resources@wpi.edu

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This volume describes recent work reflecting the discovery of the mirror symmetry phenomenon. Chapters address the geometry of the Calabi-Yau manifold, ideas from quantum field theory, the works of Candelas, de la Ossa, Green, and Parkes—based on the fact that the variation of Hodge structure of a Calabi-Yau threefold determines the Gromov-Witten invariants of its mirror under the mirror symmetry hypothesis. Also covered are Batyrev's construction—exhibiting the mirror symmetry phenomenon between hypersurfaces of toric Fano varieties, the mathematical construction of the Gromov-Witten potential, and the proof of its crucial property, which allows the construction of a flat connection. The work concludes with Givental's computation—a justification of the computation of Candelas et al. The text is written in French. Titles in this series are published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Panoramas et Synthèses, Number 2; 1996; 148 pages; Softcover; List $30; Individual AMS member $27; Order code PASY/2NA

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Victor Kac, Massachusetts Institute of Technology, Cambridge

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University Lecture Series, Volume 10; 1997; 141 pages; Softcover; ISBN 0-8218-0643-2; List $25; All AMS members $20; Order code ULECT/10NA

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VISIT THE AMS BOOKSTORE AT http://www.ams.org/bookstore/
Members of the Society who move or change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists 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.

When changing their addresses, members are urged to cooperate by supplying the requested information. 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 fill out this form, supply any other information appropriate for the AMS records, and mail it to:

Customer Services
AMS
P.O. Box 6248
Providence, RI 02940

or send the information on the form by e-mail to:

amsmem@math.ams.org or
cust-serv@math.ams.org

Name ____________________________
Customer code ____________________
Change effective as of ____________
Old mailing address

New mailing address

New position _________________________

If mailing address is not that of your employer,

please supply the following informations:

New employer ________________________

Location of employer (city, state, zip code, country) ____________________________________________

Telephone number ____________________
e-mail ______________________________
Recent honors and awards

Change of Address
Membership and Customer Services
AMERICAN MATHEMATICAL SOCIETY
P. O. Box 6248
Providence, RI 02940-9943
The Canadian Mathematical Society and the University of Manitoba cordially invite researchers, educators, and students to the 1997 Summer Meeting of the Canadian Mathematical Society. The scientific program will take place at the Drake Management Building of the University of Manitoba, Winnipeg, Manitoba, from Saturday, June 7, to Monday, June 9, 1997.

Plenary Speakers: Hyman Bass (Columbia University), David Evans (University of East Anglia), Roger Fenn (University of Sussex), Steve Halperin (University of Toronto), R. A. Horn (University of Utah), Cathleen Morawetz (Courant Institute), Boris Plotkin (Hebrew University of Jerusalem), Anne Street (University of Queensland), Wayne Watt (Government of Manitoba).

Symposia and Preliminary List of Speakers
Model Theory and Permutation Groups (Org: Bradd Hart and Matthew Valeriote, McMaster University); Ambar Chowdhury (Connecticut), Bradd Hart (McMaster), Jeffrey Koshan (Simon Fraser), Alistair Lachlan (Simon Fraser), Zeljko Sokolovic (Fields Institute), Juris Steprans (York), Simon Thomas (Rutgers), Ross Willard (Waterloo).

Group Theory and Topology (Org: Dale Rolfsen, University of British Columbia); Steven Boyer (UQAM), Gerald Cliff (Alberta), Mike Davis (Ohio State), Martin Dunwoody (Southampton), Stephen Gersten (Utah), Kanta Gupta (Manitoba), Narain Gupta (Manitoba), William Jaco (Oklahoma State), Eric Jespers (Memorial), Sergei Matveev (Chelyabinsk), Kunio Murasugi (Toronto), Andrew Nicas (McMaster), I. B. S. Passi (CAS, Chandigarh), Akbar Rhemtulla (Alberta), Peter Scott (Michigan), Hamish Short (Marseille), Sudarshan Sehgal (Alberta), Peter Shalen (Illinois at Chicago), Xingru Zhang (Waterloo), Jun Zhu (UBC), P. Zengrowski (Calgary).

Finite Geometries and Applications (Org: Lynn Batten, University of Manitoba); Catherine Baker (Mount Allison), Aiden Bruen (Western Ontario), Chris Fisher (Regina), Jennie Key (Clemson, South Carolina), Antonio Pasini (Naples, Italy), Fred Piper (London, England).

Linear Algebra (Org: P. N. Shivakumar, University of Manitoba); Paul Van Dooren (de Louvain), Stephen Kirkland (Regina), Judy MacDonald (Regina), Bryan Shader (Wyoming), Q. Ye (Manitoba).

Education - Transitions (Org: Kathleen Nicol, University of Brandon, and Lars Jansson, University of Manitoba); Wayne Watt (Government of Manitoba).

Prize Lectures: The Jeffery-Williams Lecture will be given by Steve Halperin (Toronto). The Krieger-Nelson Lecture will be given by Cathleen Morawetz (Courant Institute).

Contributed Papers: Contributed papers of 15 minutes' duration are invited, and graduate students are particularly urged to participate. Abstracts for CMS contributed papers should be prepared as specified below. For an abstract to be eligible, the abstract must be received before March 15, 1997. The abstract must be accompanied by its contributor's registration form and appropriate fees. If you intend to give a paper in this session, please contact R. Padmanabhan, University of Manitoba, at padman@ccu.umanitoba.ca well before the March 15 submission deadline to state your intent.

Graduate Student Seminar: A session is being organized for graduate students on June 10-11, 1997.

Joint CMS/ILAS Registration: The International Linear Algebra Society is also holding a meeting on the University of Manitoba campus on June 6, and 7, and 8. Joint registration will be available for those who wish to attend both the CMS and ILAS sessions.

Submission of Abstracts: The CMS publishes abstracts for all scheduled talks. Abstracts for Plenary Speakers, Prize Lecturers, and Invited Special Session Speakers for the scientific and education program will appear in the April issue of the CMS Notes. Abstracts for Contributed Papers will appear in the May/June issue of the CMS Notes. All abstracts will also be available on the Canadian Mathematical Electronics Services (Came).n

Plenary Speakers, Prize Lecturers and Invited Special Session Speakers for the Scientific and Education Program: These speakers are asked to submit their abstracts to the CMS as instructed by their organizers. Abstracts may be sent electronically, following instructions given below. Abstracts may also be prepared on the standard CMS form available from the session organizer or the CMS office in Ottawa. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, P. O. Box 450, Station A, Ottawa, Ontario, Canada K1N 6N5, so as to arrive by the invited speaker deadline of February 15, 1997.

Contributed Papers: Those submitting contributed papers may submit their abstracts electronically, following instructions given below, or by using the standard CMS form available from the CMS office in Ottawa or in the January/February issue of the CMS Notes. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, P. O. Box 450, Station A, Ottawa, Ontario, Canada K1N 6N5, so as to arrive by the contributed papers deadline of March 15, 1997. Abstracts for contributed papers are then evaluated by the Program Committee, which is responsible for scheduling all talks and confirming with the contributor.
Electronic Submission of Abstracts: This service is available only to those who use the TeX typesetting system. Files should include the speaker’s name, affiliation, complete address, title of talk, and the abstract itself. Files may be sent by e-mail to the Abstracts Coordinator at abstracts@cms.math.ca. Please note the appropriate deadline given above for the submission of your abstract. Please note that we cannot accept abstracts sent by fax.

Social Events: A number of social events are planned. These include a cash-bar welcoming reception during evening registration, Friday, June 6, 7:00-9:00 p.m. in the Heron/Gander Rooms of the Holiday Inn Winnipeg South, 1330 Pembina Highway. A joint CMS/ILAS banquet will be held at Pembina Hall, University of Manitoba, on Saturday, June 7, 1997, at 7:30 p.m. A cash bar will precede the event at 6:30 p.m. Banquet tickets are available at $40 each and are included in most registration fee categories. Extra tickets are available. Coffee will be available during the scheduled breaks.

Exhibits: Exhibits will be open on Saturday from 12:00 noon to 5:00 p.m. and Sunday from 9:00 a.m. to 5:00 p.m. Don’t forget to visit the Canadian Mathematical Electronic Services Booth and check out new services. The CMS exhibit will be open throughout the course of the meeting.

Registration: Forms are available from the CMS Executive Office, 577 King Edward, Suite 109, P. O. Box 450, Station A, Ottawa, Ontario, Canada K1N 6N5; tel: 613-562-5702; fax: 613-565-1539; e-mail: meetings@cms.math.ca.

Rates quoted are in Canadian dollars. Payment for pre-registration may be made by cheque or by VISA or MasterCard. Although registration fees are given in Canadian dollars, delegates may send cheques in US dollars by contacting their financial institution for the current exchange rate. Speakers should contact their organizers for special speaker rates. Electronic preregistration is available on our Camel site at http://camel.math.ca/. This site also has the latest information on the meetings.

(*) The fee includes one ticket to the Saturday night banquet.

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<td>Additional fee for ILAS session, June 6</td>
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<td>Graduate student session, June 10–11</td>
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Accommodation: It is recommended that those attending the conference book early to avoid disappointment. Blocks of rooms have been reserved at three different facilities and will be held until the dates given below. Reservations not in by that date will be on a request only, space-available basis. Attendees should make their own reservations. Please mention that you are participating in the CMS Summer Meeting. Reservations will be held until 6:00 p.m. on the arrival day only, unless guaranteed by a major credit card. The conference rate is extended up to two days pre- and post-convention. Rates quoted are in Canadian dollars.

Holiday Inn Winnipeg South
1330 Pembina Highway, Winnipeg, Manitoba, Canada R3T 2B4
Check-in: 3:00 p.m., Check-out: 12:00 noon
Reservation deadline: May 1, 1997
Rates: $75.00 single/double occupancy
Applicable taxes: 7% PST + 7% GST
Phone: 204-452-4747; Fax: 204-284-2751

Comfort Inn Winnipeg South
3109 Pembina Highway, Winnipeg, Manitoba, Canada R3T 4R6
Check-in: 2:00 p.m., Check-out: 11:00 a.m.
Reservation deadline: April 1, 1997
Rates: $65.00 single/double occupancy
Applicable taxes: 7% PST + 7% GST
Phone: 204-269-7390; Fax: 204-261-7655
Toll-free reservations: 1-800-228-5150

Specceley Hall, Univ. of Manitoba Conference Housing
Check-in location: Pembina Hall, 26 MacLaren Crescent, Winnipeg, Manitoba, Canada
Check-in: Mon–Fri 8:30 a.m.–12:30 a.m., Sat–Sun 4:30 p.m.–12:30 a.m.
Reservation deadline (with full payment): May 1, 1997
Rate: $33.63 per person/per night, single occupancy
$25.08 per person/per night, double occupancy
(Daily towel service included; meals not included)
Applicable taxes: Included in prices given above
Phone: 204-474-3337; Fax: 204-261-1735

Travel: Winnipeg, located at the geographic centre of Canada, is mere hours away by air from most major U.S. cities. It is just 70 miles/112 kilometers from the U.S. border. The Winnipeg International Airport is located just 20–25 minutes from the hotels and university. It services major carriers from the U.S. and overseas. VIA Rail provides passenger rail service. It is also accessible by Grey Goose Bus Lines and Greyhound Lines of Canada.

Acknowledgments: The Sessions are sponsored by the CMS, The Fields Institute, and the Pacific Institute. The visit of Hyman Bass is sponsored by the University of Manitoba. He is the Knight Distinguished Visitor for 1997. The Program Committee wishes to thank The Fields Institute, Pacific Institute, and the University of Manitoba for their generous financial support.

Program Committee: C. K. Gupta (Manitoba)—chair, Model Theory and Permutation Groups—Brad Hart and Matthew Valeriote (McMaster), Group Theory and Topology—Dale Rolfsen (UBC), Finite Geometries and Applications—Lynn Batten (Manitoba), Linear Algebra—P. N. Shivakumar (Manitoba), Education—Kathleen Nicol (Brandon) and Lars Jansson (Manitoba), Contributed Papers—R. Padmanabhan (Manitoba); G. P. Wright (CMS)—ex-officio.

Local Arrangements Committee: Lynn Batten (Manitoba)—chair, Diane Dowling (Manitoba), Monique Bouchard (CMS)—ex-officio.
Memphis, Tennessee  
*University of Memphis*  
March 21-22, 1997  

**Meeting #919**  
Southeastern Section  
Associate secretary: Robert J. Daverman  
Announcement issue of *Notices*: January 1997  
Program issue of *Notices*: March 1997  
Issue of *Abstracts*: Volume 18, Issue 2  

**Deadlines**  
For organizers: Expired  
For consideration of contributed papers in Special Sessions: Expired  
For abstracts: Expired  

**Invited Addresses**  
Keith Ball, Texas A & M University, *Convolution inequalities in convex geometry.*  
Nikolai I. Chernov, University of Alabama at Birmingham, *Conditionally invariant measures in dynamical systems.*  
Richard Martin Hain, Duke University, *Hodge theory and mapping class groups.*  
Allen R. Tannenbaum, University of Minnesota, *Invariant curve and surface flows in computer vision.*  

**Special Sessions**  
*Approximation in Mathematics,* George A. Anastassiou, University of Memphis.  
*Chaotic Dynamics,* Nikolai I. Chernov and Serge Troubetzkoy, University of Alabama at Birmingham.  
*Complex Analysis in One and Several Variables,* Dmitry Khavinson, University of Arkansas.  
*Convergence and Recurrence in Ergodic Theory,* James T. Campbell and Mate Wierdl, University of Memphis.  
*Dynamical Systems and Fractal Geometry,* Fernanda Botelho, University of Memphis.  
*Graph Theory,* Ralph J. Faudree Jr. and Richard H. Schelp, University of Memphis.  
*Harmonic Analysis and Convexity,* Eric A. Carlen, Georgia Institute of Technology, Erwin Lutwak, Polytechnic University, and Elisabeth Werner, Case Western Reserve University.  
*Numerical Solutions for Partial Differential Equations,* Xiaobing Feng and Ohannes Karakashian, University of Tennessee.  
*Partial Differential Equations,* Gisele Ruiz Goldstein and Jerome A. Goldstein, University of Memphis.  
*Random Graphs,* Bela Bollobas and Cecil C. Rousseau, University of Memphis.
College Park, Maryland
University of Maryland, College Park
April 12–13, 1997

Meeting #920
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: January 13, 1997

Invited Addresses
Lisa Claire Jeffrey, McGill University and Institute for Advanced Study, Moduli spaces of flat connections on Riemann surfaces.
Alexandre Kirillov, University of Pennsylvania, Merits and demerits of the orbit method.
Jian-Shu Li, University of Maryland, College Park, Title to be announced.
Richard Pollack, Courant Institute of Mathematical Sciences, New York University, Algorithms in real algebraic geometry.

Special Sessions
Analysis of Spatial Stochastic Models (Code: AMS SS E1), A. M. Kagan and Eric V. Slud, University of Maryland.
Automorphism Groups of Geometric Structures (Code: AMS SS J1), Alessandra Iozzi and Garrett James Stuck, University of Maryland.
Groupoids and their Applications (Code: AMS SS F1), Alan T. Paterson, University of Mississippi.

Harmonic Analysis and Applications (Code: AMS SS N1), Stephen D. Casey, American University, and David F. Walnut, George Mason University.
Hyperbolic Equations (Code: AMS SS L1), Manoussos Grillakis and Matei Machedon, University of Maryland.
Lie Groups and Automorphic Forms (Code: AMS SS C1), Jian-shu Li, University of Maryland, and Gordon Savin, University of Utah.
Numerical Solution of Differential Equations (Code: AMS SS M1), Ricardo H. Nochetto and John E. Osborn, University of Maryland.
Partial Differential Equations (Code: AMS SS K1), Jonathan Adam Poritz, University of Maryland.
Symplectic Geometry, Moduli Spaces and Integrable Systems (Code: AMS SS B1), Lisa Claire Jeffrey, McGill University and Institute for Advanced Study, and Eyal Markman, University of Massachusetts, Amherst.
Topological Dynamics (Code: AMS SS I1), Joseph Auslander and Kenneth R. Berg, University of Maryland.

Accommodations
Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS eastern meeting. All rooms will be on a space available basis after the deadline given. The meeting is scheduled on the same weekend as College Park's Cherry Blossom Festival, so hotel space is limited. It is recommended that reservations be made early. The AMS is not responsible for rate changes or for the quality of the accommodations. There is public transportation from the hotels to the campus and back. All of the hotels are within one mile of the campus.

Holiday Inn, College Park, 10000 Baltimore Blvd.; 301-345-6700; $69 single/double; two miles to campus. Van service is available. Deadline 3/21.
Quality Inn, 7200 Baltimore Blvd.; 301-864-5820; $60 with continental breakfast/single; one mile from campus. Deadline 3/11.
Best Western, 8601 Baltimore Blvd.; 301-474-2800; $79/single/double; one mile from campus. Van service is available. Deadline 3/10.
Comfort Inn, 9020 Baltimore Blvd.; 301-441-8110; $67.00 single/double with deluxe continental breakfast; one mile to campus. Van service is available. Deadline 3/12.

Food Service
Food services are available in all of the hotels mentioned above. There are several restaurants just off campus on Baltimore Blvd. On campus, there are four eating establishments available. Please ask for information at the registration desk or see the campus map on the web site below.
Local Information


AMS Book Sale

Examine the newest titles from AMS! Most books will be available at a special 50% discount offered only at meetings. AMS representatives will be on hand to demonstrate and discuss the newest electronic journals, the preprint server and other products and member services available on e-MATH. Complimentary coffee will be served, courtesy of AMS Membership Services.

Parking

Lots are metered until 10 p.m. on Friday evening. Free parking is available in campus lots Saturday and Sunday. See campus map for parking lot locations.

Registration and Meeting Information

Registration will take place in the Rotunda on the main level of the Mathematics Building from 8:00 a.m. to noon and 1:00 p.m. to 4:00 p.m. Saturday and 8:00 a.m. to noon on Sunday. Registration fees (payable on site only): $30/AMS members; $45/nonmembers; and $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express. Talks will also take place in the Mathematics Building, with the Lectures being held in the Physics Building.

Travel

College Park is served by the Baltimore/Washington, Dulles International, and National Airports.

USAir has been selected as the official airline for the meeting for its generally convenient schedule. The following specially negotiated rates are available: 5% discount off first class and any published USAir promotional round-trip fare, or 10% discount off unrestricted coach fares with seven-day advance reservations and ticketing required. These discounts are valid providing all rules and restrictions are met and are applicable for travel from the continental U.S., Bahamas, Canada, and San Juan, P.R. Discounts are not combinable with other discounts or promotions. Additional restrictions may apply on international travel. For reservations call (or have your travel agent call) 800-334-8644 between 8:00 a.m. and 9:00 p.m. Eastern Daylight Time. Refer to Gold File Number 41380118.

Driving

From Baltimore: 1-95 South to Capital Beltway (495); follow signs to College Park, U.S.1 South (Interchange 25). Proceed approximately 2 miles south on U.S.1. Right turn into Campus Drive Entrance.

From Montgomery County and Points West: Capital Beltway (495) to U.S.1 South (Interchange 25); proceed approximately 2 miles south on U.S.1. Right turn into Campus Drive Entrance.

From Bowie/Annapolis Areas and Points East: Route 50 to Capital Beltway (495); north on 495 to College Park; exit Beltway at Interchange 25 (U.S.1 South); proceed approximately 2 miles on U.S.1. Right turn into campus.

From Washington, D.C.: New Hampshire Avenue (29) or Rigg's Road (212) to East-West Highway (410); right on 410 to U.S. 1. Left on U.S. 1 to Regents Drive Entrance. Left into campus.

N.Y. Avenue (50) to Baltimore-Washington Parkway (295); exit at Riverdale Road West (410); proceed to U.S.1 and turn right. Continue to College Park. Enter campus by turning left off U.S.1 at Regents Drive Entrance.

Fares

Metro fares from National Airport to College Park are about $2.65 one way during rush hours. During non-rush hours the fares are $2.10 for a one-way ticket.

Checkered Taxicabs or Washington Flyer: Dulles International Airport to College Park, MD $45-50; National Airport to College Park, MD $25-30; Baltimore Washington Airport to College Park, MD $38-42. For bus schedules: http://inform.umd.edu/cgi-bin/post-query/.

Weather

Weather conditions during April vary widely. See National Weather Service on the web at: http://iwin.nws.noaa.gov/iwin/md/local.html for the most up to date weather in College Park.

Corvallis, Oregon

Oregon State University

April 19-20, 1997

Meeting #921

Western Section

Associate secretary: William A. Harris Jr.

Announcement issue of Notices: February 1997

Program issue of Notices: April 1997

Issue of Abstracts: Volume 18, Issue 2

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: January 13, 1997

Invited Addresses

Jerrold E. Marsden, California Institute of Technology, Stabilization and dynamics of balance systems.
Robert E. O'Malley, University of Washington, Exponential asymptotics.

Harold R. Parks, Oregon State University, Advances in computing area-minimizing hypersurfaces.

Pavel Pevzner, University of Southern California, Combinatorics of genome rearrangements.

Special Sessions


Algebraic and Elementary Number Theory (Code: AMS SS B1), Richard A. Mollin, University of Calgary, and Peter J. Shiue, University of Nevada, Las Vegas.

Clifford Algebras and Octonions (Code: AMS SS C1), Tevian Dray and Corinne Manogue, Oregon State University.

Combinatorial Methods in Molecular Biology (Code: AMS SS D1), Pavel Pevzner and Michael S. Waterman, University of Southern California.

Geometric Analysis (Code: AMS SS E1), Harold R. Parks and Donald C. Solmon, Oregon State University.

Geometry Mechanics (Code: AMS SS F1), Judith M. Arms, University of Washington, and John V. Leahy, University of Oregon.

Geometric Methods in Mathematical Physics (Code: AMS SS G1), Juha Pohjanpalo, Oregon State University.

Inverse Problems (Code: AMS SS K1), Adel Faridani and David V. Finch, Oregon State University.

Mathematical Issues in Physical Oceanography (Code: AMS SS H1), Robert L. Higdon, Oregon State University.

Operator Algebras (Code: AMS SS I1), Huaxin Lin and Christopher Phillips, University of Oregon.


Accommodations

Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS "math" meeting. All rooms will be on a space available basis after the deadline given. The AMS is not responsible for rate changes or for the quality of the accommodations. Rates do not include tax.

Courtyard Inn, 2435 Northwest Harrison Blvd., 541-754-7316; $65-$85 with breakfast/single and double; walk to meeting. Space available basis only.

Ramada Inn, 1550 Northwest 9th; 541-754-7326 or 800-272-6232; $70/single and $80/double; walk to meeting.

Motel Orleans, 935 Northwest Garfield; 541-758-9125 or 800-626-1900; $42/single or double; walk to meeting.

Food Service

Numerous eating establishments are located along Monroe Avenue within walking distance of the meeting site. The OSU Memorial Union Commons houses four fast food restaurants and will be open from 10:00 a.m. to 4:00 p.m. Additional restaurants are located approximately ten blocks from the meeting site. A list of restaurants will be available at the registration desk.

Local Information


AMS Book Sale

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Parking

Parking is permitted in visitor/student/staff lots on campus (not including special permit areas) and is free of charge on Saturday and Sunday, April 19-20. Free parking is available in campus lots.

Registration and Meeting Information

Registration will take place in Room 108 of the Math Learning Center located in Kidder Hall from 7:30 a.m. to noon and 1:00 p.m. to 5:00 p.m., Saturday, April 19, and 8:00 a.m. to noon on Sunday, April 20. Registration fees (payable on site only): $30/AMS members; $45/nonmembers; and $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express. Lectures will take place in Gillfillian Auditorium and the Social Sciences Building.

Travel

Corvallis is served by the Eugene and Portland Airports. Shuttle service is available from both airports to Corvallis and reservations are recommended for reduced fares. Anthony's Shuttle serves passengers between the Portland Airport and Corvallis, 541-753-7831 or 800-546-6158 (fares are approximately $30-$40 one way). Express Cab & Shuttle serves passengers between the Eugene Airport and Corvallis, 541-341-8444 (fares are approximately $12-$16). Driving: Take the Corvallis/Lebanon exit off of I-5 (Exit 228) and travel west on Highway 34 to Corvallis. Highway 34 turns into Harrison Blvd. After crossing the Willamette River bridge, travel west on Harrison Blvd. and turn left on 14th Street, then right on to Monroe Avenue. Campus parking lots are located along Monroe Ave. between 16th and 25th Streets (within walking distance of Kidder Hall).

Weather

Corvallis is lovely in the spring. By mid-April the rhododendrons and azaleas will be blossoming and many other flowers and flowering trees will be in bloom. Average rainfall for April is two inches and average temperature is 55
degrees F. Participants are advised to prepare for possible rainy conditions.

Detroit, Michigan
Wayne State University
May 2-4, 1997
Meeting #922
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: May 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: February 3, 1997

Invited Addresses
Harold P. Boas, Texas A&M University, Title to be announced.
Carlos E. Kenig, University of Chicago, Title to be announced.
Ernest E. Shult, Kansas State University, Title to be announced.
A. L. Volberg, Michigan State University, Title to be announced.

Special Sessions
Algebraic Combinatorics (Code: AMS SS K1), Devadatta M. Kulkarni, Oakland University.
Algebraic Topology (Code: AMS SS D1), Robert R. Bruner and David Handel, Wayne State University.
Analysis and Geometry (Code: AMS SS J1), Carlos E. Kenig, University of Chicago, and Tatiana Toro, University of Washington.
C* Algebras (Code: AMS SS H1), Jerry Kaminker, Indiana University-Purdue University at Indianapolis, and Claude L. Schochet, Wayne State University.
Differential Geometry and Its Applications (Code: AMS SS C1), Daniel S. Drucker and Chong-Shi Houh, Wayne State University.
Optimization and Variational Analysis (Code: AMS SS L1), Boris S. Mordukhovich, Wayne State University, and Jay S. Treiman and Qiji Zhu, Western Michigan University.
Recent Advances in Noncommutative Ring Theory (Code: AMS SS F1), Peter Malcolmson and Frank Okoh, Wayne State University.
Representation Theory of Finite Groups and Related Topics (Code: AMS SS B1), David Howard Gluck, Wayne State University.
Stochastic Processes in Finance and Control (Code: AMS SS G1), Raoul LePage, Michigan State University, and Bert M. Schreiber, Wayne State University.
VOA's monstrous moonshine and related topics (Code: AMS SS H1), Chongying Dong, University of California Santa Cruz, and Robert L. Griess Jr., University of Michigan.
Wavelets and Applications (Code: AMS SS M1), Gregory F. Bachelis and Tze-Chien Sun, Wayne State University, and Grant Gerhart, Tardec, Tacoma, Army.

Pretoria, Republic of South Africa
University of Pretoria
June 26-28, 1997
Meeting #923
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: June/July 1997
Issue of Abstracts: None

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: March 1, 1997
For abstracts: April 30, 1997

Invited Addresses
Hyman Bass, Columbia University, Title to be announced.
Armand Borel, Institute for Advanced Study, Title to be announced.
Percy Deift, Courant Institute of Mathematical Sciences, New York University, Title to be announced.
G.F.R. Ellis, University of Cape Town, South Africa, Title to be announced.
David Epstein, University of Warwick, United Kingdom, Title to be announced.
W. Goddard, University of Natal, Durban, South Africa, Title to be announced.
Doron Lubinsky, University of Witwatersrand, South Africa, Title to be announced.

Robert Mackay, University of Cambridge, United Kingdom, Title to be announced.

Peter Sarnak, Princeton University, Title to be announced.

Special Sessions

Algebraic K-Theory (Code: AMS SS F1), Eric M. Friedlander, Northwestern University, and Aderemi O. Kuku, ICTP, Trieste, Italy.

Commutative Algebra and Algebraic Geometry (Code: AMS SS K1), James W. Brewer, Florida Atlantic University, Barry Green, University of Stellenbosch, and Sylvia Margaret Wiegand, University of Nebraska.

Dynamical Systems and Ergodic Theory (Code: AMS SS B1), Harvey B. Keynes, University of Minnesota, Michael Sears, University of Witwatersrand, South Africa, and Lionel Slaman, University of the Western Cape.

Finite Groups and Representation Theory (Code: AMS SS J1), Jamshid Moori, University of Natal, South Africa, and Kenechukwu Kenneth Nwabueze, Mathematical Science Research Institute.

Fluid Dynamics (Code: AMS SS D1), Susan J. Friedlander, University of Illinois at Chicago, Andrew Gilbert, University of Exeter, United Kingdom, and David Mason, University of Witwatersrand, South Africa.

Geometry, Topology and Physics (Code: AMS SS A1), Steven B. Bradlow, University of Illinois-Urbana, George Ellis, University of Cape Town, South Africa, Nigel J. Hitchin, University of Cambridge, England, and Joao Rodrigues, University of Witwatersrand, South Africa.

Invariant Subspaces and Collections of Operators (Code: AMS SS G1), Peter Rosenthal, University of Toronto, and Graeme Philip West, University of Witwatersrand, South Africa.

Number Theory (Code: AMS SS E1), John Knopfmacher, University of Witwatersrand, South Africa, and Peter Sarnak, Princeton University.

Operator Spaces and Related Structures (Code: AMS SS H1), David P. Blecher, University of Houston, Allan M. Sinclair, University of Edinburgh, and Johan Swart, University of Pretoria, South Africa.


Ramsey Theory and Set Theory, Willem Fouche, University of Pretoria, Marion Scheepers, Boise State University, and Pieter Maritz, University of Stellenbosch.

Secondary and Postsecondary Curriculum Reform (Code: AMS SS C1), Johann Engelbrecht, University of Pretoria, South Africa, Deborah Hughes Hallet, Harvard University, and Harvey B. Keynes, University of Minnesota.

Please note that there will be a session for contributed papers.

Information Update

For more information regarding the program, registration, and local information please refer to the South African Mathematical Society’s web site: http://science.up.ac.za/sams/.

Montreal, Quebec Canada

University of Montreal

September 26-28, 1997

Meeting #924

Eastern Section

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: May 1, 1997
For abstracts: June 26, 1997

Invited Addresses

Jacob E. Goodman, City University of New York, City College, Title to be announced.

Dieter Kotschick, University of Basel, Title to be announced.

Francois Lalonde, University of Quebec at Montreal, Title to be announced.

I. Moerdijk, University of Utrecht, Netherlands, Title to be announced.

Special Sessions

Category Theory and its Applications (Code: AMS SS E1), Michael Barr, McGill University, Ieke Moerdijk, Mathematical Institute, and Myles Tierney, Rutgers University.

Combinatorial Geometry (Code: AMS SS C1), David Avis, McGill University, Jacob E. Goodman, City University of New York, City College, and Richard Pollack, New York University-Courant Institute.

Commutative Algebra (Code: AMS SS D1), Irena V. Peeva, Massachusetts Institute of Technology, and Hema Srinivasan, University of Missouri.

Potential Theory (Code: AMS SS A1), Kohur Gowri Sankaran, McGill University, and David H. Singman, George Mason University.

Symplectic Geometry and Differential Topology (Code: AMS SS B1), Jacques Hurtubise and Lisa Claire Jeffrey, McGill University, and Francois Lalonde, University of Quebec at Montreal.
Claremont, California
Claremont Colleges
October 4, 1997

Meeting #925
Joint meeting with the Mathematical Association of America.
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 2, 1997
For abstracts: June 27, 1997

Atlanta, Georgia
Georgia Institute of Technology
October 10–12, 1997

Meeting #926
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: January 10, 1997
For consideration of contributed papers in Special Sessions: May 14, 1997
For abstracts: July 9, 1997

Special Sessions
Computer Proofs in Set Theory and Logic (Code: AMS SS E1), Johan G. F. Belinfante, Georgia Institute of Technology.
Harmonic Analysis and Its Applications (Code: AMS SS D1), Michael Lacey, Georgia Institute of Technology.
Modern Banach Space Theory (Code: AMS SS C1), Stephen Dilworth and Maria K. Girardi, University of South Carolina.

Milwaukee, Wisconsin
University of Wisconsin
October 24–26, 1997

Meeting #927
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 21, 1997
For abstracts: July 16, 1997

Invited Addresses
Spencer J. Bloch, University of Chicago, Title to be announced.
Henri Moscovici, Ohio State University, Title to be announced.
Wei Ming Ni, University of Minnesota, Title to be announced.
Andrei Suslin, Northwestern University, Title to be announced.

Special Sessions
Analysis With Wavelets (Code: AMS SS M1), Gilbert G. Walter, University of Wisconsin-Milwaukee, and Ahmed I. Zayed, University of Central Florida.
Computability Theory (Code: AMS SS A1), Steffen Lempp, University of Wisconsin, Madison, and Robert I. Soare, University of Chicago.
Concentration Phenomena in Differential Equations (Code: AMS SS D1), Lia Bronsard, McMaster University, and Wei-Ming Ni, University of Minnesota.
Differential Geometry (Code: AMS SS N1), Hongyou Wu, Northern Illinois University.
Eigenvalue Problems for Differential Equations (Code: AMS SS K1), Paul A. Binding, University of Calgary, and Hans W. Volkmer, University of Wisconsin-Milwaukee.
Enveloping Algebras and Quantum Groups (Code: AMS SS J1), Ian M. Musson and Yi Ming Zou, University of Wisconsin-Milwaukee.
Geometric Topology and Geometric Group Theory (Code: AMS SS H1), Fredric Davis Aucel and Craig R. Guilbault, University of Wisconsin-Milwaukee.
Harmonic Analysis and Its Applications (Code: AMS SS F1), Lung-Kee Chen, Oregon State University, Dashan Fan, University of Wisconsin-Milwaukee, and Yi-Biao Pan, University of Pittsburgh.
Meetings & Conferences

Low Dimensional Dynamics (Code: AMS SS C1), Karen M. Brucks, University of Wisconsin-Milwaukee, and Beverly E. J. Diamond, University of Charleston.
Number Theory and Cryptography (Code: AMS SS D1), Eric Bach and Rene Peralta, University of Wisconsin-Milwaukee.
Operator Theory and Function Spaces (Code: AMS SS G1), Zeljko Cuckovic, University of Toledo.
Rings and Modules (Code: AMS SS I1), Karl Andrew Kosier and Shubhangi S. Stalder, University of Wisconsin Centers-Waukesha.
Symplectic Topology and Quantum Cohomology (Code: AMS SS L1), Yong-Geun Oh, University of Wisconsin, and Yongbin Ruan, University of Utah.

Albuquerque, New Mexico
University of New Mexico
November 8-9, 1997

Meeting #928
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: September 1997
Program issue of Notices: November 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: January 4, 1997
For consideration of contributed papers in Special Sessions: June 12, 1997
For abstracts: August 7, 1997

Oaxaca, Mexico
Oaxaca, Mexico
December 4-7, 1997

Meeting #929
Third Joint Meeting of the American Mathematical Society and the Sociedad Mathematica Mexicana.
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Baltimore, Maryland
Baltimore Convention Center
January 7-10, 1998

Meeting #930
Joint Mathematics Meetings including the 104th Annual Meeting of the AMS, 81st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: Robert J. Daverman
Announcement issue of Notices: October 1997
Program issue of Notices: January 1998
Issue of Abstracts: To be announced

Deadlines
For organizers: April 10, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Invited Addresses
Edward Witten, Institute for Advanced Study (AMS Josiah Willard Gibbs Lecture).

Louisville, Kentucky
University of Louisville
March 20–21, 1998
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions
Boundary Value Problems for Differential Equations (Code: AMS SS J1), Paul W. Eloe, University of Dayton.
Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.

Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.

Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.

Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.

Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.

Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.

Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.

The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS I1), Richard M. Davitt, University of Louisville.

Philadelphia, Pennsylvania

Temple University

April 4-6, 1998

Meeting #933

Eastern Section

Associate secretary: Lesley M. Silber

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Invited Addresses

Tobias H. Colding, New York University-Courant Institute.

Martin Davis, University of California, Berkeley.

Ezra Getzler, Max Planck Institute and Northwestern University.

Yanyan Li, Rutgers University, New Brunswick.

Special Sessions

Harmonic Analysis and its Applications to PDE's (Code: AMS SS G1), Cristian E. Gutiérrez, Temple University, and Guozhen Lu, Wright State University.

Modular Identities and Q-Series in Number Theory (Code: AMS SS A1), Boris Datskovsky and Marvin I. Knopp, Temple University.

PDE's in Several Complex Variables (Code: AMS SS B1), Shiferaw Berhanu and Gerardo Mendoza, Temple University.

Radon Transform (Code: AMS SS C1), Eric L. Grinberg, Temple University.

Rings and Representations (Code: AMS SS E1), Maria E. Lorenz, Ursinus College, and Martin Lorenz, Temple University.

The History of American Mathematics (Code: AMS SS D1), Karen H. Parshall, University of Virginia, and David E. Zitarelli, Temple University.

Topology of Manifolds (Code: AMS SS F1), Georgia Triantafillou, Temple University.

Manhattan, Kansas

Kansas State University

March 27-28, 1998

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: January 1998

Program issue of Notices: March 1998

Issue of Abstracts: To be announced

Deadlines

For organizers: June 26, 1997

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Special Sessions

Meetings & Conferences

Davis, California
University of California-Davis
April 25-26, 1998
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

San Antonio, Texas
San Antonio Convention Center
January 13-16, 1999
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Chicago, Illinois
DePaul University
September 12-13, 1998
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Las Vegas, Nevada
University of Nevada, Las Vegas
April 10-11, 1999
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Tucson, Arizona
University of Arizona
November 14-15, 1998
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Washington, District of Columbia
Sheraton Washington Hotel and Omni Shoreham Hotel
January 19-22, 2000
Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS, 83rd Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
Meetings & Conferences

For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

New Orleans, Louisiana

New Orleans Marriott and ITT Sheraton New Orleans Hotel

January 10–13, 2001

Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

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http://www.maa.org/
### Meetings and Conferences of the AMS

#### Associate Secretaries of the AMS

Western Section: William A. Harris Jr., Department of Mathematics, University of Southern California, Los Angeles, CA 90089-1113; e-mail: g_harris@ams.org; telephone: 213-740-3794.

Central Section: Susan J. Friedlander, Department of Mathematics, University of Illinois at Chicago, 851 S. Morgan (M/C 249), Chicago, IL 60607-7045; e-mail: g_friedlander@ams.org; telephone: 312-996-3041.

Eastern Section: Lesley M. Sibner, Department of Mathematics, Polytechnic University, Brooklyn, NY 11201-2990; e-mail: g_sibner@ams.org; telephone: 718-260-3505.

Southeastern Section: Robert J. Daverman, Department of Mathematics, University of Tennessee, Knoxville, TN 37996-1300; e-mail: g_daverman@ams.org; telephone: 423-974-6577.

The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Up-to-date meeting and conference information is available on the World Wide Web via the Internet at URL http://www.ams.org/.

#### Meetings:

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### Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 183 in the January issue of the Notices for general information regarding participation in AMS meetings and conferences.

#### Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use plain TeX, AMS-TeX, LaTeX, or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Abstracts Coordinator, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

### Conferences:

See http://www.ams.org/committee/meetings/ for the most up-to-date information on these conferences.

1997:

- June 29-July 19: Summer Research Institute, Differential geometry and control, University of Colorado at Boulder. See October 1996, p. 1304, for details.
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• Linear (In)dependence.
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• Generalizations of Fields and Related Objects.
• Category Theory.
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• Commutative Rings and Algebras.
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WOLMER VASCONCELOS, Rutgers University, New Brunswick, NJ
COMPUTATIONAL ASPECTS OF COMMUTATIVE ALGEBRA

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J.R. SHAFAREVICH, Steklov Mathematical Institute, Moscow, Russia
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