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Calendar of AMS Meetings

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

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

MEETING #	DATE	PLACE	ABSTRACT DEADLINE	ISSUE
816	January 9–13, 1985 (91st Annual Meeting)	Anaheim, California	EXPIRED	January
817	March 22–23, 1985	Chicago, Illinois	January 23	March
818	April 12–13, 1985	Tucson, Arizona	January 25	March
819	April 20–21, 1985	Worcester, Massachusetts	January 28	March
820	May 3–4, 1985	Mobile, Alabama	January 30	March
821	August 12–15, 1985 (89th Summer Meeting)	Laramie, Wyoming		
	October 26–27, 1985	Amherst, Massachusetts		
	November 1–2, 1985	Columbia, Missouri		
	January 7–11, 1986 (92nd Annual Meeting)	New Orleans, Louisiana		
	January 21–25, 1987 (93rd Annual Meeting)	San Antonio, Texas		
	January 6–11, 1988 (94th Annual Meeting)	Atlanta, Georgia		
	August 8–12, 1988 (AMS Centennial Celebration)	Providence, Rhode Island		

DEADLINES:	(*January* 1985 *Issue*)	(*March* 1985 *Issue*)
Advertising	*November* 15, 1984	*February* 7, 1985
News/Special Meetings	*October* 29, 1984	*January* 25, 1985

Other Events Sponsored by the Society

January 7–8, 1985, AMS Short Course: Fair Allocation, Anaheim, California.

May 1985, Symposium on Some Mathematical Questions in Biology, Plant Biology, Los Angeles, California.

June 23–August 31, 1985, Joint Summer Research Conferences in the Mathematical Sciences, Humboldt State University, Arcata, California.

June 30–July 13, 1985, AMS-SIAM Summer Seminar on Reacting Flows: Combustion and Chemical Reactors, Cornell University, Ithaca, New York.

July 8–26, 1985, AMS Summer Research Institute on Algebraic Geometry, Bowdoin College, Brunswick, Maine.

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The following article is the eighth in the series of Special Articles published in the *Notices*. Its author, DON ZAGIER, studied at M.I.T. as an undergraduate (B.S. in mathematics and B.S. in physics, in 1968) and did graduate work at Oxford (D.Phil., 1972) where he worked with Atiyah and Hirzebruch. Since that time he has worked at Bonn, ETH (Zurich), IHES (Bures-sur-Yvette) and Harvard. Since 1979 he has been a professor at the University of Maryland; he is also a member of the Max Planck Institute for Mathematics in Bonn. His primary research interests are number theory and the theory of modular forms.

The series of Special Articles was created to provide a place for articles on mathematical subjects of interest to the general membership of the Society. The Editorial Committee of the *Notices* is especially interested in the quality of exposition and intends to maintain the highest standards in order to assure that the Special Articles will be accessible to mathematicians in all fields. The articles must be interesting and mathematically sound. They are first refereed for accuracy and (if approved) accepted or rejected on the basis of the breadth of their appeal to the general mathematical public.

Items for this series are solicited and, if accepted, will be paid for at the rate of $250 per page up to a maximum of $750. Manuscripts to be considered for this series should be sent to Ronald L. Graham, Associate Editor for Special Articles, *Notices of the American Mathematical Society*, Post Office Box 6248, Providence, Rhode Island 02940.

L-Series of Elliptic Curves, the Birch–Swinnerton-Dyer Conjecture, and the Class Number Problem of Gauss

by D. Zagier

1. Elliptic curves over Q. Consider a Diophantine equation in two variables, i.e., a polynomial equation $f(x,y) = 0$ with rational coefficients which we want to solve in rational numbers. Already in the works of Diophantus it is clear that the level of difficulty of this problem is very different for different classes of polynomials f. If f is quadratic, then, given one solution (x_0, y_0), one can find all solutions in terms of a rational parameter t by solving the linear equation $(1/u)f(x_0+u,\ y_0+tu) = 0$ (this method was used sporadically long before, and systematically by, Diophantus). For cubic and certain quartic f, there are methods in Diophantus' works—and later much more extensively in Fermat's—for studying the rational solutions of $f = 0$ and, particularly, for constructing new solutions out of known ones. For higher degree f no general method for getting solutions has ever been found. Poincaré realized that this division into three classes depends on the topology of the set of complex points of the curve X defined by the equation $f(x,y) = 0$ (or rather by its projective version $f(x,y,z) = 0$), i.e., on the genus g of the Riemann surface $X(\mathbf{C})$. If $g = 0$ the set of rational points $X(\mathbf{Q})$, if nonempty, is isomorphic to $\mathbf{P}^1(\mathbf{Q})$. If $g = 1$ then $X(\mathbf{Q})$, if nonempty, has the structure of an abelian group. (In this case the curve can always be put into the standard Weierstrass form

$$y^2 = 4x^3 - ax - b \qquad (a, b \in \mathbf{Z}), \tag{1}$$

and the group structure is $0 =$ point at infinity, $-P = (x,-y)$ if $P = (x,y)$, $P+Q+R = 0$ if $P,Q,R \in X(\mathbf{Q})$ are collinear.) If $g \geq 2$ then we know by Faltings' recent work that $X(\mathbf{Q})$ is a finite set ("Mordell conjecture"); no further structure is known. The most interesting case from a Diophantine point of view is thus $g = 1$, in which case we call X an elliptic curve and write E instead of X. Here Poincaré conjectured, and Mordell proved, that the abelian group $E(\mathbf{Q})$ is finitely generated; the structure theorem for such groups then gives

$$E(\mathbf{Q}) \cong \mathbf{Z}^r \oplus \mathcal{F} \tag{2}$$

for some integer $r \geq 0$ and some finite abelian group $\mathcal{F}$. For a given curve E one can find $\mathcal{F}$ by a finite algorithm, while for r we can get upper bounds by descent (Fermat) and lower bounds by exhibiting independent solutions; if we are lucky, these agree. It is known exactly what groups $\mathcal{F}$ can occur: $\mathcal{F}$ has the structure $\mathbf{Z}/(2n-1)\mathbf{Z}$, $\mathbf{Z}/2n\mathbf{Z}$, or $\mathbf{Z}/2\mathbf{Z} \times \mathbf{Z}/2n\mathbf{Z}$ for some $n \in \mathbf{N}$, depending on whether $4x^3 - ax - b$ in (1) has 0, 1, or 3 rational roots (this is elementary), and a deep theorem of Mazur (1977) says that n is then ≤ 5, ≤ 6, or ≤ 4, respectively, all fifteen cases occurring infinitely often. As for r, it is known by recent examples of Mestre (1983, 1984) that values as large as 14 occur, and it is conjectured that all values can occur.

By (2) the number of rational solutions of $f(x,y) = 0$ is finite or infinite according to whether $r = 0$ or $r > 0$. In fact, we can even get an asymptotic estimate for the number $\mathcal{N}(A)$ of rational solutions $P = (x,y)$ for which the numerator and denominator of x are less than A in absolute value, namely

$$\mathcal{N}(A) \sim C(\log A)^{r/2} \qquad (A \to \infty) \tag{3}$$

with the same r as in (2) and some $C > 0$. Indeed, part of the proof of (2) consists of showing that there is a positive definite quadratic form ("*height*") $h : E(\mathbf{Q}) \otimes \mathbf{R} \to \mathbf{R}$ with $h(P) - \log \max\{|\operatorname{num} x(P)|, |\operatorname{den} x(P)|\}$ bounded (such an h is clearly unique). Equation (3) follows by counting points in an r-dimensional ellipsoid of diameter $\approx (\log A)^{1/2}$, the constant C being given by

$$C = \frac{\pi^{r/2}}{(r/2)!} \frac{|\mathcal{F}|}{\sqrt{R}}, \tag{4}$$

where R (the *regulator*) is the determinant of the symmetric $r \times r$ matrix defining h w.r.t. a $\mathbf{Z}$-basis of $E(\mathbf{Q})/\mathcal{F}$ (so $R = 1$ if $r = 0$, $R = h(P_0)$ if $r = 1$ and P_0 is a generator of $E(\mathbf{Q})/\mathcal{F}$). Note that (3) yields an elementary definition of both r and the ratio $R/|\mathcal{F}|^2$ which does not refer at all to the group structure on $E(\mathbf{Q})$. As examples, we have

(a) Fermat's equation $a^3 + b^3 = c^3$ (which can be put into Weierstrass form $y^2 = 4x^3 - 27$ by $a = y-9$, $b = 6x$, $c = y+9$); here $r = 0$, $C = |\mathcal{F}| = 3$;

(b) $y^2 - y = x^3 - x$; here $r = 1$, $|\mathcal{F}| = 1$, $C = 8.8464916\ldots$;

(c) $y^2 = 4x^3 - 28x + 25$; here $r = 3$, $|\mathcal{F}| = 1$, $C = 6.48553546\ldots$ (cf. [2]).

2. The conjecture of Birch and Swinnerton-Dyer. Around 1960, Birch and Swinnerton-Dyer formulated a conjecture which determines r, and

to some extent C, in (3). The idea is that a curve with a large value of r (or, given r, with a large value of C) has an especially large number of rational points and should therefore have a relatively large number of solutions modulo a prime p on the average as p varies. More precisely, let $N(p)$ be the number of pairs of integers $x, y \pmod p$ satisfying (1) as a congruence (mod p); then the BSD conjecture in its crudest form says that we should have an asymptotic formula

$$(5) \quad \prod_{p<x} \frac{N(p)+1}{p} \sim C_1(\log p)^r \qquad (x \to \infty)$$

analogous to (3) with the *same* r and a constant $C_1 > 0$ related to C. (The "Riemann hypothesis for elliptic curves", proved by Hasse in 1933, says that $|N(p)-p| < 2\sqrt{p}$, so at least we know that $(N(p)+1)/p \to 1$ in (5).) For a more precise formulation it is convenient to introduce the *L-series* of E. This is a Dirichlet series defined by an Euler product

$$(6) \quad L_E(s) = \prod_p{}^{*} \frac{1}{1+(N(p)-p)/p^s+p/p^{2s}} \qquad (\mathrm{Re}(s) > 3/2),$$

where * means that the Euler factor must be modified for the finitely many "bad" primes dividing $2(a^3-27b^2)$, for which (1) becomes singular modulo p. It is conjectured that $L_E(s)$ has an analytic continuation to all s. If this is so, then L_E has a Taylor expansion $L_E(s) = C_0(s-1)^m + \cdots$ for some integer $m \geq 0$ and constant $C_0 \neq 0$, and the BSD conjecture says that the order of vanishing m should equal the rank r and the constant C_0 should be given by [5]

$$(7) \qquad C_0 := \lim_{s\to 1} \frac{L_E(s)}{(s-1)^m} = \frac{R}{|\mathcal{T}|^2} \cdot \Omega \cdot S,$$

where R and $\mathcal{T}$ are as before, $\Omega > 0$ is a simple rational multiple (depending on the "bad" primes) of the elliptic integral

$$\int_\gamma^\infty \frac{dx}{\sqrt{4x^3-ax-b}}$$

(γ = largest real root of $4x^3-ax-b=0$), and S is an integer square which is supposed to be the order of a certain group Ш, the Tate–Shafarevich group of E (however, Ш is not even known to be finite!).

We are still very far from a proof of the BSD conjecture, although there are many numerical calculations supporting it (see [2] for an example and a description of the algorithms used to compute the various terms in (7)). The following partial results are known:

1. If E is a Weil curve (cf. §3), as is conjecturally always the case and verifiable in any particular case, then $L_E(1)$ is a rational multiple of Ω (note that this is compatible with (7), since if $L_E(1) \neq 0$ we should have $r=0$, $R=1$); in certain cases one can show that it is a rational *square* multiple.

2. If E has complex multiplication (for elliptic curves over $\mathbf{Q}$ this happens if and only if the j-invariant $1728a^3/(a^3-27b^2)$ takes on one of thirteen integral values 0, 1728, $-3375, \ldots, -262537412640768000$), then $m=0 \Rightarrow r=0$, i.e., if $L_E(1) \neq 0$ then (1) has only finitely many rational solutions.

3. If E is a Weil curve, then $m=1 \Rightarrow r \geq 1$, i.e., if $L_E(1)=0$ and $L'_E(1) \neq 0$ then (1) has infinitely many rational solutions.

4. If E is a Weil curve with $L_E(1)=0$ and $r=1$, then $L'_E(1)$ is a rational multiple of ΩR, and this multiple can sometimes be shown to be a square.

5. There exist curves E with $m=r=3$, e.g., the curve $-139y^2 = x^3+10x^2-20x+8$.

Result **1** is elementary except for the statement about squares, which follows from a result of Waldspurger. Result **2** is a theorem of Coates and Wiles (1977). Results **3–5** follow from a theorem of Benedict Gross and myself, announced in [3], whose statement will be explained in the next section.

3. Heegner points. We call E a *Weil curve* if for some integer N there is a nontrivial map $\phi : X_0(N) \to E(\mathbf{C})$ defined over $\mathbf{Q}$; here $X_0(N) = \mathfrak{H}/\Gamma_0(N) \cup \{\text{cusps}\}$, where $\mathfrak{H}$ is the complex upper half-plane and $\Gamma_0(N)$ is the modular group

$$\left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in \mathrm{SL}_2(\mathbf{Z}) \,|\, c \equiv 0 \,(\mathrm{mod}\ N) \right\}.$$

Such a map exists if and only if the function

$$f(z) = \sum_{n=1}^{\infty} a(n)\, e^{2\pi i n z},$$

where $a(n)$ are the coefficients of the Dirichlet series $L_E(s)$, is a modular form of weight 2 on $\Gamma_0(N)$, i.e.,

$$f\left(\frac{az+b}{cz+d}\right) = (cz+d)^2 f(z) \qquad \text{for all } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in \Gamma_0(N).$$

These curves are called Weil curves because Weil (1967) proved that the standard conjectures on the analytic continuation and functional equation of the L-series of E and its twists by Dirichlet characters imply the existence of ϕ; the possibility that all elliptic curves over $\mathbf{Q}$ might arise as quotients of Jacobians of modular curves $X_0(N)$ had already been raised some years earlier by Taniyama. That a given elliptic curve is a Weil curve can be checked by a finite algorithm (this has been done in hundreds of cases), and we will assume from now on that our curves are Weil curves, since otherwise the analytic continuation of L_E is not known and the BSD conjecture makes no sense. In particular, $L_E(s)$ is entire and the *parity* of its order m at $s=1$ is known: m is

even or odd according to whether the sign of the functional equation of L_E is $+1$ or -1, and this in turn depends on whether f satisfies $f(-1/Nz) = -Nz^2 f(z)$ or $f(-1/Nz) = +Nz^2 f(z)$.

Assuming, then, the existence of ϕ, we have the following construction of points on E, due essentially to Heegner. Let $d < 0$ be the discriminant of an imaginary quadratic field K, and assume that $(d, n) = 1$ and $d \equiv \beta^2 \pmod{4N}$ for some integer β. Then the set of $z \in \mathfrak{H}$ satisfying a quadratic equation $az^2 + bz + c = 0$ with $a \equiv 0 \pmod{N}$, $b \equiv \beta \pmod{2N}$, $c \in \mathbf{Z}$, $b^2 - 4ac = d$ is $\Gamma_0(N)$-invariant and has finitely many orbits modulo $\Gamma_0(N)$. If $z_1, \ldots, z_h$ are representatives for these (h will in fact be the class number of K), then the points $\phi(z_1), \ldots, \phi(z_h) \in E(\mathbf{C})$ are defined over a certain extension (the "Hilbert class field") of K, but their sum P_d is defined over K. Moreover, under complex conjugation P_d goes to $-\epsilon P_d$, where ϵ is the sign of the functional equation of $L_E(s)$. Thus, if $\epsilon = -1$, so that by the BSD conjecture we expect $E(\mathbf{Q})$ to have odd, and hence positive, rank, then $2P_d \in E(\mathbf{Q})$, while if $\epsilon = +1$ then $2P_d$ has the form $(x, y\sqrt{d})$, with x and y rational, and therefore gives a rational point on the "twisted" curve

$$E^{(d)} : dy^2 = 4x^3 - ax - b. \tag{8}$$

Changing the choice of β with $\beta^2 \equiv d \pmod{4N}$ changes P_d at most by sign; we will suppress this dependence in our notation. Then the result of Gross and myself mentioned in §2 says—in the case that the sign of the functional equation is -1, so that $L_E(1) = 0$ and $2P_d \in E(\mathbf{Q})$—

$$L_{E^{(d)}}(1) L'_E(1) = c \cdot \Omega_{E^{(d)}} \cdot \Omega_E \cdot h(2P_d), \tag{9}$$

where $\Omega_{E^{(d)}}$ and Ω_E are the periods occurring in the BSD conjecture for $E^{(d)}$ and E, h is the height function on $E(\mathbf{Q})$ defined in §1, and c is a simple nonzero rational number. The number $\Omega_{E^{(d)}}\sqrt{|d|}$ is independent of d. If the sign of the functional equation of L_E is $+1$, the formula becomes

$$L_E(1) L'_{E^{(d)}}(1) = c \cdot \Omega_{E^{(d)}} \cdot \Omega_E \cdot h_{E^{(d)}}(2P_d), \tag{10}$$

where $h_{E^{(d)}}$ is the height function on $E^{(d)}(\mathbf{Q})$. Actually, the result proved is more general in two respects: the heights are computed already on the Jacobian of $X_0(N)$, rather than on its quotient E, and the heights of the individual z_j (rather than only their sums P_d) are computed; however, since $X_0(N)$ is not, in general, elliptic, nor z_j rational over $\mathbf{Q}$, the full statement cannot be given without explaining height theory for curves of arbitrary genus and over arbitrary number fields.

Notice that (9) implies statements **3** and **4** at the end of §2. Indeed, if E is a Weil curve with $m = 1$, then the sign of the functional equation is -1 and $L'_E(1) \neq 0$; the same theorem of Waldspurger mentioned at the end of §2 implies that we can find a d such that $L_{E^{(d)}}(1) \neq 0$, and then (9) implies that P_d has nonzero height and, hence, infinite order in $E(\mathbf{Q})$. Moreover, by **1** we know that $L_{E^{(d)}}(1)/\Omega_{E^{(d)}}$ is rational, so (9) also gives the rationality of $L'_E(1)/\Omega_E h(P_d)$ in this case; if $E(\mathbf{Q})$ has rank 1, then $h(P_d)$ is a (square) integral multiple of the regulator R, and **4** follows, the statement about squares being a consequence of the corresponding statement in **1** applied to $E^{(d)}$. Note that the mysterious factor $S\overset{?}{=}|Ш|$ in (7) has disappeared and is replaced by something like the square of the index of the subgroup of $E(\mathbf{Q})$ generated by all Heegner points P_d. Finally, **5** also follows by applying (10) to the curve $E : y^2 = x^3 + 10x^2 - 20x + 8$ (which is a Weil curve with $N = 37$) and $d = -139$; here $L_E(1) \neq 0$ and $P_d = 0$, as we will prove in §4, so (10) shows that $L'_{E^{(d)}}(1)$ vanishes; since $L_{E^{(d)}}(s)$ has a functional equation with sign -1 and $L'''_{E^{(d)}}(1) \neq 0$, it follows that $m = 3$ for the curve $E^{(d)}$ (that $r = 3$ is elementary). Observe, by the way, that **5** is elementary if 3 is replaced by a smaller number: take a Weil curve with rank $r = 0$, 1, or 2; then, if $r = 0$, the number $L_E(1)$ must be nonzero (or we would have a counterexample to BSD), and this can be checked numerically; if $r = 1$ we need only check that the sign of the functional equation of L_E is -1 and that $L'_E(1)$ is nonzero; and if $r = 2$ we can prove $L_E(1) = 0$ by calculating the rational number $L_E(1)/\Omega$ in **1** and then prove $m = 2$ by verifying that the sign of the functional equation is $+1$ and $L''_E(1) \neq 0$. (For E a Weil curve, L_E and its derivatives at $s = 1$ can be computed by rapidly convergent series; cf. [**2**].) However, to get **5** we must show that $L'_E(1) = 0$, and this can only be done by using some such formula as (9), since the verification that a number is zero, unlike the verification that a number is nonzero, can never be carried out by numerical computation alone.

We should also say a word about the history of the above formulas. The Heegner points P_d were defined by Birch and studied extensively by Birch and Stephens from a numerical point of view; they formulated conjectures equivalent to (9) and (10) (cf. [**1**]). Gross was led by other considerations coming from the theory of descent to conjecture more general formulas of the same type, and he also saw that there might be some possibility of proving them by using local height theory on the modular curves $X_0(N)$ to compute the heights of Heegner points and by using the theory of modular forms (in particular, "Rankin's method") to compute the derivative of $L_E(s)L_{E^{(d)}}(s)$ at $s = 1$. He then suggested to me a systematic attack on the problem from both sides, and the collaboration took the following rather amusing course: one of us would find a method to compute one piece of the formula, on either the height or the L-series side of the formula (usually the L-series side succumbed first), and communicate it to the other, and then the form of the result would suggest the method by which a piece of the expression on the other side could be evaluated. At the end of this process, both sides of the

purported equality had been calculated explicitly as a sum of about a dozen terms, some of them quite complicated; these matched perfectly, and this provided the proof—without, however, giving the least inkling of *why* the height of the Heegner point and the derivative of the L-series should have anything to do with one another. It is to be hoped that this rather unsatisfactory state of affairs will eventually change.

4. Application to the class number problem of Gauss. Of the three consequences of (9) and (10) given in §2, the last one—the assertion of the existence of a single elliptic curve with $m = 3$—appears to be the most special and least interesting. Yet it is this result which leads to the most dramatic application, the final solution of a problem stated by Gauss nearly 200 years ago. The problem concerns class numbers of binary quadratic forms and appears at first sight very remote from questions about the Diophantine analysis of cubic equations; that there is a connection is a beautiful discovery made by Goldfeld a few years ago. We review the history briefly.

In Article 303 of the *Disquisitiones* Gauss describes extensive computations of class numbers of imaginary quadratic fields (or, rather, of positive definite binary quadratic forms, an equivalent problem) and observes that the sequence of discriminants with a given class number h seems to end for each value h. Thus, the last d with $h(d) = 1$ is apparently 163, the last with $h = 2$, 427, and the last with $h = 3$, 907 (Gauss uses a different normalization, so his values look different from these). The proof of this remained an entirely open problem for over a hundred years. Around 1916, Hecke showed that

$$h(d) > C\frac{\sqrt{|d|}}{\log|d|}$$

with an effective constant C if the L-series $L_d(s) = \sum(d/n)n^{-s}$ has no zeros near $s = 1$, thus solving Gauss's problem under the assumption of the generalized Riemann hypothesis. Then, in 1933, Deuring showed that the *falseness* of the (ordinary) Riemann hypothesis would imply $h(d) > 1$ for $|d|$ large enough. This was a decisive step, for, soon after, Mordell showed that $h(d)$ goes to infinity with $|d|$ if the Riemann hypothesis is false, and Heilbronn (1934) proved the same if the generalized Riemann hypothesis is false; together with Hecke's result, this provided an unconditional proof of Gauss's claim on the finiteness of the set of d with a given value of $h(d)$. A year later Siegel proved the definitive result of this type by showing that $h(d) > C(\epsilon)|d|^{1/2-\epsilon}$ as $d \to -\infty$ for any $\epsilon > 0$. But his result, like those of Deuring, Mordell, and Heilbronn, was ineffective in a very basic sense, since it said something like this: if no L-series has a zero in the interval $[1-\epsilon/10, 1]$, then $h(d) > C_0(\epsilon)|d|^{1/2-\epsilon}$ with an effectively computable constant $C_0(\epsilon)$ by Hecke's theorem; if $L_{d_0}(s)$ has such a zero for some discriminant d_0, then $h(d) > C_1(\epsilon)|d|^{1/2-\epsilon}$ for all d, where $C_1(\epsilon)$ is given explicitly but depends on d_0. Thus, to decide, say, whether there is a $d < -907$ with $h(d) = 3$, we must either know that the generalized Riemann hypothesis is true, or else have our hands on a particular counterexample; until we have this, the problem is in some sense just as unsolved as if Siegel's result were unknown.

No further progress was made on the problem for general values of h for the next forty years, although the special (and most interesting) case of class number 1 was solved by important work of Heegner (1952) and Baker and Stark (1969); the last two authors also settled the case $h = 2$, but the methods failed for larger class numbers. The final breakthrough came in 1975, when Dorian Goldfeld proved a deep and entirely unexpected theorem to the effect that the existence of a single L-function with appropriate analytic properties and a zero of sufficiently high order at the symmetry point of its functional equation could be used to give an effective lower bound for $h(d)$ which goes to infinity as $d \to -\infty$. What Gross and I did was to produce such a function.

Goldfeld's argument is a long and difficult piece of analytic number theory. A simplification and very clear exposition of it was given in a recent Bourbaki talk by Joseph Oesterlé [4], which we recommend to the interested reader (this paper also contains references to Goldfeld's work and to previous work on the class number problem). Here we give only a brief indication of the way that the L-series with a triple zero is used to obtain analytic information. Suppose we have a discriminant d with $|d|$ very large; we want to show that $h = h(d)$ is also large. We may assume that the Legendre symbol $(d/37)$ is 0 or -1, because if $(d/37) = 1$ then 37 is the norm of a prime ideal $\mathfrak{p}$ in $\mathbf{Q}(\sqrt{d})$ and 37^h is the norm of the principal ideal $\mathfrak{p}^h$ and, hence, the norm of an integer $(x + y\sqrt{d})/2$ $(x, y \in \mathbf{Z},\ y \neq 0)$, so

$$37^h = \frac{x^2 + y^2|d|}{4} > \frac{|d|}{4},$$

and we already have the desired effective lower bound for h. From $(d/37) = 0$ or -1 it follows that the L-series of $E^{(d)}$, where E is the particular elliptic curve mentioned in 5 of §2, has a minus sign in its functional equation and, hence, the product $\mathcal{L}(s) = L_E(s)L_{E^{(d)}}(s)$ has a functional equation with a plus sign (say $\gamma(s)\mathcal{L}(s) = +\gamma(2-s)\mathcal{L}(2-s)$ with an appropriate Γ-factor $\gamma(s)$) and a zero of order at least 4 at $s = 1$. On the other hand, the same argument which gave $(d/37) \neq 1$ shows that $(d/p) = -1$ for all small primes $p \nmid d$ (namely all $p < |d/4|^{1/h}$; in fact, with an argument given in [4, p. 10], one can extend this to all $p < |d/4|^{1/(\sqrt{2h}+1)}$ with at most one exception). This

means that $(d/n) = \lambda(n)$ for most small integers n, where $\lambda(n)$ is the Liouville function, defined by $\lambda(p_1 \cdots p_r) = (-1)^r$ for any primes $p_1, \ldots, p_r$. But $L_{E^{(d)}}(s)$ is the twist of $L_E(s)$ by $(d/\cdot)$ (i.e., if $L_E(s) = \sum a(n)n^{-s}$, then $L_{E^{(d)}}(s) = \sum \tilde{a}(n)n^{-s}$ with $\tilde{a}(n) = (d/n)a(n)$ for all n prime to d), so this means that the function $\mathcal{L}(s)$ should not differ too much from the function $\mathcal{R}(s) = L_E(s)L_{E,\lambda}(s)$, where $L_{E,\lambda}(s) = \sum \lambda(n)a(n)n^{-s}$ ("not too much" can be made precise by an analysis of the Dedekind zeta-function of $\mathbf{Q}(\sqrt{d})$). The function $\mathcal{R}(s)$ is nothing other than the Rankin zeta-function of the modular form $\sum a(n)e^{2\pi inz}$ associated to the elliptic curve E and has been extensively studied in the theory of modular forms. In particular, it is known to have a meromorphic continuation with all poles to the left of the line $\mathrm{Re}(s) = 1$ and a simple zero at $s = 1$. Since $\mathcal{L}(s)$ has at least a quadruple zero at $s = 1$, the functions $\mathcal{L}(s)$ and $\mathcal{R}(s)$ do *not* have the same qualitative behavior, and this contradicts the above assertion that $\mathcal{L}(s)$ and $\mathcal{R}(s)$ are close to one another if h is very small compared to $|d|$. The actual contradiction is obtained by comparing the two integrals

$$\int_{C-i\infty}^{C+i\infty} \frac{\gamma(s)\mathcal{L}(s)}{(s-1)^3}\,ds \quad \text{and} \quad \int_{C-i\infty}^{C+i\infty} \frac{\gamma(s)\mathcal{R}(s)}{(s-1)^3}\,ds$$

(C any constant > 1). The first is identically zero because the fact that $\mathrm{ord}_{s=1}\,\mathcal{L}(s) \geq 3$ permits us to move the path of integration from $\mathrm{Re}(s) = C > 1$ to $\mathrm{Re}(s) = 2 - C < 1$, and then the oddness of the integrand under $s \to 2 - s$ implies that the integral is minus itself. The second integral is nonzero because it is dominated by the nontrivial residue at $s = 1$; this residue has the form $A \log |d| + B$, because $\mathcal{R}(s)$ is independent of d and $\gamma(s)$ has the form $|d|^s\gamma_0(s)$, with $\gamma_0(s)$ independent of d. On the other hand, by estimating the difference of $\mathcal{L}(s)$ and $\mathcal{R}(s)$, one can show that the difference of the two integrals is $O(h)$, and together this leads to the desired contradiction if $|d|$ is large enough. Actually, we have somewhat oversimplified the picture, and the analytic details are more complicated if d is composite. The final result obtained in [4] is the estimate

$$h(d) > C \cdot \prod_{p|d}\left(1 - \frac{2}{\sqrt{p}}\right) \cdot \log |d|$$

for all d, where C is an absolute and effectively computable constant (Goldfeld's original result was somewhat weaker), and, in particular, $h(-p) > C' \log p$ for p prime. Good numerical values for C and C' have not yet been obtained, but this should soon be done.

Finally, we give the proof—postponed in §3—that the Heegner point P_{-139} vanishes on an elliptic curve of conductor 37. One can check whether $P_d = 0$ on any Weil curve and for any d by a finite computation, but here there is a pretty argument, found by Gross, which requires essentially no calculation. The class number of -139 is 3, and for the three points z_j defined in §2 (with $N = 37$ and $\beta = 3$) we can choose

$$\frac{-3 + i\sqrt{139}}{2 \cdot 37}, \quad \frac{71 + i\sqrt{139}}{10 \cdot 37} \quad \text{and} \quad \frac{-151 + i\sqrt{139}}{10 \cdot 37}.$$

These satisfy $37z = (az + b)/(cz + d)$ with $\left(\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}\right) = \left(\begin{smallmatrix} -3 & -1 \\ 1 & 0 \end{smallmatrix}\right), \left(\begin{smallmatrix} -77 & -31 \\ 5 & 2 \end{smallmatrix}\right)$, and $\left(\begin{smallmatrix} 34 & -7 \\ 5 & -1 \end{smallmatrix}\right) \in \mathrm{SL}_2(\mathbf{Z})$, respectively, the value of $(cz + d)^{-1}$ in each case being $(3 + i\sqrt{139})/2$. From the well-known transformation equation

$$\Delta\left(\frac{az + b}{cz + d}\right) = (cz + d)^{12}\Delta(z)$$

of the "discriminant" function

$$\Delta(z) = q \prod_{n=1}^{\infty}(1 - q^n)^{24} \qquad (q = e^{2\pi iz},\ z \in \mathfrak{H}),$$

it now follows that the function

$$g(z) = \sqrt[12]{\frac{\Delta(z)}{\Delta(37z)}} - \frac{3 + i\sqrt{139}}{2}$$
$$= q^{-3} \prod_{n=1}^{\infty}\left(\frac{1 - q^n}{1 - q^{37n}}\right)^2 - \frac{3 + i\sqrt{139}}{2}$$

vanishes at z_1, z_2, and z_3. On the other hand, $g(z)$ is $\Gamma_0(37)$-invariant, has a triple pole at $z = \infty$, and has no other poles (since $\Delta \neq 0$ in $\mathfrak{H}$), so these are the only three zeros. Therefore, $(z_1) + (z_2) + (z_3) - 3(\infty)$ is a principal divisor on $X_0(37)$, so $\phi(z_1) + \phi(z_2) + \phi(z_2) = 0 \in E(\mathbf{C})$ for any map ϕ from $X_0(37)$ to an elliptic curve E with $\phi(\infty) = 0$.

Suggested Reading

1. B. Birch and N. Stephens, *Heegner's construction of points on the curve* $y^2 = x^3 - 1728e^3$ (Séminaire de Théorie des Nombres, Paris, 1981-1982), Progress in Math., Vol. **38**, Birkhäuser, Boston-Basel-Stuttgart, 1983, pp. 1–19.

2. J. Buhler, B. Gross and D. Zagier, *On the conjecture of Birch and Swinnerton-Dyer for an elliptic curve of rank 3*, Math. Comp. (to appear).

3. B. Gross and D. Zagier, *Points de Heegner et dérivées de fonctions L*, C. R. Acad. Sci. Paris **297** (1983), 85–87.

4. J. Oesterlé, *Nombres de classes des corps quadratiques imaginaires*, Séminaire Nicolas Bourbaki 1983-1984, Exposé 631, Astérisque (to appear).

5. J. Tate, *Arithmetic of elliptic curves*, Invent. Math. **23** (1974), 179–206.

First Report

The following pages contain a first report on the 1984 AMS Survey. Included in this report are salary and other data on faculty members in four-year colleges and universities, a report on the 1984 survey of new doctorates, a report on salaries of new doctorates, and a list of names and thesis titles for members of the 1983-1984 Ph.D. class.

The Annual AMS Survey is conducted in two parts. Questionnaires were distributed in May to all departments in the mathematical sciences in colleges and universities in the United States and Canada, and later to the recipients of doctoral degrees granted by these departments between July 1983 and June 1984, inclusive. This report is based on the information collected from these questionnaires. A second round of questionnaires was distributed in September; these are concerned with data on fall enrollments, class size, teaching loads and faculty mobility. These data will be reported in the March 1985 issue of the *Notices*.

This Survey is the twenty-eighth in an annual series begun in 1957 by the Society's Committee on the Economic Status of Teachers. The present Survey is under the direction of the Committee on Employment and Educational Policy (CEEP), whose members are Lida K. Barrett, Stefan A. Burr, Lisl Novak Gaal, Gerald J. Janusz, Irwin Kra, and Donald C. Rung (chairman). The questionnaires were devised by CEEP's Data Subcommittee consisting of Lida K. Barrett, Susan J. Devlin, Lincoln K. Durst, Wendell H. Fleming, Arthur P. Mattuck, and Donald C. Rung (chairman).

Faculty Salaries, Tenure, Women

The questionnaries sent to departments in the mathematical sciences asked for information on salaries and tenure. Departments submitted a minimum, median, and maximum salary figure for each of four academic ranks, for staff members both with and without doctorates. Annual salaries of full-time faculty members for the academic year of 9 or 10 months were sought. The 1984 questionnaire requested information for both the years 1983-1984 and 1984-1985. The sample in this survey is thus the same for both years and is different from the sample used in the Twenty-Seventh AMS Survey in 1983. In the salary tables on the following pages the numbers in parentheses give the range of the middle fifty percent of salaries reported. The figures outside the parentheses represent the mimimum and maximum salary listed by any reporting institution. In some categories relatively few departments reported and, because significant figures were not available, salaries are not listed.

The information reported this year on the number of faculty members is based on returns from 675 departments in the mathematical sciences, 101 of which did not contain usable salary information.

For these reports, the departments are divided into groups according to the highest degree offered in the mathematical sciences. The doctorate-granting departments are in six groups as described in the box.

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

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

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

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

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

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

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

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

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

[1]These findings were published in *An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences*, edited by Lyle V. Jones, Gardner Lindzey, and Porter E. Coggeshall, National Academy Press, Washington, D.C., 1982. The information on mathematics, statistics and computer science was presented in digest form in the April 1983 issue of the *Notices*, pages 257–267, and an analysis of the above classifications was given in the June 1983 *Notices*, pages 392–393.

TABLE 1: Total Faculty Reported for Four-Year Colleges and Universities

	1983–1984				1984–1985			
	FACULTY		WOMEN		FACULTY		WOMEN	
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure
WITHOUT DOCTORATE								
Instructor/Lecturer	835	56	487	30	866	49	497	23
Assistant Professor	516	285	136	68	509	263	135	66
Associate Professor	341	323	41	36	336	312	41	34
Professor	94	92	7	7	92	91	9	9
	1786	756	671	141	1803	715	682	132
WITH DOCTORATE								
Instructor/Lecturer	253	20	46	3	212	21	40	3
Assistant Professor	1889	199	299	34	1967	178	316	30
Associate Professor	2459	2164	199	160	2474	2140	221	179
Professor	3929	3876	158	153	4071	4010	176	173
	8530	6259	702	350	8724	6349	753	385

TABLE 2: Percent of Doctorate Faculty with Tenure

	Fall 1983	Fall 1984
Groups I, II, III	74.0%	76.5%
Groups IV, V	63.5%	67.0%
Group VI	90.1%	90.5%
Masters and Bachelors	68.0%	69.9%

TABLE 3: Response Rates

U.S. Departments

Group	I	II	III	IV	V	M	B
% Response	77	77	71	63	30	47	33

Canadian Departments

Group	VI
% Response	43

Response Rates. Response rates among the various classes of departments vary widely, thus making it difficult to draw firm conclusions about the sizes of the faculty groups studied. Because the questionnaires request data for two years in a row, however, it is possible to estimate relative changes from one year to the next with somewhat more confidence. This year's response rates are given in Table 3. As in past years, the greatest rates of response are in Groups I, II, and III, which have a combined response rate of 74%.

Faculty Salaries

SIZE OF FACULTY

	1983-1984				1984-1985				1983-1984			1984-1985		
	FACULTY		WOMEN		FACULTY		WOMEN							
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure	Minimum	Median	Maximum	Minimum	Median	Maximum
DOCTORATE GRANTING DEPARTMENTS. Group I					(30 of 39 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	7	2	5	2	7	2	5	2						
Assistant Professor	1	1	0	0	1	1	0	0						
Associate Professor	3	3	0	0	3	3	0	0						
Professor	1	1	0	0	1	1	0	0						
	12	7	5	2	12	7	5	2						
WITH DOCTORATE														
Instructor/Lecturer	63	2	10	0	39	3	5	2	105	(200-225)	(210-230) (210-235) 332	113	(210-250)	(210-250) (230-251) 398
Assistant Professor	184	4	18	0	182	3	17	0	180	(209-239)	(225-255) (245-275) 310	210	(220-259)	(240-278) (262-310) 330
Associate Professor	191	180	14	13	184	169	11	11	237	(248-303)	(278-315) (306-347) 429	237	(266-323)	(307-350) (331-380) 450
Professor	859	858	26	26	886	885	28	28	262	(308-362)	(405-502) (580-662) 800	262	(318-378)	(435-554) (641-735) 900
	1297	1044	68	39	1291	1060	61	39						
DOCTORATE GRANTING DEPARTMENTS. Group II					(33 of 43 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	89	6	57	3	87	6	52	2	123	(143-193)	(155-201) (179-226) 331	150	(158-193)	(178-216) (185-253) 362
Assistant Professor	6	5	1	0	4	4	0	0	---		--- --- ---	---		--- --- ---
Associate Professor	12	11	3	2	10	9	3	2	---		--- --- ---	---		--- --- ---
Professor	4	4	0	0	3	3	0	0	---		--- --- ---	---		--- --- ---
	111	26	61	5	104	22	55	4						
WITH DOCTORATE														
Instructor/Lecturer	56	3	7	0	55	3	8	0	175	(180-215)	(183-217) (190-240) 320	165	(180-237)	(190-239) (190-250) 320
Assistant Professor	256	24	29	5	249	14	33	3	175	(205-224)	(225-260) (256-285) 315	201	(215-242)	(268-300) (242-270) 338
Associate Professor	369	351	20	16	350	335	22	20	204	(231-273)	(273-321) (310-360) 443	210	(250-300)	(287-326) (330-384) 560
Professor	587	585	17	15	632	629	18	18	255	(295-340)	(355-429) (506-641) 712	277	(310-366)	(383-465) (545-705) 770
	1268	963	73	36	1286	981	81	41						
DOCTORATE GRANTING DEPARTMENTS. Group III					(50 of 70 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	73	4	52	4	78	3	53	3	105	(140-175)	(143-198) (146-235) 290	117	(144-200)	(160-200) (170-214) 310
Assistant Professor	45	33	18	10	40	32	16	11	180	(208-240)	(208-250) (215-256) 281	193	(217-252)	(232-264) (232-271) 294
Associate Professor	18	18	1	1	19	19	1	1	220	(251-342)	(269-342) (269-347) 364	223	(254-377)	(280-377) (280-377) 388
Professor	7	7	0	0	5	5	0	0	---		--- --- ---	---		--- --- ---
	143	62	71	15	142	59	70	15						

WITH DOCTORATE															
Instructor/Lecturer	27	0	7	0	25	0	7	0	150(156-198)	(160-199)	(170-230) 260		168(170-210)	(178-215)	(190-220) 275
Assistant Professor	293	27	38	3	314	28	40	5	182(201-238)	(218-252)	(237-276) 323		194(220-250)	(240-270)	(255-294) 354
Associate Professor	394	350	23	20	391	352	23	20	156(228-275)	(269-310)	(309-355) 438		182(243-294)	(285-330)	(320-377) 480
Professor	556	550	8	8	564	558	11	11	207(287-335)	(345-418)	(431-538) 701		243(303-358)	(360-433)	(456-587) 757
	1270	927	76	31	1294	938	81	36							
DOCTORATE GRANTING DEPARTMENTS. Group IV (41 of 65 reporting)															
WITHOUT DOCTORATE															
Instructor/Lecturer	9	1	2	0	11	1	2	0							
Assistant Professor	8	2	3	0	6	2	2	0							
Associate Professor	1	1	0	0	1	1	0	0							
Professor	3	3	0	0	3	3	0	0							
	21	7	5	0	21	7	4	0							
WITH DOCTORATE															
Instructor/Lecturer	5	1	2	1	4	1	2	1	---	---	---		---	---	---
Assistant Professor	152	3	24	0	152	1	27	0	173(220-250)	(238-266)	(256-277) 378		194(234-260)	(248-285)	(260-310) 376
Associate Professor	119	84	13	6	126	91	12	8	212(271-331)	(286-345)	(295-368) 456		220(280-340)	(294-354)	(310-387) 504
Professor	286	281	11	11	296	286	13	12	266(316-423)	(410-522)	(511-601) 800		294(324-449)	(417-541)	(541-639) 830
	562	369	50	18	578	379	54	21							
DOCTORATE GRANTING DEPARTMENTS. Group V (16 of 53 reporting)															
WITHOUT DOCTORATE															
Professor	1	1	0	0	1	1	0	0							
	1	1	0	0	1	1	0	0							
WITH DOCTORATE															
Instructor/Lecturer	12	0	2	0	6	0	2	0	---	---	---		---	---	---
Assistant Professor	31	0	0	0	42	0	0	0	230(230-284)	(245-294)	(260-310) 340		248(250-296)	(270-324)	(281-346) 380
Associate Professor	32	25	0	0	28	22	0	0	282(295-360)	(330-375)	(343-392) 420		290(350-410)	(360-415)	(363-430) 455
Professor	103	102	4	4	107	106	4	4	331(354-420)	(404-510)	(564-645) 650		365(380-480)	(434-530)	(600-668) 690
	178	127	6	4	183	128	6	4							
DOCTORATE GRANTING DEPARTMENTS. Group VI (12 of 28 reporting) (Canadian Departments)															
WITHOUT DOCTORATE															
Instructor/Lecturer	1	0	0	0	0	0	0	0							
Assistant Professor	2	1	1	0	2	1	1	0							
Associate Professor	3	3	1	1	2	2	0	0							
Professor	3	3	1	1	2	2	0	0							
	9	7	3	2	6	5	1	0							
WITH DOCTORATE															
Instructor/Lecturer	1	0	0	0	0	0	0	0	---	---	---		---	---	---
Assistant Professor	33	6	6	2	33	6	3	0	185(185-300)	(211-338)	(260-408) 408		233(233-300)	(265-338)	(290-408) 408
Associate Professor	113	113	6	6	103	101	6	5	262(262-410)	(310-473)	(386-514) 514		289(289-468)	(319-509)	(407-546) 546
Professor	149	149	3	3	151	151	3	3	315(315-557)	(388-590)	(505-784) 784		332(332-450)	(430-614)	(508-700) 700
	296	268	15	11	287	258	12	8							

	SIZE OF FACULTY								SALARIES (in hundreds of dollars)					
	1983-1984				1984-1985				1983-1984			1984-1985		
	FACULTY		WOMEN		FACULTY		WOMEN							
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure	Minimum	Median	Maximum	Minimum	Median	Maximum
MASTER DEGREE GRANTING DEPARTMENTS					(157 of 331 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	326	34	193	18	345	31	207	15	94	(144-180)	(155-191)	(160-216) 304	120	(154-190) (164-203) (174-227) 425
Assistant Professor	194	146	47	38	185	135	46	37	148	(201-252)	(209-260)	(219-277) 330	172	(215-256) (225-271) (233-290) 361
Associate Professor	132	130	16	16	137	133	17	17	200	(241-296)	(250-302)	(263-310) 372	212	(255-308) (263-311) (274-332) 397
Professor	28	28	2	2	26	26	2	2	250	(315-366)	(315-366)	(315-379) 530	260	(323-389) (323-389) (323-389) 570
	680	338	258	74	693	325	272	71						
WITH DOCTORATE														
Instructor/Lecturer	65	11	11	2	65	12	11	2	130	(165-225)	(183-231)	(185-250) 292	130	(180-239) (183-250) (190-256) 302
Assistant Professor	493	76	74	14	537	67	82	12	173	(201-229)	(220-249)	(230-280) 355	179	(215-249) (230-265) (243-290) 370
Associate Professor	739	654	74	64	755	645	88	74	200	(240-273)	(258-301)	(280-330) 420	200	(254-290) (277-324) (301-353) 440
Professor	898	885	54	54	920	906	55	55	254	(286-343)	(320-370)	(358-423) 531	250	(302-350) (336-399) (374-450) 574
	2195	1626	213	134	2277	1630	236	143						
BACHELOR DEGREE GRANTING DEPARTMENTS					(336 of 1010 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	330	9	178	3	338	6	178	1	110	(151-185)	(160-190)	(160-200) 250	117	(160-197) (168-203) (171-213) 290
Assistant Professor	260	97	66	20	271	88	70	18	121	(180-233)	(185-244)	(188-250) 316	127	(192-241) (200-253) (200-265) 344
Associate Professor	172	157	20	16	164	145	20	14	160	(221-278)	(221-285)	(223-292) 406	165	(231-295) (232-304) (235-311) 438
Professor	47	45	4	4	51	50	7	7	205	(250-344)	(250-344)	(250-344) 486	211	(274-367) (274-385) (274-386) 510
	809	308	268	43	824	289	275	40						
WITH DOCTORATE														
Instructor/Lecturer	24	3	7	0	18	2	5	0	160	(168-207)	(170-221)	(170-255) 280	170	(195-240) (195-249) (195-258) 265
Assistant Professor	447	59	110	10	458	59	114	10	140	(194-225)	(203-240)	(210-254) 350	140	(205-239) (216-253) (220-272) 400
Associate Professor	502	407	49	35	537	425	59	41	160	(227-281)	(237-297)	(240-310) 417	170	(238-291) (250-310) (259-331) 429
Professor	491	466	35	32	515	489	44	42	182	(260-338)	(270-355)	(274-375) 556	188	(275-354) (289-375) (291-397) 600
	1464	935	201	77	1528	975	222	93						

Salary Survey for New Recipients of Doctorates

The figures for 1984 in this article were compiled from questionnaires sent to individuals who received a doctorate in the mathematical sciences during the 1983-1984 academic year from universities in the United States and Canada.

Questionnaires requesting information on salaries and professional experience were distributed to 688 recipients of degrees using addresses provided by the departments which granted the degrees. Of these, 2 were returned by the postal service as undeliverable and could not be forwarded. There were 333 individuals who returned forms between late June and early September. The tables below are based on the responses from 284 of these individuals (230 men and 54 women). Data from 49 responses were not used in the compilation of the tables below; forms with insufficient data, or from individuals who had indicated they had part-time employment, were not yet employed, or were not seeking employment were considered unusable.

Readers should be warned that the data in this report are obtained from a self-selected sample and inferences from them may not be representative of the population. More comprehensive information on the number, the sex—minority group status—citizenship, and the employment status of the recipients of new doctorates granted last year in the mathematical sciences in the U.S. and Canada may be found in the previous article of this report on the 1984 Survey.

Key to Tables. *Salaries* are listed in hundreds of dollars. *Years* listed refer to the academic year ending in the listed year. *M* and *F* are Male and Female respectively. *One year experience* means that the persons had experience limited to one year or less in the same position or a position similar to the one reported; some persons receiving a doctorate had been employed in their present position for several years. $(X + Y)$ means there are *X men and Y women* in the 1984 sample. Quartile figures are given only in cases where the number of responses is large enough to make them meaningful.

Graphs. For each category and year, the median starting salary is denoted by a horizontal bar; a vertical bar extends to the extremes. When the quartiles have also been recorded, they are denoted by the range of the box around the median, thus for those cases, the middle 50% of starting salaries lie within the range of the box. The salary information in the graphs is in hundreds of dollars. This graphical technique is based on a proposal by McGill, Tukey and Larsen in *Variations of box plots*, The American Statistician (February 1978).

The connected line segments equate value of the dollar from one year to the next, using 1965 median starting salary as a benchmark and adjusting that to current dollars by the implicit price deflators prepared annually by the Bureau of Economic Analysis, U.S. Department of Commerce. Because the deflator is not yet available for this year, the 1984 figures do not appear on the graphs. If the rate of change in the actual starting salaries is less than the slope of the corresponding line segment, median starting salaries did not keep up with inflation.

Note that starting salaries for all categories fall behind the cost of living change in 1975 as compared to 1970. Some of this loss was made up between 1980 and 1982. Between 1982 and 1983, academic salaries just kept up with inflation, research and industry salaries showed real increases, and government salaries showed no increase and thus a drop when adjusted for inflation. Generally, the range of salaries is increasing with time.

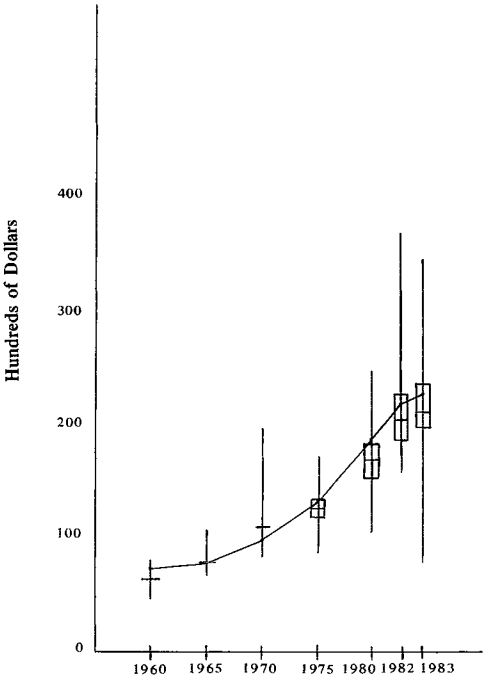
Nine-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	1965 Salary Median in Current $
TEACHING OR TEACHING AND RESEARCH (146 + 38)						
1960	49		65		80	74
1965	70		80		105	80
1970	85		110		195	98
1975	90	120	128	135	173	135
1980	105	155	171	185	250	192
1981	130	175	190	210	320	210
1982	160	190	206	229	370	223
1983	80	200	217	240	350	232
1984	140	215	230	255	380	–
1981M	130	175	190	210	320	
1981F	146	177	195	216	300	
1982M	160	192	210	229	370	
1982F	160	175	198	225	285	
1983M	95	204	220	240	350	
1983F	80	198	210	227	330	
1984M	140	215	232	255	380	
1984F	161	215	228	251	325	
One Year Experience (127 + 30)						
1984M	140	212	230	251	340	
1984F	195	215	228	251	325	

Nine-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
RESEARCH (1 + 0)				
1960	52	65	80	75
1965	71	81	90	81
1970	78	105	160	100
1975	100	–	110	137
1980	125	137	180	195
1981	143	–	145	213
1982	180	190	235	226
1983	100	200	230	235
1984	205	205	205	–
1981M	143	–	145	
1981F	–	145	–	
1982M	180	190	190	
1982F	–	235	–	
1983M	100	200	230	
1983F	205	205	205	
1984M	205	205	205	
1984F	–	–	–	
One Year Experience (1 + 0)				
1984M	205	205	205	
1984F	–	–	–	

Nine-month Teaching



Graph omitted because sample size too small

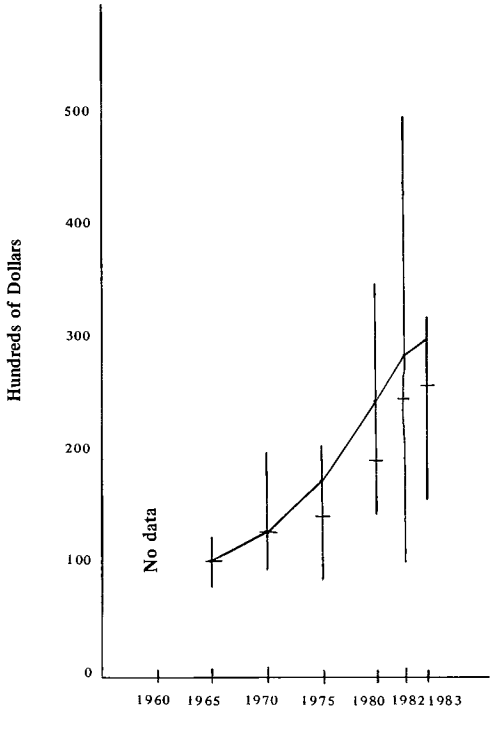
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
TEACHING OR TEACHING AND RESEARCH (25 + 4)				
1960	.....NO DATA			
1965	78	104	121	104
1970	95	128	200	128
1975	87	145	204	176
1980	143	195	350	250
1981	156	203	400	274
1982	100	250	500	290
1983	160	260	320	301
1984	134	260	450	-
1981M	156	200	400	
1981F	165	213	290	
1982M	180	250	500	
1982F	100	266	367	
1983M	160	255	320	
1983F	240	265	270	
1984M	134	260	450	
1984F	240	275	330	
One Year Experience (20 + 4)				
1984M	134	248	340	
1984F	240	275	330	

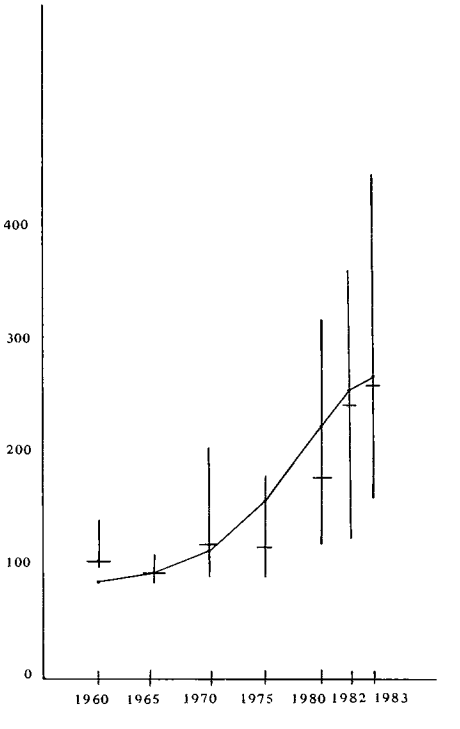
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
RESEARCH (12 + 4)				
1960	97	105	140	86
1965	81	93	107	93
1970	90	120	205	114
1975	90	119	180	157
1980	120	180	321	224
1981	140	200	280	245
1982	130	245	364	259
1983	155	262	450	269
1984	145	261	415	-
1981M	140	200	280	
1981F	150	168	200	
1982M	144	230	336	
1982F	130	265	364	
1983M	195	262	450	
1983F	155	260	364	
1984M	170	283	415	
1984F	145	200	253	
One Year Experience (11 + 3)				
1984M	170	276	415	
1984F	145	210	253	

Twelve- Month Teaching



Twelve-Month Research



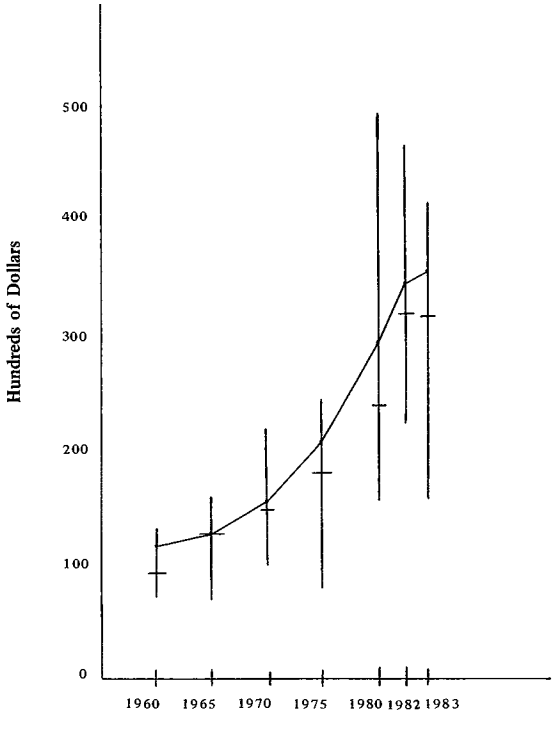
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
		GOVERNMENT (12 + 2)		
1960	72	93	130	117
1965	70	126	160	126
1970	100	150	223	155
1975	78	182	247	213
1980	156	244	501	303
1981	220	290	460	332
1982	228	325	470	351
1983	160	322	422	365
1984	140	315	490	–
1981M	220	294	400	
1981F	252	269	460	
1982M	228	331	470	
1982F	282	326	369	
1983M	160	313	422	
1983F	293	320	350	
1984M	288	326	490	
1984F	140	202	263	
One Year Experience (8 + 1)				
1984M	288	305	390	
1984F	140	140	140	

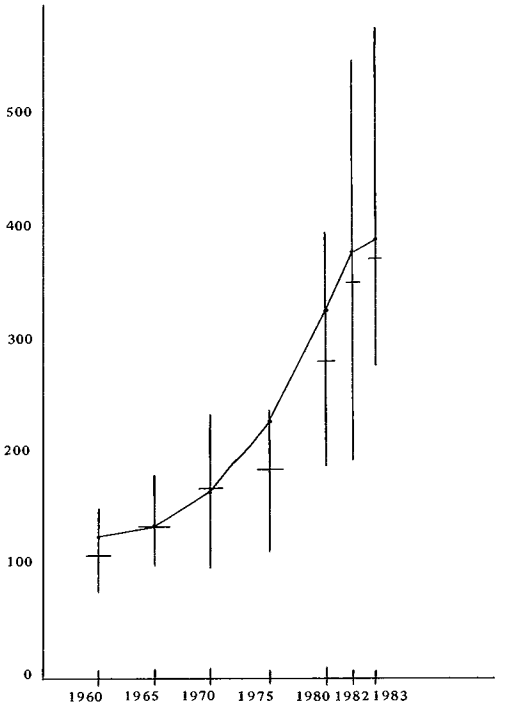
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
		BUSINESS AND INDUSTRY (34 + 6)		
1960	78	110	150	126
1965	100	136	180	136
1970	96	170	235	167
1975	114	187	240	230
1980	190	284	400	327
1981	195	308	500	358
1982	196	354	550	379
1983	276	375	580	394
1984	180	378	660	–
1981M	195	319	500	
1981F	226	290	358	
1982M	196	366	550	
1982F	230	350	430	
1983M	300	370	580	
1983F	276	375	413	
1984M	180	383	660	
1984F	200	342	416	
One Year Experience (21 + 5)				
1984M	180	359	460	
1984F	200	336	390	

Twelve-month Government



Twelve-Month Business and Industry



MATHEMATICAL REVIEWS
ASSOCIATE EDITORS

The *Mathematical Reviews* Editorial Committee invites applications and recommendations for positions as Associate Editor of **MR**, to commence as soon as possible, but no later than the summer of 1985. Applications will be welcomed from persons taking leave from other positions, and in particular from tenured faculty members who could take leave to come to **MR** for two years.

The **MR** office is located in Ann Arbor, Michigan, adjacent to the campus of the University of Michigan, and the editors enjoy many faculty privileges at the university. At present, **MR** employs eleven editors, about a dozen consultants, and over fifty non-editorial personnel. It publishes *Mathematical Reviews* and *Current Mathematical Publications* and various indexes. The responsibilities of Associate Editors fall primarily in the day-to-day operations of classifying articles and books, assigning these items to reviewers, and editing the reviews when they are returned. Other responsibilities evolve in accordance with the individual's experience and capabilities. At this time, no particular area of mathematical specialization is sought, although strength in applied areas or analysis is desirable. Considerable breadth in mathematics rather than special skill is sought. A reading knowledge of two main foreign languages is important, but not essential. (Russian is especially desirable.)

Persons interested in combining a sabbatical or other leave with a part-time or full-time appointment as an Associate Editor should write for further details. The twelve-month salary is negotiable, and will be commensurate with the experience applicants bring to the position. Retirement and insurance plans and other fringe benefits are similar to those in universities; of special importance is a policy providing a study leave after at least two years. This amounts to three months of full pay for each two years spent as Editor.

Applications (including curriculum vitae, bibliography, data on experience, and names and addresses of three references) and recommendations should be sent to Dr. W. B. Woolf, Acting Executive Editor, *Mathematical Reviews*, P.O. Box 8604, Ann Arbor, Michigan 48107 (telephone 313-764-7228). Persons interested in applying for this position are urged to inquire immediately.

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Report on the 1984 Survey of New Doctorates

by Donald C. Rung

This report presents a statistical profile of new doctorates in mathematics and statistics from both United States and Canadian universities. It includes the employment status of recipients of 1983-1984 doctorates in mathematics and statistics, and an analysis of the data by the sex, racial/ethnic group, and citizenship of the new doctorates. In addition, trends in the number of doctoral degrees are reported for each group of departments as defined by the 1982 Jones-Lindzey Survey (described on the first page of this 1983-1984 Survey).

Continuing the policy adopted in the 1983 report, doctorates in Computer Science are *not* included in this report. This corresponds to the current taxonomy describing the mathematical sciences.

The number of new doctorates reported for 1983-1984 was 789, which is almost identical to last year's figure of 792. The comparable figure for 1981-1982 was 755 and for 1980-1981 was 812. The figures for the past three years are taken from the survey reported each year in the November *Notices* with the computer science doctorates subtracted (prior to 1982-1983). As is customary, a second updated report is planned for the March 1985 *Notices*. Table 1 contrasts the number of new doctorates reported in the November reports with the more complete total reported in the following spring reports for the period 1979-1980 to 1982-1983.

TABLE 1: New Doctorates, Fall and Spring Counts

	79-80	80-81	81-82	82-83
Fall	858	904	860	792
Spring	898	927	914	840

The data for 1983-1984 is markedly similar to the 1982-1983 data except for one area. Of the 743 doctorates reported from U.S. universities (there were 46 doctorates from Canadian universities), the citizenship is known for 738 of these doctorates, with U.S. citizens accounting for 59% (433) of this total. The 1982-1983 figures were 61% and 455. The percentage of doctorates who are U.S. citizens has declined dramatically over the last five years: from 73% in 1979-1980 to the present 59% figure. It is apparent that we are now producing annually less than 450 doctorates who are U.S. citizens. (A more detailed analysis is available from the National Science Foundation: *Science and Engineering Doctorates 1960-1982, detailed tables and charts*, NSF 83-328.) Table 5 gives this analysis from 1972-1973 to 1983-1984.

For U.S. citizens, it is instructive to compare the ratio of men to women among the new doctorates. The percentage of women remained at the same 20% level as last year. Table 6 gives these figures for the period 1972-1975 to 1983-1984. The employment matrix, Figure 2, is quite identical to last year's. The number of those seeking employment was 39 as compared to last year's 38.

Employment Status of New Doctorates, 1983-1984. Table 2 shows the employment status, by type of employer and field of degree, of the 789 recipients of doctoral degrees conferred by mathematical sciences departments in the U.S. and Canada between July 1, 1983 and June 30, 1984. These 789 individuals are listed, with their theses titles, later in this report.

In rows 1 through 5, the numbers who accepted appointments in U.S. doctorate-granting mathematics and statistics departments (Groups I—V) are given. In the next two rows, the figures represent those accepting appointments in U.S. mathematical sciences departments granting masters and bachelors degrees only. The information was obtained both from the departments granting the degrees and from questionnaires subsequently completed by the recipients themselves.

Among those 1983-1984 new doctorates employed in the U.S., about 61% took positions in university or four-year college mathematical sciences departments; about 22% took positions in government, business, and industry, while the remaining 17% are in two-year colleges, high schools, other academic departments, or research institutes. These figures are about the same as in 1982-1983.

Table 2 shows as "not yet employed" about 5% of the 1982-1983 new doctorates (this excludes those whose employment status is unknown and those not seeking employment). The data in Table 2 were in many instances obtained early in the summer of 1983 and do not reflect subsequent hiring during the summer; an update of Table 2 is planned for the March 1985 *Notices*. A similar update last year revealed that all but 16 new 1982-1983 doctorates found positions by fall 1983. (See the *Notices*, November 1983, page 727 and February 1984, page 147.) Nine persons included in Table 2 reported taking part-time employment.

Sex, Race, and Citizenship of New Doctorates, 1983-1984. Table 3 below represents a breakdown according to sex, racial/ethnic group, and citizenship of these 789 new doctorates. The information summarized in Table 2 was obtained from department heads and in some cases from recipients themselves.

TABLE 2: 1983-1984 Employment Status of New Doctorates in the Mathematical Sciences

Type of Employer	PURE MATHEMATICS: Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Mathematics Education	Other	Total
Group I	23	22	14	3	1	2		1	4		2	72
Group II	7	10	6	2		3	1		9		1	39
Group III	3	5	6		4	7		2	3	1	4	35
Group IV		1				19					1	21
Group V			1	1		2		6	7			17
Masters	15	12	8	3	3	18	3	6	13		7	88
Bachelors	18	9	14	2		7		1	7		8	66
Two-year College or High School		2				2			1	1		6
Other Academic Departments	1	2	1	1	1	19	2	23	5	1	16	72
Research Institutes		2	4	1		2	1	1	8		2	21
Government	1				1	11		3	3		1	20
Business and Industry	8	5	4	1	3	31	6	10	13		19	100
Canada, Academic	4	1	4	2		8	1	4	2			26
Canada, Nonacademic									1			1
Foreign, Academic	13	15	6		1	19		4	13		10	81
Foreign, Nonacademic	5	1	1	2	1	10		2	6		4	32
Not seeking employ.		1							3		1	5
Not yet employed	9	8	2		1	7	1	1	6		4	39
Unknown	4	6	9	3	2	6	4	2	7		5	48
Total	111	102	80	21	18	173	19	66	111	3	85	789

TABLE 3: Sex, Minority Group, and Citizenship of New Doctorates

July 1, 1983--June 30, 1984

U.S. DEGREES	MEN					WOMEN					TOTAL
	CITIZENSHIP					CITIZENSHIP					
RACIAL/ETHNIC GROUP	U.S.	Canada	Other	Not Known	Total Men	U.S.	Canada	Other	Not Known	Total Women	
Asian, Pacific Islander	15	1	118	3	137	10		14		24	161
Black	3		3		6						6
American Indian, Eskimo, Aleut											
Mexican American, Chicano, Puerto Rican	5		3		8						8
None of those above	313	7	135	1	456	71		20		91	547
Unknown	10		6	1	17	4				4	21
Total Number	346	8	265	5	624	85		34		119	743

CANADIAN DEGREES	MEN					WOMEN					TOTAL
	CITIZENSHIP					CITIZENSHIP					
RACIAL/ETHNIC GROUP	U.S.	Canada	Other	Not Known	Total Men	U.S.	Canada	Other	Not Known	Total Women	
Asian, Pacific Islander			4		4						4
Black											
American Indian, Eskimo, Aleut											
Mexican American, Chicano, Puerto Rican			1		1						1
None of those above	1	22	5		28						28
Unknown		6	3		9		2	1	1	4	13
Total Number	1	28	13		42		2	1	1	4	46

Analysis of the 1983-1984 employment forms for the new U.S. doctorates indicates that 10% of those employed by Groups I, II, and III departments are women, the same figure as for the last two years. Of the new doctorates employed by bachelors and masters degree-granting departments, 24% are women, while of those employed by government, business, and industry, 13% are women.

Trends in the Number of New Doctorates. Table 4 gives the number of doctorates granted during 1981-1982, 1982-1983, and 1983-1984 by those departments in Groups I—VI, *which reported in all three years* (as of August 31, 1984). The number of such departments out of the total is indicated in parentheses. This table does not include computer science doctorates. The groups are derived from the 1982 rating.

TABLE 4: Number of New Mathematics and Statistics Doctorates Reported by Selected Departments

	81-82	82-83	83-84
Group I (36 out of 39 depts.)	234	283	232
Group II (36 out of 43 depts.)	80	114	107
Group III (50 out of 72 depts.)	88	81	79
Subtotal	402	478	418
Group IV (40 out of 66 depts.)	124	120	106
Group V (23 out of 54 depts.)	100	98	103
Group VI (18 out of 35 programs)	32	39	38
Subtotal	256	257	241
TOTAL	658	735	659

Citizenship and Gender of U.S. Doctorates, 1972–1984. Again this year information is presented on the annual number of doctorates receiving their degrees from U.S. universities who are U.S. citizens (Table 5). This number is divided into male and female doctorates (Table 6). This is presented for the period 1972–1984 using the CEEP reports on new doctorates published annually in the October or November *Notices*.

In Table 5 the first column is the number of doctorates, *whose citizenship is known*, produced between July 1 and June 30 of the indicated years. Column 2 gives the number that were U.S. citizens and in Column 3 the percentage this represents. In Table 6 the number in Column 2 of Table 5 is further divided into men and women. Note that in both tables *all years but 1982-1983 and 1983-1984 contain computer science doctorates.*

TABLE 5: U.S. Citizen Doctorates

	Adjusted Total of Doctorates given by U.S. universities	Total of Doctorates who are U.S. citizens	%
1972-1973	986	774	78%
1973-1974	938	677	72%
1974-1975	999	741	74%
1975-1976	965	722	75%
1976-1977	901	689	76%
1977-1978	868	634	73%
1978-1979	806	596	74%
1979-1980	791	578	73%
1980-1981	839	567	68%
1981-1982	798	519	65%
1982-1983	744	455	61%
1983-1984	738	433	59%

TABLE 6: U.S. Citizen Doctorates, Male and Female

	Doctorates who are U.S. Citizens	Male	Female	% Female
1972-1973	774	696	78	10%
1973-1974	677	618	59	9%
1974-1975	741	658	83	11%
1975-1976	722	636	86	12%
1976-1977	689	602	87	13%
1977-1978	634	545	89	14%
1978-1979	596	503	93	16%
1979-1980	578	491	87	15%
1980-1981	567	465	102	18%
1981-1982	519	431	88	17%
1982-1983	455	366	89	20%
1983-1984	433	346	87	20%

It is apparent there has been a precipitous decline over the last four years in the number of new doctorates who are U.S. citizens. Until 1982-1983 the percentage of women receiving doctorates who are U.S. citizens has increased steadily, and has remained at the 20% level over the last two years.

Doctoral Degrees Conferred 1983–1984

THE ANNUAL AMS list of doctoral degrees in the mathematical sciences and related subjects reports 789 degrees conferred between July 1, 1983, and June 30, 1984 by 205 departments in 139 universities in the United States and Canada. Each entry contains the name of the recipient and the thesis title. The numbers in parentheses following the names of universities have the following meanings: the first number is the number of degrees listed for that university; the next seven numbers are the number of degrees in the categories of 1. Pure mathematics (i.e., algebra, number theory, analysis, functional analysis, geometry, topology, logic, or probability); 2. Statistics; 3. Computer science; 4. Operations research; 5. Applied mathematics; 6. Mathematics education; 7. Other.

ALABAMA

Auburn University
(2;2,0,0,0,0,0,0)

MATHEMATICS

Hamm, Rose Condon, *Embedding theorems for triple systems.*

Walsh, John T., *Marczewski sets, measure and the Baire property.*

University of Alabama, Birmingham
(1;0,1,0,0,0,0,0)

BIOSTATISTICS AND BIOMATHEMATICS

Shamsa, Falah Hassan, *Families of survival models in clinical trials and a multivariate methodology of estimation applicable to cancer research data.*

University of Alabama, Tuscaloosa
(2;0,1,0,0,0,0,1)

MANAGEMENT SCIENCES AND STATISTICS

Davis, Reuben Dean, *A process for selecting and breeding plants based on multiple objective linear programming.*

Wang, Huang-San Samuel, *On estimation of stationary points of a response surface function.*

ARIZONA

Arizona State University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Bank, Edward James, *Pollaczek type polynomials and functions.*

University of Arizona
(5;2,0,0,0,3,0,0)

APPLIED MATHEMATICS

Gayek, Jonathan Edward, *Approximating reachable sets for a class of linear systems subject to bounded control.*

Xaba, Abraham Busa, *Maintaining an optimal steady state in the presence of persistent disturbances.*

MATHEMATICS

Pickrell, Doug, *Spin extensions and measures of infinite dimensional Grassmann manifolds.*

Roten, Charles, *The structure and properties of an approximate solution to a system of reaction-diffusion equations.*

Ullery, William Davis, *The isomorphism problem for commutative group algebras.*

ARKANSAS

University of Arkansas
(1;1,0,0,0,0,0,0)

MATHEMATICAL SCIENCES

Hiremath, Mahesh M., *Joint graphs, cyclic graphs and graphs with maximum local connectivity less than five.*

CALIFORNIA

California Institute of Technology
(7;2,0,0,0,5,0,0)

APPLIED MATHEMATICS

Reinelt, Douglas A., *The penetration of a finger into a viscous fluid.*

Robinson, Allen Conrad, *Existence and stability of vortices and vortex arrays.*

Simmen, Jeffrey, *Steady deep-water waves on a linear shear current.*

Smyth, Noel Frederick, *Part I: Soliton on a beach and related problems; Part II: Modulated capillary waves.*

Tanveer, Saleh A., *Topics in 2-D separated vortex flows.*

MATHEMATICS

Fowler, Joel Christopher, *Topics in linear spaces and projective planes.*

Mikolič-Torreira, Igor, *Norm constant holomorphic functions on Banach spaces.*

Claremont Graduate School
(2;2,0,0,0,0,0,0)

MATHEMATICS

Larson, Suzanne, *Convexity conditions on a class of lattice ordered rings.*

Zachariah, Thomas M., *Stochastic and deterministic sets.*

Naval Postgraduate School
(1;1,0,0,0,0,0,0)

OPERATIONS RESEARCH

Kisi, Takasi, *Optimization of artificial dispersion in salvo firing.*

Stanford University
(34;2,5,0,6,0,0,21)

ENGINEERING-ECONOMIC SYSTEMS

Agogino, Alice, *A primal-dual algorithm for constrained generalized polynomial programming: Application to engineering design and multiobjective optimization.*

Ansu, Yaw, *An exchange rate system for an economy with parallel markets.*

Berman, Lawrence Edward, *Incentives for vertical integration in the information services industry.*

Brown, Pamela Clark, *The design of incentive-compatible procurement contracts that allow risk-sharing.*

Dhebar, Anirudh S., *Theory of optimal dynamic pricing and market equilibria for goods with positive demand externalities.*

Dopfel, Frederick Edward, *A composite investor criterion for capital budgeting.*

Duffie, J. Darrell, *Advances in general equilibrium theory.*

Edwards, Gonzalo, *An analysis of Chilean wheat imports.*

Gieringer, Dale, *Drugs and choice: A consumer choice analysis of FDA drug regulation.*

Herriott, Scott Robert, *The political economy of partnerships with applications to power pooling in the electric utility industry.*

Khanna, Anupam, *An approach to modelling systems of political economy: Towards introducing the notion of power in economic analysis.*

Lamont, Alan Duryea, *Strategies for running predictive models.*

MacQuhae, Nelson Guillermo, *A dynamic macro-economic interactive planning support system for policy assessment in Venezuela.*

Manuel, Ernest H., *Economic effects of air pollution on production: Estimates for selected manufacturing industries.*

Metcalfe, Murray Robert, *The adoption of an innovation in systems of interconnected technologies.*

Mir, Anjum Altaf, *The strategic implications of varying environments: Aspects of decision making under instability.*

Olmsted, Scott Mostyn, *On representing and solving decision problems.*

Razavi, Hamid, *Generalized dynamic system descriptions: Rectangular descriptor systems.*

Regulinski, Stephan G., R&D *portfolio selection.*

Samuelson, Ralph Dale, *Regulation and efficiency in a public utility: The economics of the natural gas pipeline and distribution industry.*

MATHEMATICS

Foddy, Marjorie Ellen, *An analytic solution for the stationary distribution of Brownian motion with drift confined to a quadrant by oblique reflection.*

King, Jonathan, *Another counter example of ergodic theory.*

Pei, Hsu, *Reflecting Brownian motion, boundary local time and the Neumann problem.*

OPERATIONS RESEARCH

Anstreicher, Kurt Martin, *Generation of feasible descent directions in continuous time linear programming.*

Broadie, Mark Nathan, *Piecewise linear methods for solving equations.*

McCormick, Seth Thomas, V, *A combinatorial approach to some sparse matrix problems.*

Preckel, Paul Veitch, *Intertemporal equilibrium models: Development and results.*

Rosenberg, Adam Nathan, *Numerical solution of systems of simultaneous polynomial equations using continuous homotopy method.*

Roundy, Robin Otho, *98%-effective lot-sizing for multi-item multi-stage production/inventory systems.*

STATISTICS

Green, Timothy Allen, *Asymptotic enumeration of Latin rectangles and associated waiting times.*

Henry, David H., *Multiplicative models in projection pursuit.*

Hogan, Michael Leo, *Problems in boundary crossing for random walks.*

Huh, Myung-Hoe, *Regression analysis of multicollinear data.*

Therneau, Terry M., *Variance reduction techniques for the bootstrap.*

University of California, Berkeley
(34;20,0,1,6,6,0,1)

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

DeGuia, Arthur Araujo, *Design of a hierarchial production planning and inventory control system for a consumer products manufacturing network.*

Hackman, Steven Todd, *A general model of production: Theory and application.*

Ireson, Robert Grant, *Information transfer structures, a model of formal analysis addressing the effects of formulation on the interpretation of results.*

Karayel, Mahmut Nedim, *Dual based heuristics for capacity-constrained production scheduling.*

Kasper, Martin, *Production planning of capacitated, multi-stage, discrete manufacturing systems.*

Miller, Douglas Alan, *A class of topological oriented matroids with some applications to non-linear programming.*

Politof, Themistocles, *A characterization and efficient reliability computation of $\Delta - y$ reducible networks.*

Shamir, Ron, *On the efficiency of simplex method.*

MATHEMATICS

Anderson, Christopher Radcliff, *Vortex methods for flows of variable density.*

Caldwell, Chris Kelly, *The elliptic curve $aX^3 + bY^3 + cZ^3 = dXYZ$.*

Christy, Joseph Parsons, *Anosov flows on three-manifolds.*

Djomehri, Mohammad Djahed, *Moving finite element solution of systems of partial differential equations in 1-dimension.*

Donmez, Dogan, *On the degree of symmetry of product manifolds.*

Ebrahimzadeh, Elizabeth Shahnaz, *On the sums of a certain arithmetic function.*

Enomoto, Kazuyuki, *Contributions to the geometry of submanifolds of codimension bigger than one in Eculidean space.*

Fan, Paul Shih, *Amalgams and trees with prime valence.*

Fox, Jeffrey Stephen, *Harmonic analysis on algebraic solvable groups.*

Gompf, Robert Ernest, *An invariant for Casson handles, disks, and knot concordance.*

Hellerstein, Nathaniel Shawn, *Diamond: A four-valued logic of paradox.*

Hobby, David Charles, *Algebra derived from minimal congruences.*

Hochwald, Scott Howard, *The uniqueness of the adjoint operation.*

Krasny, Robert, *A numerical study of Kelvin-Helmholts instability by the point vortex method.*

Ng, Kwok Choi, *Contributions to the computation of the martix exponential.*

Perlman, Mirta Beatriz, *On the accuracy of vortex methods.*

Ryan, John Gerard, *Extensions of representations of Lie algebras.*

Rychlik, Marek Ryszard, *Invariant measures and the variational principle for Lozi mappings.*

Saunders, Gregg Willard, *Iteration of rational functions of one complex variable and basins of attractive fixed points.*

Sing, Banson, *Decompostion of certain principal semi-AFLs.*

Ventura, Belisario Augusto, *On spectral subspaces of covariant representations of C^*-algebras.*

Viet, Ngo Nhu Phu, *Automatic continuity in algebras of differentiable functions.*

Wadge, William Wilfred, *Reducibility and determinateness on the Baire space.*

Walsh, Shelley Lauren, *Cyclic vectors for the backward Bergman shift.*

Yang, Jae-Heun, *Einstein-Hermitian vector bundles.*

Zandi, Ahmad, *Quaternionic Kahler manifolds and their twister spaces.*

University of California, Davis
(2;2,0,0,0,0,0,0)

MATHEMATICS

Iraniparast, Nezam, *Qualitative behavior of solutions of the Goursat problem for hyperbolic differential equations.*

Kunitaka, Shoji, *On right self-injective regular semigroups.*

University of California, Irvine
(1;1,0,0,0,0,0,0)

MATHEMATICS

Davidson, Mark Gregory, *The harmonic representation of $U(p,q)$ and its connection with the generalized unit disk.*

University of California, Los Angeles
(11;6,3,0,0,2,0,0)

BIOSTATISTICS

Chun, Calvin Siu Yuen, *Testing equality of two multiple correlation coefficients.*

Cohen, Betty Jo, *Prediction theory approach to multistage sampling with unknown cluster size.*

MATHEMATICS

Brenan, Kathryn Eleda, *Stability and convergence of difference approximations for higher index differential-algebraic systems with applications in trajectory control.*

Brenner, Charles Hallam, *Asymptotics of partition functions.*

Chou, Jine-Phone, *Multivariate exponential families: An identity and the admissiblity of standard estimation.*

Hsueh, Yuang-Cheh, *Varieties generated by lattices not containing a given partially ordered set.*

Jennings, George Alan, *Algebro-geometric invariants arising from the local differential geometry of projective varieties.*

Lin, Kai-Ching, *Harmonic analysis on the bidisc.*

Moss, Lawrence Stuart, *Power set recursion.*

Rimbey, Scott Everett, *Transonic jets: A numerical approach in the hodograph plane.*

Rothstein, Mitchell Jay, *Supermanifolds over an arbitrary graded commutative algebra.*

University of California, Riverside
(3;0,0,0,0,2,0,1)

MATHEMATICS

Moghadam, Hosien Said, *Compression operators and a solution to the bandwidth problem of the product of n paths.*

Moussavi, Saadat, *Generalized two parametric "SOR" method for linear sparse systems.*

Shabell, Barbara Jo, *Computable error estimates resulting from modifications of Newton's method for finding roots.*

University of California, San Diego
(7;3,2,0,0,0,0,2)

MATHEMATICS

Egecioglu, Omer, *Combinatorial proofs of identities for symmetric functions.*

Fletcher, Evan Martin, *Holomorphic mappings and invariant metrics on the unit ball of $n \times n$ matrices.*

Fochler, Michael, *Potential theory of random processes.*

Goldstein, Larry Mark, *Extensions of stochastic approximation procedures.*

Johnson, Roger William, *Simultaneous estimation of generalized Pearson means.*

Kaschube, Paul August, *Matroid algorithms, recursion and the subgraph homeomorphism problem.*

Kemp, Paul Martin, *Focal and focal-cut points.*

University of California, Santa Barbara
(8;5,2,0,0,1,0,0)

MATHEMATICS

Deretsky, Tatiana, *Abelian inverse property neofields: Existence and algebraic structure.*

Deretsky, Zakhar Yuryevich, *On the Smith Normal form for (v,k,λ) designs.*

Haussermann, John William, IV, *Generalized porosity characteristics of a residual set of continuous functions.*

Hsu, Lifang, *New procedures of group testing problem based on Huffman lower bound and Shannon entropy criteria.*

Janeba, Mark Riley, *Analytic structures in certain compactifications of the unit ball and polydisc in C^2.*

Nemzer, Dennis, *Boehmians as a F-space.*

Rodriguez Esquerdo, Pedro J., *Group testing to identify the sample minimum from a discrete uniform distribution.*

Wilson, Greg, *A family of modular functions: Construction and computer application.*

University of California, Santa Cruz
(2;1,0,0,0,0,0,1)

MATHEMATICS

Hartsfield, Nora Anne, *The toroidal splitting number of the complete graph K_n.*

Sarli, John, *On the maximal subgroups of ${}^2F_4(q)$.*

COLORADO

Colorado State University
(9;2,4,0,0,3,0,0)

MATHEMATICS

Chien, Peter Cheng-Sheng, *Continuation and local perturbation for numerical treatment of simple and non-simple bifurcations.*

Huotari, Robert Heikki, *Best L_1 approximation by nondecreasing functions.*

Nagata, Kenneth Wayne, *Codimension two bifurcation in double-diffusive convection.*

Strate, Gordon Joseph, *A multilevel scheme for the Cauchy-Riemann equations.*

STATISTICS

Cline, Daren B. H., *Estimation and linear prediction for regression, autoregression and ARMA with infinite variance data.*

Gonzalez-Cossio, Felix Valerio, *Estimation of the parameters of pareto distribution by order statistics and empirical Bayes procedures.*

Halteman, Edward James, *Location estimation in tow dimensions.*

Leiva, Ricardo Anibal, *Properties, convergence and range behavior of shifting level processes.*

Vecchia, Aldo Vincent, *Aggregation and estimation for periodic autoregressive-moving average models.*

University of Colorado
(5;4,0,0,0,1,0,0)

MATHEMATICS

Baltus, Christopher, *Limit-periodic continued fractions: Value regions and truncation error bounds.*

Merrill, Kathy Donovan, *Cohomology of step functions under irrational rotations.*

Meyers, Charles, *Topological and statistical stability of dynamical systems.*

Quinn, Terrence Raymond, *Exponential L^2 and uniform convergence of a class of infinite dimensional diffusion and jump processes.*

Shultz, Gerald, *Computationally practical globally convergent algorithms for unconstrained and linearly constrained optimization.*

University of Northern Colorado
(4;0,1,0,0,0,0,3)

MATHEMATICS AND APPLIED STATISTICS

Al-Heeti, Khalaf Nassar, *Judgment analysis technique applied to readability prediction of Arabic reading material.*

Boynton, Mary, *Academic and social success of Colorado migrant children: Perceptions by child, tutor, teacher, and parent.*

Britton, Gary L., *A history of some recent applications of survey sampling for human populations.*

Jost, Allen P., *Residential property tax equity in Greeley, Colorado.*

CONNECTICUT

University of Connecticut
(2;2,0,0,0,0,0,0)

MATHEMATICS

Goeters, Herman Pat, *Some injective classes.*

Venugopalan, Poothampilly, *Z-continuous partially ordered sets and union complete subset systems.*

Wesleyan University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Madden, James Joseph, *Two methods in the study of k-vector lattices.*

Yale University
(6;4,2,0,0,0,0,0)

MATHEMATICS

Bhate, Hemant, *Discrete scattering theory.*

Chatzidakis, Zoé Maria, *Model theory of profinite groups.*

Smith, Stuart Thomas, *Nonstandard syntax and semantics and full satisfaction classes for models of arithmetic.*

Wildberger, Norman John, *Quantization and harmonic analysis on nilpotent Lie groups.*

STATISTICS

Possolo, Antonio M. G., *Spatial point processes.*

Zelterman, Daniel, *Goodness of fit tests for large sparse tables of categorical data.*

DELAWARE

University of Delaware
(7;1,1,0,4,0,1,0)

MATHEMATICAL SCIENCES

Carlson, Dean Allen, *On the existence of optimal solutions for infinite horizon optimal control problems.*

Chakravarthy, Srinivasaraghavan, *A stochastic model for two servers sharing a common tool magazine and its analysis.*

Flam, Sjur Didrik Beck, *Resource management under uncertainty.*

Hoerl, Roger Wesley, *A simulation of biased and subset selection regression techniques.*

Katsuura, Hidefumi, *Set functions and continous mappings.*

Kumar, Seshavadhani, *A simulation study of a multi-nodal communication network with contention.*

Morningstar, Kay, *Self-teaching enrichment modules on modern applications of mathematics for talented secondary students and evaluation of effective utilization through an original prediction model.*

DISTRICT OF COLUMBIA

American University
(2;0,2,0,0,0,0,0)

MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Brick, John Michael, *Bootstrap methods for finite population sampling.*

Samuhel, Michael, *A general approach to the missing data problem.*

George Washington University
(7;1,1,0,5,0,0,0)

MATHEMATICS

Mifflin, Thomas, *Almost periodic selections.*

OPERATIONS RESEARCH

Blackwell, Louis Mason, II, *Filtering in colored noise–a Bayesian perspective: Applications to accelerated life testing.*

Jackson, Richard Henry Frymuth, *Tensors, polyads, and high-order methods in factorable programming.*

Kyparisis, Jerzy, *Sensitivity and stability for nonlinear and geometric programming: Theory and applications.*

Sabbagh, Mohammad Saiid, *A general lexicographic partial enumeration algorithm for the solution of integer nonlinear programming problems.*

Sofer, Ariela, *Efficient matrix methods for solving nonlinearly constrained optimization problems via Newton's method when the projected Lagrangian Hessian is given in dyadic form.*

STATISTICS

Meinhold, Richard James, *A robustification of the Kalman filter via the Bayesian approach.*

FLORIDA

Florida State University
(3;1,1,1,0,0,0,0)

MATHEMATICS AND COMPUTER SCIENCE

Pacheco, Peter, *K_{-i} obstructions to factoring an open manifold.*

Zemankova-Leech, Marie, *Fuzzy relational data bases.*

STATISTICS

Rasp, John Milton, III, *Determining a sufficient level of inter-rater reliability.*

University of Florida
(6;0,4,0,1,1,0,0)

INDUSTRIAL AND SYSTEMS ENGINEERING

Chen, Mei-Lung, *Location problems on tree-like networks.*

Lawphongpanich, Siriphong, *Decomposition techniques for the traffic assignment problem.*

STATISTICS

Breen, Timothy, *On the combination of 2×2 contingency tables.*

Chen, Wen-Jen, *Directional data and some tests of hypothesis.*

Groggel, David John, *Asymptotic nonparametric confidence intervals for the ratio of scale parameters in balanced one-way random effects model.*

Kezouh, Abbas, *Association models for cross-classification having ordered categories.*

University of Miami
(5;3,0,0,0,0,0,2)

MATHEMATICS AND COMPUTER SCIENCE

Cruz, Eliseo Guillermo, *On monotone methods and the solution of nonlinear integral equations of Hammerstein type.*

Elkhoury, Walid N., *Linear skew product flows, exponential dichotomies and structural stability.*

Jagadish, Mysore, *Sequential technique in optimization.*

Marin, Myriam M., *The multiplier theorem.*

Martinez, Victor J., *On Fatou's theorem and an extension of Rudin.*

University of South Florida
(2;1,1,0,0,0,0,0)

MATHEMATICS

Liles, Albert Douglas, *Mixed and memory fading forecasting models.*

Steele, David Arthur, *A commentary on the correlated random walk: Some additional results and a two-step correlation.*

GEORGIA

Emory University
(2;2,0,0,0,0,0,0)

MATHEMATICS AND COMPUTER SCIENCE

Fichtner, Ronald Raymond, *The closed graph theorem and perfect sequence spaces.*

Pedersen, John F., *Confluence methods and the word problem in universal algebra.*

Georgia Institute of Technology
(1;0,0,0,1,0,0,0)

MANAGEMENT

Lowe, James K., *Modelling with integer variables.*

University of Georgia
(5;4,1,0,0,0,0,0)

MATHEMATICS

Argyros, Ioannis Konstantinos, *Quadratic equations in Banach space, perturbation techniques and applications to Chandrasekhar's and related equations.*

Brown, Jeffrey Lawrence, *Local codimension one splitting.*

Hurd, Spencer Peyton, *0-primitive lattice-ordered permutation groups.*

Yokura, Shoji, *Polar classes and Segre classes on singular projective varieties.*

STATISTICS AND COMPUTER SCIENCE

Prince, Robert H., *Selecting the best population with a preliminary test.*

HAWAII

University of Hawaii
(1;0,1,0,0,0,0,0)

PUBLIC HEALTH SCIENCES

Shiono, Patricia, *Maternal exposure to tobacco, alcohol, and caffeinated beverages and the occurrence of spontaneous abortions.*

IDAHO

Idaho State University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Waters, Steven Ray, *Inertia theory for transformations* $H \to \sum_{i,j=1}^{s} g_{ij} A_i H A_j^*$.

ILLINOIS

Illinois State University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Miller, Mark, *Computer-oriented application modules for abstract algebra.*

Northwestern University
(4;2,0,0,1,0,0,1)

INDUSTRIAL ENGINEERING AND MANAGEMENT SCIENCES

Knapp, Connie M., *Factors influencing formal and informal key communicator effectiveness in the multidivision industrial corporation.*

Schneider, Michael H., *Single commodity spacial equilibria: A network complementary approach.*

MATHEMATICS

Bouzar, Nadjib, *Strict C-sequences: A class of Martingale-like sequences.*

Joshua, Roy, *Spanier-Whitehead duality and Becker-Gottlieb transfer in étale homotopy.*

University of Chicago
(5;3,1,0,0,1,0,0)

MATHEMATICS

Garcia, Sonia Maria Fidelis, *Mixed finite element methods for semilinear second order parabolic problems.*

Hudson, Steven M., *Polynomial approximation in Sobolev spaces.*

Muder, Douglas Jacob, *Zero cycles on del Pezz surfaces over local and global fields.*

Scott, Ronald L., *Fourier transforms of orbital integrals for* GL_2.

STATISTICS

Lahiff, Maureen, *Bayes and likelihood methods for prediction and estimation in the AR (1) model.*

University of Illinois, Chicago
(2;2,0,0,0,0,0,0)

MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Ahlbrandt, Gisela E., *Totally categorical structures of modular type.*

Winker, Steven Karl, *Quandles, knot invariants, and the N-fold branched cover.*

University of Illinois, Urbana-Champaign
(9;4,0,0,0,3,0,2)

MATHEMATICS

Beezer, Robert Arnold, *Polynomials of the adjacency matrix of a graph.*

Challener, David Carroll, *A question of completeness of expansions arising from a method of solving the biharmonic problem.*

Haken, Armin, *Computational complexity.*

Menninga, Nadine Louise, *Immersions of positively curved manifolds into manifolds with curvature bounded above.*

Raggi-Cardenas, Alberto Gerardo, *Zeta function defined by two-sided ideals.*

Wu, Jinn-Wen, *Nonlinear problems in mechanics and some other areas.*

THEORETICAL AND APPLIED MECHANICS

Kurath, Peter, *Extension of the local strain fatigue analysis concepts to incorporate time dependent deformation in Ti-6A-4V at room temperature.*

Pott, John, *Two studies in evanescent wave propagation.*

Sehitoglu, Huseyin, *Characterization of thermo-mechanical fatigue.*

INDIANA

Indiana University
(6;3,1,0,0,1,0,1)

MATHEMATICS

Adams, Gregory T., *The Bergman bilateral shift.*

Namazi, Javad, *On a singular integral.*

Ralescu, Anca Luminita, *General rates of decay for weighted empirical processes.*

Schaeffer, John, *Wave equations with positive nonlinearities.*

Seoh, Munsup, *Rate of convergence to normality and Edgeworth expansions for signed linear rank statistics with regression constants.*

Williams, John K., *Some problems in function theory.*

Purdue University
(23;3,6,0,8,5,0,1)

INDUSTRIAL ENGINEERING

Cochran, Jeffery Keith, *Improving the productivity of the American automobile: A stochastic process view.*

Fox, Dale Robert, *Parametric and algorithmic solutions for the steady-state analysis of Markovian queueing systems using graphical enumeration.*

Kang, Keebom, *Confidence interval estimation via batch means and time series modeling.*

Klein, Cerry Martin, *Duality in dynamic programming.*

Lin, Zone-Ching, *A quasi-steady state thermo-elasto-plastic analysis of stress distribution in the workpiece in machining.*

Maimon, Oded Zvi, *Activity controller for a multiple robot assembly cell.*

Matsumoto, Yoichi, *Mechanics of chip formation and its effect on the surface integrity of hardened steels.*

Nagaraj, Kolinjuwadi Sankaran, *The a posteriori approach for discrete optimization.*

Nelson, Barry Lee, *Variance reduction in simulation experiments: a mathematical - statistical framework.*

Reilly, Charles Henry, III, *PIPZI: A partial enumeration algorithm for pure 0-1 polynomial integer programming problems.*

Sharit, Joseph, *Human supervisory control of a flexible manufacturing system: An exploratory investigation.*

Vinod, Balakrishnan, *Queueing models for flexible manufacturing systems subject to resource failure.*

MATHEMATICS

Arzberger, Peter William, *A mathematical treatment of regular inbreeding systems.*

Brophy, John Francis, *Computation of capacity, polarization and added mass.*

Frohliger, John Anthony, *Maximal homotopy Lie subgroups of maximal rank.*

Ganapathy, Jayanthi, *$L^{p,q}$ inequalities for the Hardy-Littlewood maximal functions and the Hardy operator.*

Kraft, Jürgen, *Singularity of monomial curves.*

STATISTICS

Chen, Shun-Yu, *Restricted risk Bayes estimation.*

Huang, Mong-Na Lo, *Design problems in model robust regression and exact D-optimality.*

Huang, Wen-Jang, *On a study of point processes arising in certain live situations.*

Lau, Tai Shing, *Theory of canonical moments and its applications in polynomial regression.*

Leu, Lii-Yuh, *Contributions to multiple decision theory.*

Taylor, Wayne A., *Selecting efficient single stage and double stage attribute sampling plans of a given power.*

University of Notre Dame
(5;5,0,0,0,0,0,0)

MATHEMATICS

Elko, Constance Louise, *Embedding 4k-manifolds up to cobordism.*

Elko, David, *Extending semifree actions on finite groups on spheres.*

Fania, Maria Lucia, *Extension of modifications of ample divisors on four-folds.*

Higgins, Aparna Narayan Pradhan, *Heterogeneous algebras associated with non-indexed algebras, a representation thcorem on weak automorphisms.*

Khor, Hoe Peng, *On the automorphisms of the unipotent radical of certain parabolic subgroups of groups of Lie type A.*

IOWA

Iowa State University
(12;2,9,0,0,0,0,0,1)

MATHEMATICS

Rockswold, Gary Kent, *Stable variable step stiff methods for ordinary differential equations.*

Smith, Ronald Kenneth, I. *Circumspheres in Hilbert space.* II. *Automatic handling of finite-dimensional, nonassociative algebras.*

Steiner, Donald DeWitt, *Bijectional, generic and permutational models of* ZF.

STATISTICS

Chua, Tin Chiu, *Response errors in repeated surveys with duplicated observations.*

Harter, Rachel M., *Small area estimation using nested-error models and auxiliary data.*

Hung, Hsien-Ming, *Use of transformed LANDSTAT data in regression estimation of crop acreages.*

Lee, Youngjo, *Estimation of multivariate normal mean and its application to mixed linear models.*

Lewis, Jerry, *Some effects of subdivision of finite populations on genetic diversity measures.*

Lin, Cherng-Tarng, *Waiting times for target detection models.*

McNulty, Sallie, *Exact generalized inverses and solution to least squares problems using multiple modulus arithmetic.*

Petenate, Ademir, *Optimal allocation and other aspects of kriging on a line.*

Zamudio, Francisco, *Estimation of Poisson parameters: Maximum likelihood, Bayes, empirical Bayes or compromise?.*

University of Iowa
(7;6,1,0,0,0,0,0)

MATHEMATICS

Boyland, Philip Lewis, *Bifurcations of circle maps/Arnol'd tongues, bistability and rotation intervals.*

Burkholder, Douglas Glenn, *On Azumaya rings.*

Froelich, John, *Compact operators, invariant subspaces and spectral synthesis.*

Gallegos-Jarpa, Gricelda, *Representation theory of* Gl *of a local ring.*

Salas, Hector Nicolas, *C^*-algebras of isometries with commuting range projections.*

Tsau, Chichen Michael, *Killers of knot groups.*

STATISTICS AND ACTUARIAL SCIENCE

Manmin, Mookda, *Parameter changes in time series models.*

KANSAS

Kansas State University
(5;1,3,0,0,0,1,0)

MATHEMATICS

Maleki, Pir Mohammad, *An investigation of factors affecting social science students attitudes towards mathematics.*

Ronsse, Gregory, *Sub-manifolds of Saskian manifolds which are tangent to the structure vector field.*

STATISTICS

Albohali, Mohamed Hassan, *A time series approach to the analysis of repeated measures designs.*

Ordonez, Alfred Abelard, Jr., *Applications of sequential methods in observational studies.*

Samaranayake, Vanniarachchige Amaraisi, *Asymptotic properties of sample autocorrelations, least squares estimators and predictors of non-stationary multivariate time series.*

University of Kansas
(2;2,0,0,0,0,0,0)

MATHEMATICS

Gokhale, Sudhir B., *Joint quasitriangularity of certain pairs of essentially commuting operators.*

Tikoo, Mohan L., *Remainders of H-closed extensions.*

KENTUCKY

University of Kentucky
(6;0,6,0,0,0,0,0)

STATISTICS

Hosmane, Balakrishna, *Bias reduction in the estimation of log-linear contrasts and for related chi-square test criteria.*

Leitnaker, Mary Grace, *Delayed and nonlinear stochastic compartmental models.*

Liu, Jen-Pei, *On evaluation of the predictive ability of an estimated response surface.*

Malpass, Peter Gordon, *A queueing analysis of a telecommunications node,and related models.*

Mansouri-Ghiassi, Seied Hossein, *Asymptotically distribution-free tests in balanced two-way layouts.*

Sharma, Subhash C., *On the rates of convergence to asymptotic normality least squares estimators in linear regression model with autocorrelated errors.*

LOUISIANA

Louisiana State University, Baton Rouge
(1;0,0,0,0,0,0,0,1)

MATHEMATICS

Bridgland, Michael F., *Geodetic graphs and convexity.*

Tulane University
(6;4,0,0,0,1,0,1)

MATHEMATICS

Ballotti, Michael E., *Modern versions of the theorems of Kneser and Wiener.*

Farag, Saad F. M., *The central measure algebra of a connected Lie group.*

Keith, Verena Sabine, *On invariant bilinear forms on finite dimensional Lie algebras.*

Latiolais, Marion Paul, *Homotopy type versus simple homotopy type in dimension 2.*

Soileau, Peggy Lynn, *Tensor and torsion products of modules over valuation domains.*

Spurr, Michael J., *On the zero set of a homorphic one form.*

MARYLAND

Johns Hopkins University
(4;4,0,0,0,0,0,0)

MATHEMATICS

Bremser, Priscilla Suzanne, *Some studies on character sums over finite fields.*

Chin, Kok Leang, *On the classification of the finite dimensional Lie algebras generated by two differential operators one with constant coefficients and the other with polynomial coefficients.*

Dellomo, Michael R., *Through the non-simply connected looking glass or the inverse limit of the finite branched cyclic covers of a knot.*

Irk, Sitki, *Operators induced by Gauss sums over finite fields and the algebra generated by these operators.*

University of Maryland, College Park
(14;8,2,0,0,4,0,0)

MATHEMATICS

Chambers, Daniel Warren, *Central and functional central limit theorems for functionals of Gaussian processes.*

Chang, Myron, *Nonparametric estimation for doubly censored data.*

Deanin, Alice Ann, *Mahler's p-adic continued fraction algorithm.*

Gordon, Ben Brent, *Intersections of higher weight cycles and modular forms.*

Katok, Svetlana R., *Modular forms associated to closed geodesics and arithmetic applications.*

Fennell, James, *A p-adic transcendence measure for the Weierstrass* PE*-function.*

Majer, Vaclav, *Numerical solution of boundary value problems for ordinary differential equations of nonlinear elasticity.*

Pearn, Wen-Lea, *Capacitated Chinese Postman problem.*

Reed, George W., *Some properties and applications of higher order crossings.*

Robinson, E. Arthur, Jr., *Ergodic measure preserving transformations with finite spectral multiplicities.*

Rogers, Robert Charles, *Analysis of the nonlinear equations describing the elastic, thermal, and electromagnetic behavior of solids: Existence of solutions of semi-inverse problems.*

Schumer, Peter David, *On the large sieve inequality in an algebraic number field.*

Wun, Lap-Ming, *The effect of misspecified intervention function on parameter estimation of time series models.*

Zettler, George, *Howe duality over finite fields.*

MASSACHUSETTS

Boston University
(3;1,1,0,0,1,0,0)

MATHEMATICS

Deutsch, David, *An integral equation for the solution of non-linear wave equations.*

Heeren, Timothy C., *The robustness of the T-test when applied to ordinal scale D data.*

Sawyer, Ann K., *The Dynamics of piecewise linear mappings of the plane.*

Brandeis University
(6;6,0,0,0,0,0,0)

MATHEMATICS

Boffi, Giandomenico, *The universal form of the Littlewood-Richardson rule.*

Brown, Anne, *A structure theorem for a class of grade three perfect ideals.*

Ko, Ki Hyoung, *Seifert matrices and boundary links.*

Kollar, Janos, *Canonical threefolds.*

Munroe, Carol L., *Orders whose indecomposable nonprojective lattices are irreducible.*

Platt, Mary L., *On the Alexander polynomial.*

Clark University
(1;0,0,0,0,0,0,1)

MATHEMATICS

Bisk, Richard C., *A Markov chain model of smooth muscle contraction.*

Harvard University
(24;8,6,4,3,3,0,0)

APPLIED SCIENCES

Cao, Xi-ren, *Optimization of discrete event dynamic systems.*

Denenberg, Lawrence A., *Computational complexity of logical problems: Formulas, dependencies, and circuits.*

Dumas, William R., *Extended sensitivity analysis in linear programming.*

Huang, Peter H., *Asymptotic and structural stability of signalling equilibria.*

Keyes, David Elliot, *Numerical modeling of steady, laminar free-convective boundary layer flow beneath heated or combusting horizontal surfaces.*

Peck, Stephen R., *Pole placement by constrained output feedback.*

Shasha, Dennis, *Concurrent algorithms for search structures.*

Tay, Yong-chiang, *A mean value performance model for locking in databases.*

Sistla, Prasad A., *Theoretical issues in the design and verification of distributed systems.*

Taylor, Thomas J., *Hypoelliptic diffusions and non-linear control theory.*

BIOSTATISTICS

Accomando, William, *Resistant fitting and diagnostic methods for discrete data analysis.*

Baker, Stuart, *Markov models for categorical longitudinal data.*

Day, Roger, *A general cell kinetics model with applications to cancer treatment.*

DerSimonian, Rebecca, *Combining evidence from different sources.*

Halvorsen, Katherine Taylor, *Estimating population parameters using information from several independent sources.*

Polansky, Marcia, *Robust estimation with applications to the Poisson distribution.*

MATHEMATICS

Bailey, Colin George, *B-degrees for weakly inadmissible B.*

Datskovsky, Boris, *On zeta functions associated with the space of binary cubic forms with coefficients in a function field.*

Dunne, Ed, *Hyperfunction solutions of the zero-rest mass equations and representation theory.*

Gilbert, George, *Analytic multiplicity ones theorems for* GL(n).

Gurevich, Mikhail, *Theory of* ϵ*-representations.*

Kengmana, Thongchai, *Discrete series characters on non-Riemannian symmetric spaces.*

McCallum, William, *The Tate-Shafarevich group of the Jacobian of a quotient of the Fermat curve.*

Ticciati, Robin, *Singularities in moduli spaces of Yang-Mills fields.*

Massachusetts Institute of Technology
(16;11,0,0,1,3,0,1)

MATHEMATICS

DeBlassie, Richard Dante, *Hitting times of Brownian motion.*

Gonzalez, Fulton Beltran, *The Radon transform on Grassmannian manifolds.*

Grant, Caroline Galt, *Entire holomorphic mappings of* $\mathbf{C}$ *into surfaces of general type.*

Gregory-Allen, Richard W., *Regarding the evolution of warmed interfacial swells.*

Haddad, Ziad S., *Infinite dimensional flag varieties.*

Haughton, Dominique M. A., *On the choice of a model to fit data from an exponential family.*

Lasaga, Fernando Rene, *Counting full graphs on N sets and squares which block a pentomino.*

Levstein, Fernando, *A classification of involutive automorphisms of an affine Kac Moody Lie algebra.*

Lubarsky, Robert Seth, *Topics in admissibility theory.*

Magnuson, Alan W., *Symplectic singularities, periodic orbits of the billiard ball map, and the obstacle problem.*

Ritter, Niles D., *Progressing wave solutions to nonlinear hyperbolic Cauchy problems.*

Schroeder, Carolyn Lee, *Decay rates of Green's functions for the time independent Schrödinger equation with periodic potentials.*

Sturtevant, Dean G., *Three combinatorial problems.*

Tuckerman, Laurette S., *Formation of Taylor vortices in spherical couette flow.*

Yang, Jin-Gen, *On quintic surfaces of general type.*

OPERATIONS RESEARCH

Matsuo, Hirofumi, *Capacitated lot size problems.*

Northeastern University
(2;0,0,0,0,1,0,1)

MATHEMATICS

Abadeer, Adel A., *On zeros of solutions of ordinary differential equations.*

Erbland, John P., *Factoring maps through immersions.*

University of Massachusetts, Amherst
(4;3,0,0,0,1,0,0)

MATHEMATICS AND STATISTICS

Bennett, Fredricka Terry, *On a sequence of Markov processes converging to a multivariate Ornstein-Uhlenbeck process.*

Costa, Peter Justin, *The linearization of nonlinear evolution equations.*

Necochea, Alejandro, *Equivariant Euler classes and group actions on Poincaré duality spaces.*

Prisco, Mary Kathryn, *On the structure and classification of nilpotent Lie algebras of maximal rank.*

MICHIGAN

Michigan State University
(7;3,2,0,0,2,0,0)

MATHEMATICS

Abudiak, Fawaz, *$\mathbf{Z}_{2_p}$-actions on the 2-dimensional and the Klein bottles.*

Long, John J., *Hyponormal Toeplitz operators and weighted shifts.*

Martinez, Rafael, *PL homeomorphisms of period 2^n on the solid Klein bottle.*

Mohseni, Moghadam Mahmoud, *Homotopy continuation method for nonlinear equations.*

Riazi-Kermani, Mohammad, *Periodic orbits in the modified logistic equation.*

STATISTICS AND PROBABILITY

Schick, Anton, *On adaptive estimation.*

Wang, Wei-hong, *Statistical inference for randomly censored linear model.*

University of Michigan, Ann Arbor
(31;12,15,1,1,0,0,2)

BIOSTATISTICS

Bromberg, Judith, *Modified estimators in log-linear models.*

Chu, Shenghui, *Some aspects of the direction and collinearity factors of Wilks' lambda.*

Hung, Yung-Tai, *Some aspects of discriminant analysis.*

Katz, Barry, *Detection of a random alteration in a multivariate observation based on knowledge of probable direction.*

Mahmoudi, Mohamed, *Using auxiliary information to improve estimates of the population element variances, element covariances, and correlation coefficients.*

Naberhuis-Stehouwer, Sharon Ann, *Some aspects of recovery in interblock information.*

Ruppel, Patricia Kemp, *Drug evaluation using blocking agents in receptor systems consisting of multiple subsites.*

Vonesh, Edward F., Jr., *Relative efficiencies in the multivariate analysis of repeated meaurements.*

INDUSTRIAL AND OPERATIONS ENGINEERING

Golhar, Damodar, *Sequential analysis: Non-stationary processes and truncation.*

Hopp, Wallace John, *Non-homogeneous Markov decision processes with applications to R & D planning.*

Jaraiedi, Majid, *Inspection error modelling and economic design of sampling plans subject to inspection error.*

Umar, Amjad, *The allocation of data and programs in distributed data processing environments.*

Tsui, Louis, *Production scheduling for a fabrication-assembly system.*

MATHEMATICS

Ansari, Mohammed, *On reductive and transitive operator algebras.*

Exner, George R., *Systems of equations in the predual of an operator algebra, the classes $/A_n$, and related operators.*

Fenson, Eitan M., *Recursion over continuous type structures.*

Flinn, Barbara Brown, *The geometry of conformal mappings.*

Kim, Hyuk, *Complete left-invariant flat affine structures on simply connected nilpotent Lie groups.*

Koh, Jee Heub, *The direct summand conjecture and behavior or codimension in graded extensions.*

Lamken, Esther Rose, *Coverings, orthogonally resolvable designs and related combinatorial configurations.*

Levenberg, Norman, Jr., *Capacities in several complex variables.*

Levy, Bruce Jay, *A splitting for right angled reflection manifolds.*

Lo, Libo, *On the computational complexity of the theory of Abelian groups.*

Lyons, Russell D., *A characterization of measures on whose Fourier-Stieltjes transforms vanish at infinity.*

Ma, Frank Tzen, *Splitting in module-finite extensions and Cohen-Macaulay modules and algebras.*

STATISTICS

Daghel, Mohamed M., *Asymptotic minimax point estimators with compact parameter space.*

Denby, Lorraine, *Smooth regression functions.*

Kramer, Morrey, *Stopping a size dependent exploration process.*

Rehailia, Mohamed-el-hadi, *L_p expansions for posterior moments with applications in sequential analysis.*

Tsang, Vincent Ying Yin, *Density estimation for censored data.*

Verathaworn, Theeraporn, *Decision theoretic approaches to estimating covariance matrices in the multivariate normal one-sample and two-sample problems.*

Wayne State University
(2;1,0,0,0,0,0,1)

MATHEMATICS

Hong, Yi, *On helical submanifolds in Euclidean spaces.*

Tan, Xiao-Jiang, *Holomorphic mappings: (1) Classification of embeddings of compact complex manifolds with given normal bundle. (2) The Schwartz lemma for the Skwarcynski distance and a family of biholomorphic invariants.*

Western Michigan University
(2;0,0,0,0,0,0,2)

MATHEMATICS

Gimbel, John, *The chromatic and cochromatic number of a graph.*

Ruiz, Sergio, *On isomorphic decompositions of graphs.*

MINNESOTA

University of Minnesota, Minneapolis
(10;3,3,0,0,1,0,3)

BIOMETRY

McRoberts, Ronald, *Near non-identifiability in non-linear parameter estimation.*

MATHEMATICS

Du, Bau-Sen, *Bifurcations of diffeomorphisms on R_3.*

George, Adel Aziz Michael, *Some results on groups related to compact Riemann surfaces.*

Greene, John R., *Character sum analogues for hypergeometric and generalized hypergeometric functions over finite fields.*

Hernandez, Gaston E., *Existence of solutions of populations problems with nonlinear diffusion.*

Lau, Chi-Ping, *The boundary behavior of solutions of quasilinear second order elliptic partial differential equations arising from geometrical problems.*

Waksman, Peter, *The associated function of a plane polygon.*

STATISTICS

Clayton, Murray K., *Bayes sequential sampling for choosing the better of two populations.*

Tsai, Chih-Ling, *Contributions to the design and analysis of non-linear models.*

Witmer, Jeffrey Alvin, *Multistage decision problems.*

MISSOURI

St. Louis University
(1;1,0,0,0,0,0,0)

MATHEMATICS AND COMPUTER SCIENCE

Ryan, Kara, *A class of affine geometries.*

University of Missouri, Columbia
(3;2,1,0,0,0,0,0)

MATHEMATICS

Lucas, Thomas George, *The annihalator conditions: Property* (A) *and* (AC).

Trautman, David Anthony, *Linear topological properties of non-locally convex Hardy-Orlicz spaces.*

STATISTICS

Tarmast, Ghasem, *Reliability of complex systems.*

Washington University
(7;3,0,0,0,0,0,4)

MATHEMATICS

Rigoli, Marco, *Surfaces with parallel mean curvature vector in a 4-space form.*

Semmes, Stephen, *The Cauchy integral and related operators on smooth curves.*

SYSTEMS SCIENCE AND MATHEMATICS

Cheng, Jing-shiang, *Performance analysis for randomly dispersive optical channels.*

Hill, Stacy D., *Estimation and control on the unit circle.*

Leake, Don H., *Acceleration of iterative processes in a multiprocessor environment.*

Lin, Shin-Yeu, *Emergency control to remedy voltage and thermal violations in a segment of the large scale power system by active and reactive means.*

Stendahl, Steven J., *Functional integrals and stochastic control problems.*

MONTANA

University of Montana
(3;1,1,0,0,1,0,0)

MATHEMATICAL SCIENCES

Boyd, Ernest James, *A model for successional change in a grassland ecosystem.*

Hollister, Robert Ashley, *A correlation coefficient based on maximum deviation.*

Ulsafer, Carol A., *Module categories.*

NEW HAMPSHIRE

Dartmouth College
(1;0,0,0,0,0,0,1)

MATHEMATICS

Halsey, Mark D., *Line closure and the Steinitz exchange axiom: Hartmanis matroids.*

University of New Hampshire
(3;0,1,0,0,1,1,0)

MATHEMATICS

Dick, Thomas Patrick, *An investigation of calculus learning using factorial modeling.*

Kokoska, Stephen Michael, *Statistical methods for analysis of cancer chemoprevention experiment.*

Magness, Carolyn Margaret, *Some problems in Bayesian inference in a nonclassical setting.*

NEW JERSEY

Princeton University
(8;5,2,0,0,1,0,0)

MATHEMATICS

de Shalit, Ehud, *On p-adic L-functions associated with CM elliptic curves and arithmetical applications.*

Ho, Lop-Hing, *Subellipticity of the $\overline{\partial}$-Neumann problem on non-pseudoconvex domains.*

Kuhn, Nathaniel S., *A conjectural inequality on the slice genus of links.*

Redmond, Timothy St. J., *PL equivariant characteristic classes and G-signature.*

Scheinerman, Edward R., *Intersection classes and multiple intersection parameters of graphs.*

Silverberg, Alice, *Mordell-Weil groups of generic polarized Abelian varieties.*

STATISTICS

Morgenthaler, Stephan, *Robust confidence intervals for location and scale parameters: The configural approach.*

O'Brien, Fanny L., *Polyefficient and Polyeffective simple linear regression estimators and the absolute polyefficiency of the biweight regression estimator.*

Rutgers University, New Brunswick
(12;7,2,0,1,2,0,0)

MATHEMATICS

Adams, Norman S., *Set theoretic methods in topos theory.*

Chapin, Steven A., *Periodic solutions of some nonlinear differential-delay equations.*

Cho, Eung Chun, *Smith equivalent representations of generalized quanternion groups.*

Farmer, Joan Eileen, *Mathematical models of one-dimensional non-equilibrium systems.*

Ferreyra, Guillermo Segundo, *The partial differential equations of nonlinear filtering.*

Lindgren, Terence, *Proper morphisms of topoi.*

Maier, Robert Sullivan, *Random Schroedinger operators on a lattice: Rigorous results on the density of states.*

Mitzman, David, *Integral bases for affine Lie algebras and their universal enveloping algebras.*

Opsut, Robert, *Optimization of set assignments for graphs.*

Suh, Dong-Youp, *Smith equivalence of representations.*

STATISTICS

Chiou, Wen-Jau, *Estimating common location of exponential distributions.*

Natarajan, Jayalakshmi, *Sequential James-Stein estimation and related results.*

NEW MEXICO

New Mexico State University
(2;1,0,0,1,0,0,0)

MATHEMATICAL SCIENCES

Kirby, James Carroll, *Admissible variables and extreme point analysis.*

Stelzer, Joerg Mathias, *Ring theoretical criteria for cancellation.*

University of New Mexico
(3;2,1,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Andradas, Carlos, *Real places in function fields.*

Kim, Hae Kyung, *Statistical properties of generalized nonlinear regression estimators with application.*

Ombe, Hitoshi, *Besov spaces on certain groups.*

NEW YORK

Adelphi University
(2;0,0,0,0,1,0,1)

MATHEMATICS AND COMPUTER SCIENCE

Baderian, Armen Robert, *Solutions of the random one dimensional Reynolds equation of lubrication theory.*

Vargas, John David, *The Smirnov-Sobelev and Cagniard technique for the solution of the Lamb half-space problem in elastodynamics.*

CUNY, Graduate Center
(5;4,0,1,0,0,0,0)

MATHEMATICS

Hurwitz, Carol M., *On the homotopy of monoids.*

Jarnigan, Richard, *Statistical aspects of data structures for database systems.*

Kalish, Diane, *The Morse index theorem with ends submanifolds.*

Pzena, Howard, *The explicit construction of ring class fields with applications to quadratic forms.*

Sureson, Claude, *Excursion en mesurabilite.*

Clarkson University
(5;1,0,0,0,3,0,1)

MATHEMATICS AND COMPUTER SCIENCE

Briggs, Sanda C., *Topics in nonlinear mathematics.*

Heinssen, Dennis Karl, *Graph theory applications to architecture.*

Kachroo, Pandit Dilaram, *On the Allendoerfer-Eells cohomology of differentiable spaces.*

Knickerbocker, Collen Joseph, I, *Long waves in nonuniform media.*

Santini, Paolo Maria, *Studies on nonlinear evolution equations and the inverse scattering transform.*

Columbia University
(7;5,2,0,0,0,0,0)

STATISTICS

Chang, Fu, *Contributions to the multi-armed bandit problem.*

Liu, Yueh-Chin (Regina), *Histogram estimation of failure rate and some related functions under random censoring.*

MATHEMATICS

Lok, Walter Lawrence, *Deformations of locally homogeneous spaces and Kleinian groups*

Lyubeznik, Gennady, *Set-theoretic intersections and monomial ideals.*

Pittaluga, Marilena, *On the automorphism group of a polynomial algebra.*

Suciu, Alexandru Ion, *Homotopy type invariants of four-dimensional knot complements.*

Wu, Xiaolong, *On the extensions of abelian varieties by affine group schemes.*

Cornell University
(12;4,3,0,3,2,0,0)

APPLIED MATHEMATICS

Housman, David Leo, *Some Noncooperative game models of exchange.*

Pothen, Alex, *Sparse null bases and marriage theorems.*

BIOMETRICS

Evans, John C., *Stagewise selection and classification of multivariate repeated measurements.*

Piegorsch, Walter William, *Admissible and optimal confidence bands in linear regression.*

Sitonik, Wilson K., *Effects of distributional assumptions on the probability of correctly selecting the largest mean in a Model II balanced one-way classification.*

MATHEMATICS

Helou, Charles, *An explicit 2^nth reciprocity law.*

Lou, Jiann-Hua, *Some properties of a special class of self similar processes.*

Odell, David Alan, *Trace constructions in alpha-recursion theory.*

Webb, David Lea, *Grothendieck groups of dihedral and quaternion group rings.*

OPERATIONS RESEARCH

Fox, Robert William, *Asymptotic properties of parameter estimates for strongly dependent random variables.*

Hilliard, Michael Ross, *Weighted voting: Theory and applications.*

Madras, Neal Noah, *A process in a randomly fluctuating environment.*

New York University, Courant Institute
(9;4,0,0,0,5,0,0)

MATHEMATICS

Battifarano, Ernest, *Conservative modification of upwind differencing.*

Bledsoe, Margaret Randolph, *The method of complex characteristics for design of transonic compressors.*

Hsieh, June, *The bad Boussinesq's equation.*

Klingenberg, Christian, *On the stability of triple deck flow.*

Kondopirakis, Emanuel, *A time substitution problem.*

Mullhaupt, Andrew, *Boolean delay equations: A class of semi discrete dynamical systems.*

Sturm, Rachel, *Link cobordism invariants.*

Szyld, Daniel Benjamin, *A two level iterative method for large sparse generalized eigenvalue calculations.*

Tso, Kaising, *Perturbation theorems for nonlinear positive symmetric systems and nonlinear degenerate elliptic-parabolic equations.*

Polytechnic Institute of New York
(4;1,3,0,0,0,0,0)

MATHEMATICS

Bennett, David Alan, *A new sequential group-screening design for factorial experiments.*

Kneisler, Theodore Frederick, *A hybrid K-means clustering method.*

Lawson, John Scott, *Some aspects of the statistical analysis of time to tumor data in carcinogenicity tests.*

Pomerance, Errol, *A generalization in cobordism of the Lefschetz fixed point theorem.*

Rensselaer Polytechnic Institute
(10;1,0,5,0,4,0,0)

MATHEMATICAL SCIENCES

Ahn, John Kwangho, *Automatic map name placement system.*

Barr, Alan, *Geometric modeling and fluid dynamic analysis of swimming spermatozoa.*

Ganser, Gary, *Nonlinear waves in one-dimensional bubbly flow.*

Hagan, Robert, *Dynamic phase transitions.*

Itzikowitz, Samuel, *Theoretical studies of mesoscale eddies and their influence on acoustic transmission through the ocean.*

Kaltofen, Erich, *On the complexity of factoring polynomials with integer coefficients.*

Kandri-Rody, Abdelilah, *Effective methods in the theory of polynomial ideals.*

Narendran, Paliath, *Church-Rosser and related Thue systems.*

Sandberg, Jonathan Sheffer, *The minimum circuit cover problem.*

Spagnuolo, John, *Local recognition of certain digitized curves using automata-theoretic concepts.*

SUNY at Albany
(4;3,1,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Ali, Mirza W., *Test of equality of expected values of positive definite quadratic forms.*

Cupillari, Antonella, *Inner functions and boundaries for H^∞ on strictly pseudoconvex domains.*

Dabrowski, Romuald, *Rationality of the compact forms of semisimple affine groups.*

Perera, Shelton, *Support points and extreme points of some classes of analytic functions.*

SUNY at Binghamton
(2;2,0,0,0,0,0,0)

MATHEMATICAL SCIENCES

Lawrence, L. Brian, *General product spaces.*

Mahdavianary, Seyed Kazem, *Groups with many subgroups.*

SUNY at Buffalo
(3;2,1,0,0,0,0,0)

MATHEMATICS

Flagg, Robert C., *Integrating classical and intuitionistic mathematics.*

Shambayati, Rahim, *Fourier transforms of distributions with one-sided bounded supports and their products.*

STATISTICS

Chen, Chang-Shang, *On the estimation of system reliabilities.*

SUNY at Stony Brook
(17;9,1,0,0,6,0,1)

APPLIED MATHEMATICS AND STATISTICS

Chen, Dao-Qi, *Methods for function minimization.*

Choi, Young-Myung, *Single vehicle trailer routing and scheduling problem with partial loads, time windows and dwell times.*

Don, Eugene C., *A numerical procedure for the solution of nonlinear eigenvalue problems.*

Kim, Kwang Ick, *Inverse problems for attenuated random transform.*

Lee, Kelvin C., *Numerical study of an orthotropic solid under dynamic loads.*

Ong, Michael King, *Numerical solution of elasto dynamic problems in fracture mechanics.*

Rodriguez, Juan Carlos, *Maximum entropy histograms.*

Xie, Guan-Quan, *Theoretical analysis and computational method of inverse problems of wave equations.*

MATHEMATICS

Cortes, Victor, *About the smoothness of the limiting distribution functions.*

Hurley, John, *The Schur multiplier of the exceptional Lie group G_2.*

Lee, Min Ho, *Conjugation of group theoretical Abelian schemes over an arithmetic variety.*

Moskowitz, Ira, *Volume preserving foliations and diffeomorphism groups.*

Petersen, Troels, *On the geometry of Abelian schemes over arithmetic varieties.*

Purohit, Dayal, *Curvature inequality and certain Toeplitz-like operators.*

Rosenthal, William Evan, *On the cohomology of Lie algebra extensions.*

Sung, Li-yeng, *Gaussian beams.*

Xia, Jingbo, *Traces, indices and spectral theory of Toeplitz operators on multiply connected domains.*

Syracuse University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Droms, Carl Gordon Arthur, *Graph groups.*

University of Rochester
(1;1,0,0,0,0,0,0)

MATHEMATICS

Silva, Cesar Ernesto, *On Radon-Nikodym derivatives.*

NORTH CAROLINA

Duke University
(5;3,0,0,0,2,0,0)

MATHEMATICS

Goodrich, John Winston, II, *A mathematical analysis and numerical simulation of inert gas flow in a model avian parabronchial lung.*

Israel, Karen Foster, *Monotone behavior for equilibria of dynamical systems.*

Messer, Thomas Clark, *The propagation and creation of singularities of solutions of quasilinear, strictly hyperbolic systems in one space dimension.*

Micheli, Lucio, *Propagation of singularities for non-strictly hyperbolic semilinear systems in one space dimension.*

Reid, Leslie Foster, *Some results on the lower K-theory of singular affine algebras.*

North Carolina State University, Raleigh
(12;2,3,0,4,0,0,3)

MATHEMATICS

Jensen, David Warren, *Derivations of a prime ring which satisfy a polynomial identity.*

Smith, Marjolein V., *Stochastic differential equations from a modeling point of view with special emphasis on biological applications.*

OPERATIONS RESEARCH

Abdel-Gawad, Ekram Fathy, *Control of arrivals and routing in networks of queues with applications to communication systems.*

Chou, Jaw H., *Contributions to nondifferential mathematical programming.*

Erdem, Ismail, *Three phase sampling for misclassified binary data.*

Rajasekera, Jayantha Ranjith, *Perturbational techniques for the solution of posynomial, quadratic and l_p-approximation programs.*

STATISTICS

Chalfant, James Allen, *Choosing among flexible functional forms: An application of the generalized Box-Cox and Fourier flexible forms to U. S. agriculture.*

El Badawi, Ibrahim, *Semi-nonparametric analysis of consumer demand systems.*

Elssamadisy, Elssayed Mousa, *An extended life cycle model of investments, work and consumption.*

Fountis, Nicolaos George, *Test for a unit root in autoregressive multivariate time series.*

Hester, Robert Allen, Jr., *Uniform residuals and NU residuals tests for heteroscedasticity.*

Tamura, Roy Noriki, *Minimum Hellinger distance estimators for multivariate location and covariance.*

University of North Carolina, Chapel Hill
(17;3,11,0,1,1,0,1)

BIOSTATISTICS

Andrade, Dalton, *ML estimation and LR tests for the multivariate normal distribution with patterned mean and covariance matrix. Complete and incomplete data cases.*

Boyle, Kerrie Eileen, *Survival model for fertility evaluation.*

Bryant, Edward Carroll, *Area-under-the-curve analysis and other analysis strategies for repeated measures clinical trials.*

Hawkins, Doyle L., *Sequential detection procedures for autoregressive processes.*

Johnson, Robert Earl, *A comparison of error probabilities for two standard analyses of variance in unbalanced two-way designs.*

Stanek, Edward J., III, *The relationship between weighted least squares categorical data analysis, seemingly unrelated regression and growth curve analysis.*

Whaley, Fredrick Seymour, *Some properties of the two-sample multidimensional runs statistic.*

MATHEMATICS

Goolsby, Ronnie, *Duality for polynomially complete subspaces for Bergman spaces.*

Halchin, Judy Diane, *Analytic properties of random power series.*

Hemakul, Wanida, *A Neuman problem associated with the ordinary differential equation of second order.*

Martin, Mary Barone, *Invertible ideals in a polynomial ring.*

Sullivan, Frances Patrick, *Entropy and dimension for conformal real and complex dynamical systems.*

OPERATIONS RESEARCH AND SYSTEMS ANALYSIS

Mitchell, John Christopher, *Multi-item (s,S) inventory systems with a service objective.*

STATISTICS

Giltinan, David Michael, *Bounded influence estimation in heteroscedastic linear models.*

Kim, Byung Soo, *Studies in multinomial mixture models.*

Smith, Robert Alan, *Asymptotic behavior of degenerate U-statistics.*

Stefanski, Leonard A., *Influence and measurement error in logistic regression.*

OHIO

Case Western Reserve University
(6;0,0,0,5,0,0,1)

BIOMETRY

Keltner, Lew, *A software system for display of family relationships and information in pedigree form.*

OPERATIONS RESEARCH

Chen, Wen-Kuei, *A mean-lower partial moment analysis of hedge portfolios.*

Madey, Gregory Richard, *A corporate R&D strategic planning and budgeting model.*

Nishimura, Koichi, *Applications of integer programming to radio frequency management.*

Thadathil, Jacob Mani, *Optimization methods in hierarchical holographic modeling.*

Venkateswaran, V., *A new approach for determining when the linear complementarity problem has no solution.*

Kent State University
(3;3,0,0,0,0,0,0)

MATHEMATICAL SCIENCES

Eid, Ghazi Mahmoud, *Classical quotient rings with perfect topologies.*

Norfolk, Timothy Shane, *On the zeros and poles of Pade approximants to certain hypergeometric functions.*

Wei, Yu Chuen, *L-L integral transforms.*

Ohio State University
(12;5,3,0,0,1,0,3)

MATHEMATICS

Bagchi, Sitadri Nath, *On* A.E. *convergence of classes of multivalued asymptotic martingales.*

Chidume, Charles Ejike, *Iteractive methods and nonlinear functional equations.*

Grove, John Whitaker, *A priori estimates in non-isentropic gas dynamics.*

Hung, David Cheung-Yan, *Theta series of quadratic forms over* $\mathbf{Z}$ *and* $\mathbf{Z}[(1+\sqrt{p})/2]$.

Sheen, Rong-Chyu, *Orthogonal polynomials associated with* $\exp(x^6/6)$.

Thirunavukkarasu, K., *Quotient sets, homomorphic images and multipliers.*

Wajima, Masayuki, *Non-associative algebras and their automorphism groups.*

STATISTICS

Chauhan, Chand K., *Orthogonal factorial structure in an incomplete block design.*

Shukla, Rakesh, *The statistical analysis of* DNA/RNA *base sequence symmetries and the role of biological marker in leukemia through multistate survival analysis.*

Voss, Daniel Thomas, *Confounding in single replicate factorial designs.*

Wang, Chinying Jean, *Simulation study of grouped effect of Cox's regression with application to liver cancer.*

Willavize, Susan Anne, *Nonparametric discrimination: A comparative study of several methods for the univariate two-sample case.*

Ohio University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Grabner, Elise Marlene, *Pre-images of certain generalized metric spaces.*

University of Cincinnati
(7;2,1,1,1,0,0,2)

EPIDEMIOLOGY AND BIOSTATISTICS

Ruberg, Stephen John, *An adaptive two-sample for shifts in location using truncated ranks.*

MATHEMATICAL SCIENCES

Bendjilali, Boualem, *Stability of an economic system using ordinary and retarded functional differential equations.*

Benedict, Jeffrey P., *A unification of several multivariate statistical procedures with new applications.*

Guacaneme, Julio Enrique, *Aspects of the theory of Tikhonov's method for the numerical solution of integral equations.*

Ortega, Louis A., *A Sturmian theorem for parabolic operator with periodic coefficients and applications.*

QUANTITATIVE ANALYSIS

Godlewski, Fabienna, *Analysis of coordination mechanisms in decentralized, hierarchical decision making processes.*

Leigh, William Ernest, Jr., *Interpretation of natural language database queries using optimizating methods.*

OKLAHOMA

Oklahoma State University
(6;1,4,0,0,1,0,0)

MATHEMATICS

El-Gebeily, Mohamed, *Isometries and epsilon-near isometries of analytic function spaces.*

Hoecker, Niel Edward, *A modified finite difference method to solve elliptic partial differential equations with reentrant corners.*

STATISTICS

Cook, Peyton, *A Bayesian analysis of auto-regressive processes: Time and frequency domain.*

Hamdy, Hosny, *Sequential estimation of the parameters of negative exponetial and rectangular distributions.*

Moen, David, *The Bayesian analysis of structural change in multivariate linear models.*

Sung, Chung-Hsien, *The estimation of stability parameters.*

University of Oklahoma
(1;1,0,0,0,0,0,0)

MATHEMATICS

Harmon, Dennis Ray, *NK_1 of non-abelian groups.*

OREGON

Oregon State University
(2;0,2,0,0,0,0,0)

STATISTICS

Hanlen, Richard C., *An atomic approach to assessing the outlier properties of probability models.*

McClellan, Paul James, *Maximum-efficient admissible linear unbiased estimation in mixed linear models.*

University of Oregon
(3;2,0,0,0,0,0,1)

MATHEMATICS

Johnson, Diane Louise, *Fixed point evaluation in Gaussian quadrature and generalized monosplines of minimal norm.*

Owens, Margaret Ann, *Continua which are unicoherent at a subcontinuum.*

Rowell, James W., *Unilateral Fredholm theory in Banach algebras.*

PENNSYLVANIA

Carnegie-Mellon University
(12;1,5,0,0,3,0,3)

MATHEMATICS

Chen, Tsu-fen, *On finite element approximations to compressible flow problems.*

Cox, Christopher Lee, *Weighted least squares finite element methods for domains with corners.*

Deisher, Caroline I., *A survey of the applications of Pólya's enumeration theorem.*

Miller, Dale, *Proofs in higher-order logic.*

Spear, Kathleen Ann, *Some results in continuum mechanics.*

Suri, Manil, *Mixed variational principles for time dependent problems.*

Thomas, John Powers, Jr., *A qualitative analysis of an elastic-plastic oscillator with conservative loading.*

STATISTICS

Bellow, Michael Elliot, *Performance of self-organizing sequential search heuristics under stochastic reference models.*

May, Sherryl, *Log-linear modelling techniques applied to some epidemiologic and psychiatric data.*

Saphire, Diane G., *Estimation of victimization prevalence using data from the national crime survey.*

Stasny, Elizabeth Ann, *Estimating gross flows in labor force participation using data from the Canadian labour force survey.*

Wu, Da-Ching, *An analysis of first nuptial confinements in Australia.*

Lehigh University
(2;2,0,0,0,0,0,0)

MATHEMATICS

Frantz, Deborah A., *Summability methods, probability distributions, and associated positive linear operators.*

Friedland, Lewis, *A certain class of almost Hermitian manifolds.*

Pennsylvania State University
(5;5,0,0,0,0,0,0)

MATHEMATICS

Abu-Sbeih, Moh'd Zuheir Ibrahim, *Wrapped coverings and genus embeddings of graphs.*

Bator, Elizabeth Mary, *Duals of separable Banach spaces.*

Matet, Jean Pierre, *Filters of partitions and generalized descriptive set theory.*

Presler, Dwayne Lyle, *On the solution of a minimax dual.*

Reiter, Clifford Arno, *Large fundamental units and the monomial norm equation.*

Temple University
(5;2,3,0,0,0,0,0)

MATHEMATICS

Cavaliere, Richard, *Automorphic integrals and their period functions.*

Horwitz, Alan, *Optimal recovery and restricted interpolation of certain classes of functions.*

STATISTICS

Boik, Robert J., *Multiplicative models for interaction in unbalanced two-way ANOVA.*

Dinh, Khoan Tan, *A new multivariate distribution related to the minimum variance unbiased estimator of the multivariate normal with applications.*

Moore, Annette L., *Extensions of multivariate missing plot techniques to bivariate design settings.*

University of Pennsylvania
(4;2,2,0,0,0,0,0)

MATHEMATICS

Brittain, Donald Lee, *A diameter pinching theorem for positive Ricci curvature.*

Petro, John, *Great sphere fibrations of manifolds.*

STATISTICS

Dunn, Dennis, *Estimation of parameters in discrete time hazards models.*

Haroun, Ahmed, *On the asymptotic efficiency of the moment estimates of the covariances of a stationary moving average process.*

University of Pittsburgh
(7;1,5,0,0,1,0,0)

BIOSTATISTICS

Arbutiski, Thomas, *A family of multiplicative survival models incorporating cure as a function of covariates.*

Seth, Anand K., *Some statistical considerations in the analysis of incomplete data on weight of cleft palate children.*

MATHEMATICS AND STATISTICS

Nayak, Tapan K., *Applications of entropy functions in measurement and analysis of diversity.*

Peddada, Shyamal Das, *Some contributions to the theory of non-negative estimation of variance components, with applications components.*

Sarkar, Shakuntala, *Correlated regression equations and inference from nonnormal populations.*

Sledge, Frank R., *A finite element implementation of the dual variable method for the Navier-Stokes equations.*

Zomorrodian, Reza, *Homomorphisms of Fuchsian groups and nilpotent automorphism groups of Riemann surfaces.*

RHODE ISLAND

Brown University
(4;4,0,0,0,0,0,0)

MATHEMATICS

Blomstrom, Carol Ann, *Extrinsically symmetric and planar geodesic isometric immersions in Pseudo-Riemannian space forms.*

Dorman, David Richard, *Prime factorization of singular moduli.*

Ryan, Kevin M., *Schubert varieties in the flag manifold of* $\mathrm{SC}(n, C)$.

Spyropoulos, Konstantine, *Certain diophantine equations of degree three and four.*

SOUTH CAROLINA

Clemson University
(4;0,0,2,0,2,0,0)

MATHEMATICAL SCIENCES

Black, Stephen Bennett, *Coordination of control for large-scale systems.*

Frawley, Michael David, *Discrete models for nonwoven fabrics.*

Pfaff, John Stuart, *Algorithmic complexities of domination-related graph parameters.*

Stevenson, Dennis Elliott, *A framework for the development of simulation systems.*

University of South Carolina
(1;0,1,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Patterson, Ronald F., *Strong convergence theorems for exchangeable arrays of random variables and random elements in banach spaces.*

TENNESSEE

University of Tennessee
(6;2,0,0,0,4,0,0)

MATHEMATICS

Allen, Edward J., *A Galerkin method for numerically solving the energy-dependent neutron transport equation.*

Bestvina, Mladen, *Characterizing K-dimensional universal Menger compacta.*

Bowers, Philip Lee, *Applications of general position properties of dendrites to Hilbert space topology.*

de Luna, Jose T., *Analysis of mathematical models of resource-consumer-toxicant interactions.*

Goyal, Sulbha, *A class of Rosenbrock-type schemes for second-order nonlinear systems of ordinary differential equations.*

Guirguis, George H., *On the existence, uniqueness, regularity and approximation of the exterior Stokes problem in R^3.*

TEXAS

North Texas State University
(3;3,0,0,0,0,0,0)

MATHEMATICS

Huang, Kuodo James, *Algebraic numbers and topologically equivalent measures.*

Walsh, John Breslin, *Iterative solution of linear boundary value problems.*

Williams, Stanley Carl, *Universally measurable sets and nonisomorphic subalgebras.*

Rice University
(5;1,1,1,0,2,0,0)

MATHEMATICAL SCIENCES

Boswell, Steven Blake, *Nonparametric mode estimation for higher dimensional densities.*

Fontecilla, Rodrigo, *A general convergence theory for quasi-Newton methods for constrained optimization.*

Scheidler, Michael Joseph, *Acceleration waves.*

Zadeck, Frank Kenneth, *Incremental data flow analysis in a structured program editor.*

MATHEMATICS

Wilkinson, Steven V., *Characterizing Gauss maps.*

Southern Methodist University
(4;0,2,0,2,0,0,0)

OPERATIONS RESEARCH

Farhangian, Keyvan, *Networks with side constraints: An LU factorization update for the working basis inverse.*

Patty, Bruce Willard, *The suppressed basis algorithm for linear programs with special structure.*

STATISTICS

Eslinger, Paul W., *Minimum Hellinger distance estimation.*

Lee, Young-Ha, *A modified bootstrap method for distribution free confidence intervals.*

Texas A & M University
(1;0,1,0,0,0,0,0)

STATISTICS

Spector, Philip Charles, *Analysis of variance with autocorrelated errors.*

University of Houston
(3;2,0,0,0,1,0,0)

MATHEMATICS

Nall, Van Clyne, *Weak confluence and W-sets.*

Roberson, Pamela D., *An uncountable collection of Case-Chamberlain type continua with no model.*

Sparra, James, *Stochasitc approximation of fixed points.*

University of Texas, Arlington
(5;2,1,0,0,0,0,2)

MATHEMATICS

Chiou, Chwei-Jeng (Paul), *On the choice of a prior distribution for binomial sampling: An information theoretic approach.*

Mahaney, Lou Ann, *On primary factorization and generating sets for ideals in commutative rings.*

McCasland, Roy Lynn, *Some commutative ring results generalized to unitary modules.*

Moore, Jane Karen Camp, *Two generalized concepts of ordinary differentail equations: M_0-stability and mixed monotone operators.*

Pandit, Sudhakar G., *The method of upper, lower solutions for hyperbolic partial differential equations.*

University of Texas, Austin
(3;1,1,0,0,1,0,0)

MATHEMATICS

Kuga, Ken'ichi, *On immersed 2-spheres in some 4-manifolds.*

Seager, Mark Kennedy, *Adaptive finite element grid generation and extension for elliptic problems posed on unbounded domains.*

Wuu, Julie, *Efficient incomplete block designs.*

UTAH

University of Utah
(1;1,0,0,0,0,0,0)

MATHEMATICS

Luminet, Denis Laurent, *A functional calculus for Banach algebras with polynomial identities.*

VIRGINIA

University of Virginia
(4;2,0,2,0,0,0,0)

APPLIED MATHEMATICS AND COMPUTER SCIENCE

Carson, Scott David, *Geometric models of concurrent programs.*

Charlton, Spottswood Coleman, *Lookahead paging algorithms.*

MATHEMATICS

Kennedy, Thomas Garrett, *A rigorous study of the mean field approximation of Debye and Huckel for Coulomb systems.*

Young, Virginia Ruth, *Branched coverings arising from group actions.*

Virginia Commonwealth University
(3;0,3,0,0,0,0,0)

BIOSTATISTICS

Best, Alvin M., III, *A Monte Carlo evaluation of a method to determine confidence region about the stationary point and the response of the stationary point in a response surface model.*

Goodlow, Janis Lee, *Use of confidence regions for testing hypotheses concerning activity and therapeutic synergism in chemotherapy experiments.*

Schwab, Barry S., *Parametric and nonparametric analysis of the multiple design mulitvariate linear model.*

Virginia Polytechnic Institute and State University
(18;1,3,0,6,1,0,7)

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Beaton, Robert John, *Image quality and human performance: An evaluation of quantitative predictors for soft-copy and hard-copy displays of digital images.*

Cavalier, Tom Michael, *Static and sequential location-allocation problems on networks and areas with probabilistic demands.*

Chansaenwilai, Petcharat, *Monotone bounds on the productivity of fixed-cycle production lines.*

Chao, Betty Pao-Ti, *Human performance evaluations of selected image enhancement/restoration techniques.*

Co, Henry C., *Design and implementation of flexible manufacturing systems: Some analysis concepts.*

Cordes, Richard Edward, *Use of magnitude estimation for the evaluation of software ease-of-use using direct and indirect comparison approaches.*

Jones, Marilyn Smith, *A computerized robot selection system.*

Kiessler, Peter Charles, *Flows in queueing networks.*

Leung, Larry C., *A time-dynamic production function approach to equipment replacement decisions and economic equipment replacement models for flexible manufacturing systems.*

Rajan, Roby, *A game theoretic analysis of cooperative phenomena in oligopolistic markets.*

Revesman, Mark Elliot, *Validation and application of a model of human decision making for human/computer communication.*

MATHEMATICS

Fernandez, Roberto, *Study of ferromagnetic systems with many phase transitions.*

Khouzam, Fouad, *Stiffly stable Adams-type methods.*

Landman, Bruce Michael, *Generalized van der Waerden numbers.*

Miekisz, Jacek, *Gibbs states in ferromagnetic, abelian systems.*

STATISTICS

Banks, David Lane, *A nonparametric Bayesian test.*

Grubbs, William Douglas, *Collinearity in simultaneous systems.*

Hussey, James Robert, *Effects of correlation induction schemes on variance criteria and experimentally designed computer simulation.*

WASHINGTON

University of Washington
(11;3,0,0,2,5,0,1)

APPLIED MATHEMATICS

Easthope, Paul Fripp, *An alternative approach to boundary layer disturbances.*

Li, Hon Keung, *Part* I. *Resonant interactions for nearly periodic weakly nonlinear dispersive waves. Part* II. *Resonant modal interactions and adiabatic invariance for a nonlinear wave equation in a variable domain.*

Mansfield, Edward Joseph, *Modeling and control of membrane transport processes: Applications to lung fluid balance.*

Murray, John Michael, *On the proper extension of optimal control problems to admit impulses.*

MATHEMATICS

Bell, Allen Davis, *Localization and ideal theory in Noetherian crossed products and differential operator rings.*

Bell, Bradley Martin, *Nonsmooth optimization by successive quadratic programming.*

Chakravarti, Rajiva Srinivas, *The basic element theorem for fully bounded rings.*

Saerens, Rita, *Interpolation manifolds.*

Sallee, John Francis, *Some triangulations of cubes.*

Treiman, Jay S., *A new characterization of Clarke's tangent cone and its applications to subgradient analysis and optimization.*

Vakil, Nader, *Infinitesimal spaces: A topological characterization of Wattenberg infinitesimals.*

Washington State University
(3;3,0,0,0,0,0,0)

MATHEMATICS

Boerner, Victoria Lee, *A new class of semifields.*

Chang, Li-Ly, *Basic scales.*

Pérez-Esteva, Salvador, *Convolution operators for the one-sided Laplace transformation.*

WISCONSIN

University of Wisconsin, Madison
(14;14,0,0,0,0,0,0)

MATHEMATICS

Adams, Colin Conrad, *Hyperbolic structures on link complements.*

Byun, Hyeja, *Endomorphism rings and elementary division theory for modules over Dedekind-like rings.*

Calcaterra, Robert Anthony, *Galois correspondences in group actions.*

Carroll, Jeffrey Steven, *Recursively enumerable equivalence relations.*

Enayat, Ali, *Topics in the model theory of set theory.*

Fajardo, Sergio, *Contributions to the model thoery of probability logics.*

Falk, Michael J., *Geometry and topology of hyperplane arrangements.*

Fernando, Suren Lala, *Simple weight modules of complex reductive Lie algebras.*

Franzosa, Robert David, *Index filtrations and connection matrices for partially ordered Morse decompositions.*

Goldwasser, John L., *Some contributions to the theory of permanents.*

Jia, Rong-qing, *Spline interpolation and some related topics.*

Kass, Steven Neil, *A recursive formula for characters of simple Lie algebras.*

Ross, David A., *Measurable transformations in saturated models of analysis.*

Shao, Jia-yu, *On the properties of nonnegative primitive matrices,irreducible matrices and their associated directed graphs.*

WYOMING

University of Wyoming
(2;1,1,0,0,0,0,0)

MATHEMATICS

Waters, Charles William, *Some fixed point theorems for radial contractions, nonexpansive, and set valued maps.*

STATISTICS

Andrew, Michael Elliot, *Hypothesis tests involving ocean wave properties.*

CANADA

Carleton University
(3;3,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Chaudhry, Muhammad Aslam, *Distributional Hilbert transform and boundary value problems.*

Estrada Navas, Luis, *On selfinjective algebras of finite representation type.*

Shah, Mihr Jahanian, *Certain infinite sums involving ultraspherical polynomials and ultraspherical functions of the second kind.*

McGill University
(6;4,1,0,0,1,0,0)

MATHEMATICS AND STATISTICS

Jay, C. Barry, *Generalizing the structure-semantics adjuntion: Operational categories.*

Kenny, Patrick Joseph, *Ergodic measures for a class of horocycle flows.*

Power, John Anthony, *Butler's theorem and adjoint squares.*

Provost, Serge, *Distribution problems connected with the multivariate linear functional relationship models.*

Sangines, Luis Manuel, *On quadratic planes.*

Selby, Alan M., *Determinacy and unfoldings for non-smooth maps.*

McMaster University
(2;1,0,0,0,0,0,1)

MATHEMATICAL SCIENCES

Cho, Chung Je, *Combinatorial designs with prescribed automorphism types.*

Poole, David Gordon, *Prime ideals and localization in Noetherian Ore extensions.*

Queen's University
(2;1,0,1,0,0,0,0)

MATHEMATICS AND STATISTICS

Dilcher, Karl H., *Zeros of Bernoulli polynomials.*

Meijer, Hendrikus, *Cryptology: Computational complexity and applications.*

Université de Montréal
(4;1,2,0,0,1,0,0)

MATHÉMATIQUES ET STATISTIQUE

Baghagha, Layachi, *Estimation par le maximum de vraisemblance dans les modèles des réponses aléatoires.*

Boivin, Andre, *Approximation uniforme harmonique et tangentielle holomorphe ou méromorphe sur les surfaces de Riemann.*

Hudon, Georges, *Tests concernant la moyenne d'une population normale multivariée.*

Karrakchou, Jamila, *Analyse et commande des systèmes différentiels fonctionnels de type héréditaire.*

Université Laval
(2;1,0,0,0,1,0,0)

MATHÉMATIQUES

Fortin, Andre, *Methodes d'éléments finis pour les équations de Navier-Stokes.*

Zraibi, Abdelwahab, *Sur les fonctions analytiques multiformes.*

University of British Columbia
(5;4,0,0,0,1,0,0)

MATHEMATICS

Foreman, Michael, *Dispersion analyses of finite element solutions of the shallow water equations.*

Holzmann, Wolfgang, *Involutions with* 1 *or* 2*-dimension fixed point sets on orientable torus-bundles over a* 1*-sphere and on unions of orientable twisted* 1*-bundle over a Klein bottle.*

Sertoz, Sinan, *Singular holomorphic foliations.*

Sharpe, Bruce, *The Faddeer-Popov techniques in gauge field theories.*

Slade, Gordon Douglas, *An asymptotic loop expansion for the effective potential in the* $P(\phi)_2$ *quantum field theory.*

University of Calgary
(1;1,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Offin, Daniel C., *An index theory for periodic orbits in Hamiltonian systems.*

University of Manitoba
(1;0,1,0,0,0,0,0)

STATISTICS

Weiss, Günter Max Theodor, *A large deviation study of consistent estimation of a translation invariant location parameter.*

University of Toronto
(5;0,5,0,0,0,0,0)

STATISTICS

Bartlett, Sheryl Anne, *Posterior and predictive distributions for the normal multivariate linear model with monotone blocks of data which are missing at random.*

Berkowitz, Jonathan, *On assessing the chi-squared approximation to log likelihood ratio tests.*

Hui, Tak-Kee, *On tests of multivariate normality.*

Katapa, Rosalia Sam, *Statistical analysis of familial data.*

Stukel, Therese, *Generalized logistic models.*

University of Waterloo
(11;4,2,0,3,2,0,0)

APPLIED MATHEMATICS

Goode, Stephen W., *Spatially inhomogeneous cosmologies and their relation with the Friedmann-Robertson-Walker models.*

Vrscay, Edward Robert, *Continued fractions, algebraic and quantum mechanical large order perturbation theory.*

COMBINATORICS AND OPTIMIZATION

Caron, Richard John, *A parameterized Hessian quadratic programming problem.*

Cook, William John, *On some aspects of totally dual integral systems.*

Feofiloff, Paulo, *Disjoint transversals of directed coboundaries.*

Koop, Gerald Jacob, *Optimal multiple shift manpower scheduling models and algorithms.*

O'Neill, Philip Francis, *Piecewise continuous optimization.*

Richter, Robert Bruce, *The topology of embedded graphs.*

PURE MATHEMATICS

Simons, Gordon Edward, *Varieties of rings, groups and lattices with definable principle congruences.*

STATISTICS AND ACTUARIAL SCIENCE

Bartlett, Roy F., *On estimation with kriging for finite populations under super-population models.*

DiCiccio, Thomas Jules, *Higher order comparisons of asymptotic methods for conditional and unconditional interval estimation.*

University of Western Ontario
(3;1,0,0,0,2,0,0)

APPLIED MATHEMATICS

Beaudoin, Yves, *The iterative solution of a nonlinear equation using the integral-equation formulations of an imbedding.*

Salhani, Douglas Stephen, *Numerical solutions to porous flow problems.*

MATHEMATICS

Thomas, George Rubin, *Reflectivity: A generalization of commutativity, cancellation and separativity in semigroups.*

University of Windsor
(1;0,1,0,0,0,0,0)

MATHEMATICS

Masaro, Joseph C., *A-optimal weighting designs.*

Doctoral Degrees Conferred 1982-1983

Supplementary List

The following entry supplements the list of thesis titles published in the November 1983 *Notices*, pages 734–747, and in the April 1984 *Notices*, pages 331-332.

MINNESOTA

University of Minnesota, Minneapolis
(1;0,1,0,0,0,0,0)

STATISTICS

Christensen, Ronald R., *Searching for the lowest price using Dirichlet processes to model the unknown price distribution.*

Mathematics Salaries: Up and Competitive

by R. D. Anderson

The College Placement Council Salary Survey analyzes initial (nonteaching) offers to bachelor's and master's candidates in various disciplines and by various categories of employment. The 1983-1984 report (July 1984) uses data from 187 placement offices at 162 colleges and universities in the United States. The table below gives data for all those curricula with at least 500 offers reported for bachelor's candidates in 1983-1984 (with monthly salary reports converted to an annual basis).

Curriculum (for all types of Employers)	Average 83-84 Offer (12 month basis)	% Change From 82-83
Chemical Engineering	$27,420	+2.6
Electrical Engineering (incl. Comp. Engineering)	26,556	+4.0
Mechanical Engineering	26,280	+4.5
Industrial Engineering	25,224	+2.6
Engineering Technology	24,936	+3.6
Computer Science	24,552	+5.4
Mathematics	*23,400*	*+8.4*
Civil Engineering	22,764	+1.5
Economics	19,980	+4.7
Accounting	19,524	+4.0
Business (Gen'l incl. Mgmt.)	18,660	+4.6
Marketing & Distribution	17,820	+5.2
Humanities	17,724	+7.0
Other Social Sciences	17,424	+10.0

Of the eighteen categories of employment listed in the report about a third of the 533 offers to mathematicians were in the "banking, finance and insurance" category and another third were in the "aerospace, electronics and instruments" category with the remaining third scattered among the other sixteen categories. Interestingly, in each of these two employment categories with high employment of mathematicians, the average offer to mathematicians was slightly in excess of the average offer to computer scientists in the same employment category.

The average Master's candidate offer in mathematics (78 offers reported) was $28,764, about $1,300 below that for Computer Scientists and $2,200 below that for Electrical Engineers but about $5,500 above that for Master's candidates in Accounting. The average math offer was up 12.9% from the 1982-1983 level, more than twice the increase in the three other disciplines cited here.

The data here provide further evidence that mathematicians are in increasing demand and are doing very well in the "real world". Mathematics training as well as that in computer science and engineering is being recognized as increasingly important in the age of technology. Those of us in mathematics should get the word out to high school students and undergraduates.

A Word of Caution: The size of salary offers depends on supply, demand, the state of the economy, tradition, and many other factors. One cannot tell with certainty what the market would be like under a really large increase in the supply of mathematics majors. However, the central and pervasive role of mathematics in the age of technology should help prevent the boom-or-bust employment phenomena that occasionally affect more specialized areas of science and engineering.

Mathematics and Technology

by Robert Hermann

For twenty-five years I have been involved with the development of mathematics in science and technology: Thus I am very pleased to see the recent Report of the "Ad Hoc Committee on Resources for the Mathematical Sciences," published in the August 1984 issue of the *Notices*. As part of their campaign to persuade Congress to make up for the bad treatment mathematics has received in the last fifteen years, they have suggested as first priority—at least it is first on their list of "Opportunities"—the development of Mathematics and Technology. I hope such attention by a distinguished panel will, as a side benefit, bring to the attention of the mathematical world the prospects and realities of life outside of the cocoon of academic mathematics. I would like to supplement the Report with a few comments based on my own experience.

The main thrust of the Report is the financial situation: Mathematicians, having no need of extensive facilities or postdoctoral programs, have not fought as have the physicists and other scientists and engineers to keep the share of the pie which they had in the 1960s. The Report goes into considerable documentary detail about this, but does not speculate on the underlying reasons. My own belief is that the mathematicians who were involved with process of scientific policy and politics—and they form a small closed group—did not want to become involved with the messy political business of radically changing direction from the monolithically "pure" emphasis of the 1960s and developing new institutions needed to solve old problems of balance between "pure" and "applied." These problems are especially acute in American mathematics, which has historically had little of the interaction between theory and applications which existed in the great European centers of the early 20th century. (Many of the refugees of the 1930s—most notably Weyl and von Neumann—remarked on this imbalance in the structure of American mathematics, and warned of the problems to come.) There has been some encouraging change of emphasis since 1970 towards renewed intellectual contact between science and engineering, and development of subjects like Numerical Analysis and Combinatorics which are closely linked to applications; but it has been too little and too late.

Part of the problem has been the gap between life and perception in the mathematical Centers—the Berkeleys, Harvards, NYU's—and the outside world. The Committee which wrote the Report is strongly represented by people from these Centers, and their point of view is evidently dominant. Everything looks neat and clean from this Olympian perspective: Let us drive ahead and develop Global Analysis or Supercomputers or whatever and the goodies will flow out to Science and Technology. However, those of us out in the trenches often find little appreciation or understanding among most mathematicians of what is involved in this process of development of mathematics used in other disciplines. It is very difficult for anyone trained in pure mathematics who wants to work on the mathematical problems of interest to scientists and engineers: Like rowing upstream, with people on the shore throwing rocks at you.

The mathematical areas of greatest importance for science and technology often first arise from inconspicuous origins which have no obvious place in the world of the mainstream mathematician. Two examples are Soliton and Control theory. Now in principle there is nothing contradictory about this: From a sufficiently broad perspective everything flows together. Solitons have been absorbed into this Big Picture—thanks mainly to the Russian mathematical community, which for historical reasons seems to have more of a feeling of how mathematics is applied. In Control, this understanding by the broader mathematical world has yet to take place!

A major obstacle is the NIH (Not Invented Here) syndrome. Thus it is now (but not in the 1960s, when the physicists were doing the original work, and a few of us were trying to make some sense of it!) respectable in terms of Berkeley/Harvard/Princeton mathematics to think about the challenging mathematical problems at the summit of Quantum Mechanics or Elementary Particle Physics, but someone thinking about things mathematical at the level of the present-day "working" scientist or engineer often still finds himself extremely isolated and his work hindered because of the NIH factor. And of course under present conditions—in contrast to the 1960s—this is likely to mean death for financial reasons. The rewards and recognition for mathematical research are made on classical Calvinist lines: He who has gets more!

Another delicate but crucial point is at the level of what what one might call the "sociology" of the mathematical world. This world, as it

stands, is very hierarchical and even colonial: Pure Mathematicians are to be educated as graduate students in the Centers, trained as Algebraists, Analysts, Topologists, or whatever, then scatter out to serve in the Provinces, where they will bring Mathematical Culture to the Natives. Applied Mathematicians are trained in such subjects as Numerical Analysis or Combinatorics and are then either to work in Industry (where they will rarely meet a problem in the form which their training will do them much good) or else teach and try to emulate their "pure" cousins. This is the state of the mathematical world that we have inherited from the expansion of the 1960s, and the underlying structure is now threatened by bankruptcy. The Report is an admirable attempt to raise money to save it, but going in the directions it suggests will require more fundamental changes to overcome the inertia of the present system.

Turning to the intellectual side of the issues, I want to pose as a main problem the state of communication between the academic mathematicians—and it is strange that it makes so little difference whether they are "pure" or "applied"—and those of us who work on the mathematical problems encountered in engineering and try to make use of what has been developed in the "pure" world, and adapt it to the applications. I often feel that we live in a Black Hole: Information about the mathematical world filters in, but it seems that none gets out. This is not primarily the fault of those on the engineering side: They often make great efforts to establish communication and intellectual collaboration with the mathematical world, but more often than not find themselves rebuffed. One can go over the history of the last thirty or so years and find the same pattern over and over again: Attempts to develop a topic of interaction between mathematics and engineering, which is enthusiastically pursued on the engineering side for a few years, but then dies when the mathematicians reject or ignore it, or on the engineering side it is considered to fall under "basic research" and therefore out-of-bounds for engineering-oriented supporting agencies. There is much peer pressure among engineers, even the "mathematical" ones, to only work on topics which have a short pay-off time, and/or to drop it when the mathematical formalism seems too exotic or difficult.

One can sympathize with the engineers: It is the mathematician's job to take over the oars at a certain point. For example, the Report mentions with pride the role that Wiener and Levinson played in the development of the mathematics of 1-D linear filtering theory: What it does not say is that, after the brisk development in the 1960s (mainly by engineers), the further development of the theory and its extension to higher-dimensional or nonlinear situations suggested by current topics of importance in engineering is not at all presently of concern to any substantial number of people in the mainstream mathematical world. NIH again!

I can understand that this Report is something of a political document—like a Party Platform—and not the place to face head-on these difficult and structural problems. However, I have seen many chances slip by over the last twenty years while the Dr. Panglosses who speak for us assure us that everything is for the best in the best of all possible worlds. Now that it is clear that we are headed over the cliff perhaps more attention will be paid.

Z. W. Birnbaum Awarded Wilks Medalist

At the 1984 Annual Meeting of the American Statistical Association, Z. W. Birnbaum was awarded the Wilks Medal "for major contributions to the theory of reliability and to nonparametric statistics, for the study of the characteristics of wearout and multicomponent systems, for the ingenious derivation of inequalities and bounds used in his theory, for the wide applications and leadership provided by his work, and for his inspiration as a collaborator with and teacher of outstanding statisticians."

Birnbaum is Professor Emeritus at the University of Washington. He is best known for his innovative work in reliability and, in particular, in multicomponent systems. But professional statisticians are well acquainted with his results in nonparametric statistics and stochastic inequalities and bounds. What is not as well known is his early work in actuarial science and biometry.

Birnbaum was born in Lwow, Poland, and received his Ph.D. in Mathematics at University of Lwow in 1929. After several postdoctoral years at the University of Goettingen, he served as chief actuary in a life insurance company in Poland until he came to New York University as a biometrician in 1937. In 1939 he joined the faculty of the Department of Mathematics at the University of Washington, where he made his best-known contributions as a researcher, teacher, and collaborator.

The Samuel S. Wilks Memorial Medal Award was established in 1964 with funds donated by Philip G. Rust, Thomasville, Georgia. The Award consists of a medal, a citation, and an honorarium and is given to honor an individual "for contributions to statistical theory or practice, through publications or participation in programs of instruction on practical application, that directly or indirectly have benefited the U.S. Government or the country generally."

AMS Research Fellowship Fund

Request for Contributions

The AMS Research Fellowship Fund was established in 1973. From this fund AMS Research Fellowships are awarded annually to individuals who have received the Ph.D. degree, who show unusual promise in mathematical research, and who are citizens or permanent residents of a country in North America.

Twenty-seven Research Fellowships have been awarded including one granted for 1984-1985 and one for 1983-1984 (see the announcements in the February 1984 *Notices*, page 157, and in the April 1983 issue, pages 304-305). The number of fellowships awarded depends on the contributions the Society receives. The Society contributes a minimum of $9,000 to the Fund each year, matching one-half of the funds in excess of $18,000 raised from other sources, up to a total contribution by the Society of $20,000. Each member of the Society is requested to contribute to the fund.

Contributions to the AMS Research Fellowship Fund are tax deductible. Checks should be made payable to the American Mathematical Society, clearly marked "AMS Research Fellowship Fund," and sent to the American Mathematical Society, Post Office Box 1571, Annex Station, Providence, Rhode Island 02901.

Statistical Awards Presented

At the 1984 Joint Statistical Meetings the following awards were presented.

The **COPSS Presidents' Award** was presented to David V. Hinkley, University of Texas at Austin. This award, sponsored by the statistical societies in North America, is given annually to a statistician under 40 years of age "in recognition of a single contribution or an aggregate of contributions to the profession of statistics." The award consists of a certificate and a $1,000 prize.

The **George W. Snedecor Award**, sponsored by the North American Regions of the Biometric Society and the American Statistical Association, is for the best paper published in biometry. The award, which consists of a prize of $300, was given to two papers: *Estimation of time-specific survival rates from tag-resighting samples: A generalization of the Jolly-Seber model*, C. Brownie and D. S. Robson, Cornell University, *Biometrics*, **39** (1983), pages 437–453, and *Determination of the maximum Foregut volume of western rock lobsters (Panulirus cygnus) from field data*, R. A. Mailer, E. S. De Boer, and L. M. Joll, CSIRO, Western Australia, and D. A. Anderson and J. P. Hinde, University of Lancaster, England, *Biometrics*, **39** (1983), pages 543–551.

The 1985 Pierre Robillard Award

The objective of this award is to recognize the best Ph.D. thesis defended at a Canadian university in 1984 and written in a field covered by *The Canadian Journal of Statistics*. Judging will be on the basis of the level of originality in the ideas and techniques, the possible applications and their treatment, and the potential impact on the statistical sciences.

The Award Coordinator must receive four (4) copies of the thesis together with a covering letter from the thesis supervisor indicating why the thesis is suitable as an entry in the competition (description of the problem, techniques and results, potential impact...), by January 16, 1985. Official confirmation that the thesis has been defended in 1984 must also be provided. Award Coordinator: C. Field, Department of Mathematics, Statistics and Computing Science, Dalhousie University, Halifax, Nova Scotia B3H 4H8, Canada; 902-424-3339.

Claude Shannon Given *Who's Who* Achievement Award

Claude E. Shannon is one of five Americans who have received the Marquis Who's Who, Inc., 1984-1985 Achievement Award. Shannon's award was given in the Technology, Mathematics, and the Physical Sciences category.

Shannon, who is Donner Professor of Science at M.I.T., and who was a member of the Technical Staff at Bell Laboratories before joining the M.I.T. faculty in 1956, is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. He was awarded the National Medal of Science in 1966 by President Johnson.

Shannon was educated at M.I.T. (Ph.D. 1940). He is noted for his contributions to information theory (as developed in his paper *A mathematical theory of communication*, Bell System Technical Journal **27**, 1948) and for his application of boolean algebra to the theory of switching circuits (which he developed in his master's thesis at M.I.T.).

1984-1985 Fulbright-Hays Awards

Four hundred ninety-seven U.S. graduate students have received Fulbright-Hays awards for 1984-1985. These awards are administered by the Institute of International Education. Only two of the awards were given to students in the mathematical sciences. The mathematics' students, their U.S. institutions and the countries in which they will study are DIANE M. HARRINGTON (Hartwick College), Austria; and KATHLEEN M. STONE (College of St. Catherine), West Germany.

Request for Photos

In conjunction with the Centennial of the American Mathematical Society which is to be celebrated in Providence in 1988, the AMS would like to set up an exhibit of group photos from meetings and similar items of interest.

If anyone has memorabilia of this kind which they would like to give or loan to the AMS, please write to William J. LeVeque, Executive Director, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

Claude Chevalley 1909–1984

Claude Chevalley, professeur honoraire, Université de Paris 8, died on June 28, 1984. He was born February 11, 1909, in Johannesberg, Transvaal. He was educated in Paris, completed his agrégation in 1929 and received the Docteur ès Sciences degree in 1934. Chevalley was one of the founding members of the Bourbaki project. In 1937 he was awarded the Prix Francoeur in Paris. He came to the Institute for Advanced Study in 1938 and during the 1940s he served on the faculty at Princeton. From July 1949 to June 1957 he was a professor of mathematics at Columbia University. Following his service at Columbia, he returned to France.

Chevalley received the Society's Cole Prize in 1941 for his paper *La théorie du corps de classes*, Annals of Mathematics (2), volume 41 (1940), pages 394–418. He gave an invited hour address, *Theory of algebraic Lie groups*, at the AMS meeting in New York City, April 1947, and he served as a member of the *Transactions* editorial committee from 1950 to 1955. In 1951 the Society published his book *Introduction to the theory of functions of one variable* in the Mathematical Surveys series (volume 6), which was most recently reprinted in 1979. In 1967 he was elected an honorary member of the London Mathematical Society.

NRC Senior and Postdoctoral Research Associateships

The National Research Council (NRC) has announced the 1985 Postdoctoral, Resident, and Cooperative Research Associateship Programs for research in the sciences and engineering to be conducted on behalf of twenty-one federal agencies or research institutions, whose laboratories are located throughtout the United States. The programs provide Ph.D. scientists and engineers of unusual promise and ability with opportunities to perform research on problems largely of their own choosing yet compatible with the research interests of the supporting laboratory. Initiated in 1954, the Associateship Programs have contributed to the career development of over 3,800 scientists ranging from recent Ph.D. recipients to distinguished senior scientists.

Approximately 250 new full-time associateships will be awarded on a competitive basis in 1985 for research in chemistry, engineering, and mathematics, and in the earth, environmental, physical, space, and life sciences. Most of the programs are open to both U.S. and non-U.S. nationals, and to both recent Ph.D. degree holders and senior investigators.

News from the Mathematical Sciences Research Institute

Berkeley

Three programs are in progress during 1984-1985, the third year of MSRI: K-theory and index theory of operator algebras, low-dimensional topology, and differential geometry. The first two are full scale programs and differential geometry is a "miniprogram". Operator algebras began with an intensive week-long workshop in August. The three members of the program committee (Alain Connes, Ronald Douglas, and Masamichi Takesaki) each gave a presentation that ran a full morning and there were also such presentations by Raout Bott, Daniel Quillen, and Isadore Singer. A similar closing workshop will take place in June 1985.

A highlight of the workshop was the announcement by Vaughan Jones of a new polynomial invariant for knots; this arose in a totally unexpected way from his work on subalgebras of factors of Type II. This has subsequently been generalized by several mathematicians: Adrian Ocneanu, Ray Lickorish and Kenneth Millett, Peter Freyd and David Yetter, and James Hoste; they found a polynomial in two variables which includes as special cases both the Jones polynomial and the classical Alexander polynomial. This work is of course of keen interest to the low-dimensional topologists and has brought about an unanticipated bridge between the two programs.

Three workshops on manifolds will move logically from dimension 2 (October) to 3 (January) and then to 4 (May). The program committee consists of Robert Edwards, Robion Kirby, John Morgan, and William Thurston.

The programs for 1985-1986 have been announced in widely distributed posters: there will be a full program in computational complexity, and half size ones in mathematical economics and geometric function theory. Plans for 1986-1987 are virtually complete. The feature will be a large program in number theory with connections to algebraic geometry.

Topics will include:

(a) The relationship between the arithmetic of algebraic varieties and the analytic properties of their L-series; the conjectures of Tate, Birch and Swinnerton-Dyer, Deligne, and Beilinson.

(b) Finiteness theorems for curves and abelian varieties.

(c) The arithmetic of Shimura varieties and automorphic forms.

(d) p-adic analysis and uniformization.

The organizing committee for the program consists of Benedict Gross (chairman), Nicholas Katz, Barry Mazur, Kenneth Ribet, and John Tate. In addition, two innovations will be introduced in 1986-1987. The first is partial sabbatical-type support for midlevel mathematicians; this will be publicized well in advance, with applications invited. The second innovation will be several (probably two) programs running for approximately a month; these are intended to widen the coverage MSRI is able to give to important areas of mathematics. Suggestions for these "microprograms" are welcome and can be communicated to Calvin Moore, the Deputy Director.

In the middle of December 1984, MSRI will move to its new building in the hills overlooking the Berkeley campus.

Shiing-Shen Chern became Director Emeritus on September 1. However, he continues to be very active in MSRI affairs and is running the current differential geometry program. His successor is Irving Kaplansky.

Awards are made for one or two years; senior applicants who have held the doctorate at least five years may request shorter tenures. Stipends for the 1985 program year will begin at $25,350 a year for recent Ph.D.'s and be individually determined for senior associates. A stipend supplement up to $5,000 may be available to regular (not senior) awardees holding recognized doctoral degrees in those disciplines wherein the number of degrees conferred by U.S. graduate schools is significantly below the current demand. In the 1984 program year these areas have been engineering, computer science, space-related biomedical science, and petroleum-related earth sciences.

Applications to the National Research Council must be postmarked no later than **January 15, 1985**. Initial awards will be announced in March and April followed by awards to alternates later. Information on specific research opportunities and federal laboratories, as well as application materials, may be obtained from Associateship Programs, Office of Scientific and Engineering Personnel, JH 608-D3, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418; 202-334-2760. –NRC News Release

Smithsonian Opportunities in the History of Science and Technology

The Smithsonian Institution announces its program of research training in higher education in the History of Science and Technology for 1985-1986. Smithsonian Fellowships are awarded to support independent research, in residence at the Smithsonian, related to research interests of the Institution's professional staff and using the Institution's collections, facilities, and laboratories. Six to twelve month pre- and postdoctoral fellowship appointments and ten-week graduate student appointments are awarded. Proposals for research may be made in fields in which the Institution has research strength: history of mathematics, physical sciences, medicine and pharmacy, engineering, transportation, agriculture, air and space, electrical technology, and the history of science in America.

Applications are due by **January 15, 1985**. Stipends supporting the awards are: $18,000 per year plus allowances for postdoctoral fellows; $11,000 per year plus allowances for predoctoral fellows; and $2,000 for graduate students for the ten-week period of appointment. Pre- and postdoctoral stipends and allowances are prorated on a monthly basis for periods of less than one year.

Awards are based on merit. Smithsonian Fellowships are open to all qualified individuals without reference to race, color, religion, sex, national origin, age, or condition of handicap of any applicant. For more information and application forms, please write: Office of Fellowships and Grants, Smithsonian Institution, Desk

News from the Institute for Mathematics and its Applications

Minneapolis

The 1984-1985 year in Continuum Physics and Partial Differential Equations is well under way. In addition to a workshop on Homogenization and Effective Moduli, October brought a series of visits from several distinguished physicists. These included Peter Chen of Sandia Laboratory, Pierre de Gennes of the Collège de France, Roger Tanner of the University of Sydney, and Robert Thurston of Bell Communications Research. A number of interesting problems concerning ferro-electric crystals, dynamics of wetting, numerical viscoelasticity and stability of liquid crystals were considered.

Melvin Hochster, Peter Huber, and Victor Klee have agreed to serve three-year terms on the board of governors of the IMA. They will replace Wendell Fleming, Frederick Gehring, and Jürgen Moser, whose terms expire on December 31. Continuing members of the board are Donald Burkholder, James Glimm, Elliott Lieb, Joseph Keller, Daniel Kleitman, Karen Uhlenbeck, and Shmuel Winograd.

The Board will be selecting topics for programs beyond the 1986-1987 year on Scientific Computation. Suggestions from the mathematical community would be much appreciated. Persons with ideas for programs should contact the director, Hans Weinberger, at an early date.

P, 3300 L'Enfant Plaza, Washington, D.C. 20560. Please indicate the particular area of the proposed research and give the dates of degrees received or expected.

Mathematics Educators' Program in the Soviet Union

Soviet mathematics is an important component in elementary and secondary school curricula. Since educators in the U.S. are strengthening the mathematics requirements in schools, the Citizen Exchange Council (CEC) is sponsoring a visit to the USSR, March 8–25, 1985, for U.S. mathematics educators.

During this visit, the U.S. educators will meet their Soviet counterparts in their institutes and schools to discuss with them methods and aims in mathematics education. The program will be lead by James Ware, Professor of Mathematics and Head of the Department of Mathematics at the University of Tennessee at Chattanooga. He will be assisted by a fluent Russian-speaking CEC staffer. The program will visit Moscow, Simferopol, Yalta, and Leningrad in the USSR, and Helsinki in Finland. For a detailed brochure please write to Citizen Exchange Council, 18 East 41 Street, New York, New York 10017; 212-889-7960.

Letters to the Editor

Renewing U.S. Mathematics

I am a new mathematics Ph.D. who turned down academic offers to take a job in industry. I suppose this qualifies me as one of the "disillusioned young researchers" discussed in the report of the Ad Hoc Committee on Resources for the Mathematical Sciences and in the companion article by Murray Gerstenhaber, both of which call for increased federal funding. As I examine the causes of my disillusionment with academics, however, I find that they have much more to do with the academic system itself than with the lack of funding.

In the mathematical community today, there is no common view of what is good mathematics. There is no common definition of our purpose as mathematicians or our role in the world. There is no global vision that would allow us to see how our individual research contributes to the progress of man. Instead, each group of specialists seems to trudge forward with its head down, not even bothering to interpret its work for the rest of us, to say nothing of the general public.

I make this complaint for a very specific reason: In the absence of any cultural standards, I have no way to evaluate the significance of my own work. My nightmare is not that I will reach 40 and lose support for my research, it is that I will reach 70 and decide that my research was pointless.

Many believe that this kind of chaos is inevitable in a field as large as mathematics, but I think it is the result of an academic system that actively discourages the search for a global view, especially among younger mathematicians.

For example, if a young mathematician takes a theorem whose significance he does not understand and generalizes it blindly, this is publishable research and increases his chances for promotion and tenure. If, instead, he works to discover the significance of this theorem, and writes an expository article explaining this to other mathematicians (or even to the general public), this is likely to go unpublished or, if published, be discounted by those who evaluate him for advancement.

A young mathematician who tries to understand mathematics' relationship to the other sciences is courting trouble in a similar way. At one university where I had a job offer, I was told about a previous assistant professor who was denied tenure because his interdisciplinary work "wasn't really mathematics".

A young mathematician is expected to teach, but not to teach well. An abominable teacher may have his advancement hindered slightly, but one who puts in the time and effort to be excellent will not be rewarded. To the extent that this time and effort detracts from his publishable research, an excellent young teacher is cutting his own throat. At one university where I interviewed, I was warned not to let the students take up my time. Another university considered one of its selling points to be its large lecture classes, which would be completely outlined for me so that I could teach them by rote, without "wasting" my research time. What could be more demoralizing than a system which expects (or even demands) that I do a bad job?

I do not know whether I am typical of those leaving academia. But if I am, it is clear that more is needed than just additional funding. The mathematical community needs to realize that discovering new knowledge is only half of its job. The other half is to make sense out of this new knowledge, i.e. to figure out what this knowledge means to mathematics and to the world.

If this second half of the job is ever going to get done, it must be done in the universities. Mathematics departments should commit themselves to this sense-making, both in the form of exposition and in the form of teaching. Moreover, this commitment must be made where it counts–in promotion and tenure decisions. Any other kind of commitment is just a lot of pious mumbling.

Of course more funding would be welcome. But if more money simply reinforces the notion that mathematics can sprawl endlessly without priorities or values, then the mathematical community may be better off without it.

Douglas J. Muder
MITRE Corporation
(Received July 27, 1984)

So the National Research Council's Ad Hoc Committee on Resources for the Mathematical Sciences says in the August 1984 issue of the *Notices* that pumping large amounts of new research money mainly into the top 10 or 20 mathematics centers will renew mathematics in the U.S.A.

We don't believe it.

How will that increase our ridiculously low salaries, or reduce our high teaching loads, or improve the quality of students we are sent from the high schools, or make careers in mathematics more attractive to our students? It won't. Students don't have to be told that mathematics in the U.S.A. is terminally ill. Why would any student consider mathematics even for a fleeting moment when, for example, starting salaries for Ph.D.'s in mathematics are thousands of dollars less than B.Sc.'s in engineering?

Putting fresh icing on a rotten cake will not make the cake edible. Those at the top 10 or 20 mathematics centers in the U.S.A. will eat most of the fresh icing, and the rotten cake will remain untouched.

P.S. Only when mathematics becomes a profession with an accreditation organization and lobby like the medical, business, and engineering organizations will it be possible to begin rebuilding mathematics in the U.S.A.

Dallas S. Lankford
Louisiana Tech University
(Received August 1, 1984)

Status of the Profession

It seems from Professor Gerstenhaber's article "On the Status of the Mathematics Profession" that he understands the problems and causes but that he can't find any practical solutions. The basic problem of course is that nobody understands us and we won't explain ourselves. Instead of waiting for the public to get smart and recognize us for the "national treasures" we are, it is time for us to actively come out of our holes.

We have fostered the public perception that mathematics stopped in the eigthteenth century by striving for ever greater abstraction and purity. This has removed the understanding of this work from all but specialists. When important applications such as computers and game theory were opened up we abdicated these fields to other departments such as engineering and economics.

It is time to realize that in abstracting our work we have denied the public the ability to understand and appreciate us. We have at the same time confused ourselves so that many of us don't realize any ultimate purpose to our work.

I suggest that we refocus our efforts to give the nation a better understanding of how twentieth century mathematics has contributed to the growth of other fields in the soft and hard sciences. Perhaps we can restate this work to show its relevance.

Policy on Letters to the Editor

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

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

The committee reserves the right to edit letters.

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

Letters should be mailed to the Editor of the *Notices*, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, and will be acknowledged on receipt.

In addition, instead of doing outside consulting for industry and government, why not bring industrial problems into the schools? This could be accomplished by closer cooperation between mathematical and industrial groups and the very contacts we use to obtain consulting work.

Instead of complaining how other fields are draining the pool of mathematical talents we should be encouraging mathematics to grow in areas that are of obvious use and interest. What are we working on today that will create new departments in the future because we can't cope with success?

David M. Weiss
Ridgewood, New Jersey
(Received August 14, 1984)

Mathematics Education

In the fifties and sixties, knowing the power and pleasure youngsters have in advanced mathematical thinking, the "new math" was brought into being by mathematicians. Spreading first on the secondary level, it caused real problems on the elementary level; after a period of agony it was mostly rejected, to be replaced by a demand for "back to the basics." In the present time of pressures, the focus is on the passing of multiple choice tests, the lowest indicator of learning, and more discipline and harder work in school are called for, while the true state of growth and learning is at its lowest ebb, particularly in "problem solving" [5].

On the highest levels, search for the underlying causes of failure seems to be abandoned, with recommendations aimed at symptoms, not the disease. The two national commissions of 1983 (see [6]) both call for all students to take more mathematics in high school, for lengthening the school day and year, and for more homework, testing and monitoring. It is clear on the face of it that for the great mass of failing students with real "math anxiety," this will push them increasingly into dropping out, delinquency, crime and suicide.

It is essential for the health of our youth and the country that we regain responsibility and move in better directions. True cures are simple and well known: Let the students regain their natural powers. What is needed is a full understanding of what pushes children into rote learning at an early age, how teachers and students can return to proper creative work, and especially, how to get community cooperation to let good programs continue, once started. Above all, we need to face openly our loss of true goals and subsequent denying of the humanity of both students and teachers; your help here is sorely needed.

To regain real goals, it is sufficient to note that preschool children are exploring and learning in the best possible manner, at a level far above any school mathematics (for instance in verbal and non-verbal communication), and without any

formal teaching. It is such powers that are needed in adult life, and need to be nurtured and practiced in school; but particularly in mathematics, such experience is almost totally lacking. We give a brief description of the usual school experience, as seen through my intensive observations since 1967, in the classroom and out. The low morale in the schools is well known [4], but the actual dynamics and attitudes in the mathematics classroom have not been brought out clearly. The general pattern is that of presenting all material, denying the knowledge and power in the children, and through pushing for constant work, completely stopping their own thinking and hence learning with meaning.

Early on, the patterns like $2 + 3 = \square$ are easily handled; you find the number 5 and write it in the box. But later patterns like $4 = \square - 7$ given no clue as to what to do; this forces explanations like "the equal sign means ..." which are totally incomprehensible and against the children's experience. The resulting rejection of explanations and search for rules of the day increase right through high school.

Most of the teaching is traditional in nature. Subtraction of 2-digit numbers is taught first "without borrowing." In $\begin{array}{r} 37 \\ -14 \\ \hline \end{array}$ "we work first with the units" tells the children to cut the problem into two subtractions; the message is: Forget the numbers, learn the rules. This is easy, and the topic is soon "mastered." Next comes $\begin{array}{r} 42 \\ -18 \\ \hline \end{array}$ which is again easy for the children; there are two problems, and of course you always take the smaller number from the bigger. But no, there comes "can you take 8 from 2? What does that 4 mean?" The new message is ominous: The rules you learn one day will change with a new topic, even if you see nothing new. The children are beginning to experience those feelings they have seen in older children and adults: "I never could do math!"

The reality of the failure is shown by the national assessments (NAEP); see [5]. The exercise "Subtract 237 from 504" was asked of all three age groups, 9, 13 and 17, with success rates 28%, 73% and 84% respectively. In division, $6\overline{)608}$ was done by 69% and 65% of the 13- and 17-year olds respectively. Yet with decimal currency, it is trivial to divide six 100's and eight 1's between six people, with two 1's left over.

"Drop long division and fractions from the curriculum" is the present call. If the baby suffers from pumping trash food into him, throw him out. It is the continual teaching, forcing rote learning, that is at fault. I have seen countless hours of teaching addition and subtraction of "mixed numbers" with continual forgetting the only result. The futility is shown by the NAEP exercise $2\frac{2}{5} + 5$, done by 43% and 65% of the 13- and 17-year olds respectively. Before you are taught, there is no problem. When I asked a fourth grader "What is $6\frac{2}{7} - 2\frac{4}{7}$?" her answer came easily: "Take away $\frac{2}{7}$, leaves 6; take away another $\frac{2}{7}$, leaves $5\frac{5}{7}$; take away 2, leaves $3\frac{5}{7}$."

After the initial grade or two, the teachers are nearly always pressed to cover the material. Each topic must be taught and continually retaught; and next year's teacher has the same problem with the same topics. Remedial classes are under way, and there are lower tracks for the "slow" and "disadvantaged" (labeled through pressure and failure, not true ability). The teachers are pressed to teach, monitor and test more, and they demand more work, which only aggravates the problem; that is the system which all must obey. We blame the teachers quite unfairly for this.

All this pressure causes the children to listen harder to the teacher at all moments, answer questions at once (otherwise you are passed over); and especially, don't think for yourself! (There is never time to, anyway.) There are many homework problems (all meaningless). You do the first simply by trying to apply the rules for the day; most are done haphazardly, and in none of them do you pay attention to either question or answer as something to learn from. The idea that in all this you are learning bit by bit is preposterous. The main result is the building of negative feelings, anxiety in particular.

I am painting the general picture; there are exceptions among students and whole classes, but these are relatively rare. In the better classes, the "learning" is still essentially as I describe, mostly without meaning, but with less pressure. The NAEP question, 26 children, four per car, how many cars needed, got 3% correct response from the 9-year olds with calculators (12% said 6.5, 7% said 65). Word problems are school problems, not real. All the way around a rectangular garden, 10 feet by 6 feet, gave rise to adding the numbers by 59% and 38% and multiplying them by 14% and 21% of the 9- and 13-year olds respectively. Putting the fractions 5/8, 3/10, 3/5, 1/4, 2/3 and 1/2 in order of size was accomplished by 0%, 2% and 12% of the three age groups respectively.

Would the best procedure be simply to throw out all this teaching, merely helping the children attack valid problems? This, if allowed, would be ideal; and it was actually done with amazing results by Benezet in the thirties [2]. In the present period we must choose a partial solution: Begin by allowing *some* real exploration, leading at first directly to those elusive algorithms; this is needed to satisfy both the public and professionals. Here is one sample. Using play money with ones, tens and hundreds only, give a child (better, a small group) five hundreds and four ones for instance, and offer an object for sale for $237. On being given three hundreds, respond "Sorry, I have no change." This *gives the responsibility to the child* (or group) to find a way. In real life, go to a bank; here, see that you can look in that money bag and use it as a bank. You have to get change

twice (get tens, then more ones); then the object is bought and the change counted. The result, "I can subtract without help!" is generally magic. Repeating the process and recording what was done, the algorithm appears; using the recording to repeat your (or another group's) process relates the written work firmly to meanings. Shortly the topic is *solidly understood*, and the teacher may proceed to other topics, abandoning those long lists of useless homework exercises and escaping the pressure of covering the material. I have seen the validity of this plenty of times. As to long division, I have carried out a similar process with a group of teachers in a poor school in Brazil, six of them to share a given sum, and seen the electric change from "impossible to teach long division" to "Now *I know they can*," since no mathematical rules of any kind were used.

For their future, true responsibility belongs to the students. It is stopped by the handing in of papers and waiting for the papers to be marked. It is promoted by the student's asking, "Do I know I can do this well?" *before* doing it, and handing in only top work.

Algebra, as now taught, removes responsible exploration, since the student has no basis on which to judge validity; there is no clear situation to explore. And I realized recently how I failed to do really well with my college and graduate students when I asked an adult (with real math anxiety) how she might put numbers from one to a million on one line, showing enough numbers to get a feeling for different sizes. She soon spaced 1, 10, 100...evenly. Then, trying numbers 2, 3,..., 9, and looking at 11 and up, she found squeezing needed. Now she chose a better place for 2 ahead of 1, and at once put 20 correspondingly ahead of 10. I suddenly realized she had invented the (general) exponential function and found its derivative! She had gotten a *feeling* for meanings that my calculus students almost never reached, and with absolutely no teaching! We are really holding back our college students' natural powers in the same way it happens all through school.

What are the most pressing needs? Certainly of high priority are the stopping of mandating more work which serves only to increase anxiety, and educating against promoting still earlier teaching [1], [2]. The excuse for the above mandating lies in the belief of researchers that "time on task" is the only factor in learning, and this in turn arises from studying school results on standardized tests only. It represents what happens in school, not what could happen. The quality is held down by this belief, the belief that students cannot solve problems involving two or more steps, and the belief that most students are slow learners or disadvantaged. All these beliefs are shown to be false by [2], along with the belief that accomplishment can come only through prolonged teacher training. Moreover, the pressing need of improved language skills is solved by the same program of Benezet.

The usual "individualized" programs and "mastery learning" have the basic flaw of controlling all by standardized tests. This removes the students from contact with the teacher, so complete lack of understanding goes undetected [3]; and 20% failure is called 80% success and hence "mastery."

For positive results, work in local school systems, first to promote real communication among people and groups (starting through more accepting listening); then cooperation for true goals is vital. Getting experiments started where real explorations take place, particularly to arrive at algorithms as shown above, can be of enormous benefit. I cannot make specific recommendations; you must explore ways and means yourself.

References

[1] Helen L. Beck, *Don't push me, I'm no computer*, McGraw-Hill, New York, 1973.

[2] L. P. Benezet, *The story of an experiment*, Journal of the National Education Association, **24** (1935), 241–244 and 301–303; **25** (1936), 7-8.

[3] S. H. Erlwanger, *Benny's conception of rules and answers in IPI mathematics*, Journal of Children's Mathematical Behaviour, **1**, No. 2, (1973), 7–26.

[4] J. I. Goodlad, *A placed called school*, McGraw-Hill, New York, 1984.

[5] National Council of Teachers of Mathematics, Report on the Second National Assessment of the National Assessment of Educational Progress (NAEP), Reston, VA, 1980.

[6] *Notices*, **30**, No. 6 (October), 580–590; No. 7 (November), 748–754, 1983.

Hassler Whitney
Institute for Advanced Study

(Received September 28, 1984)

Erratum

In my letter titled *Definitions* (*Notices*, October 1984, page 629), an error occurs in the next-to-the-last paragraph (beginning "A non-unit ... "). In place of the last two words of that paragraph, "integral domains," one should read "unique factorization domains."

P. M. Cohn
University College London

(Received October 9, 1984)

Black Women Mathematicians

Since my article on black women in mathematics appeared in the October 1981, *Monthly*, many people have asked me about other black women research mathematicians. There are two Americans inadvertantly omitted from the article and three who received their degrees between the time the article was written and mid-1982, as well as several in other countries. The November 1983, *Notices* reports that there were six other who received degrees recently.

Who and where are these? I would appreciate being told their names and addresses. One young mathematician telephoned 3000 miles to tell me how much the article had "motivated" him two years before, and many others have expressed appreciation for knowledge about this scattered but inspiring group. Recent information would enable me to write other articles to help combat the sense of isolation that minorities and women too often feel as they strive toward mathematical excellence.

Patricia C. Kenschaft
Montclair State College
(Received July 1984)

An International Shame

I am writing to request an apology from the Editorial Committee for the publication of the 4 November 1983 letter, *An international shame*, of H. Silverman [*Notices*, June 1984, page 375] and for the evident lack of professional courtesy for not providing me the opportunity to refute Silverman before publishing his slanderous claim, an unfounded attack on the presentation at our Fairfield, Connecticut, 29 October 1983 AMS meeting of my paper, *Is not relativity theory becoming an international shame?* [*Abstracts* AMS, vol. **4**, 1983, page 424, No. 806-83-56].

Silverman asserts that, in my presentation, I stated, without even an attempt at justification, that Einstein was led to his relativity theories because of his Judaic background and that these theories should therefore be discredited.

Silverman is absolutely wrong. I never made this statement, either during the paper's 10-minute presentation or during the roughly twenty minutes of discussion which ensued at the close of the session in which I presented the paper in question.

I of course have a tape recording of both my presentation and the post-session discussion and, as their transcript reveals, there were at least three attempts in questions formulated from the audience (including, I suspect, Silverman) to impute erroneous interpretations to my presentation: My own responses ('I didn't say that,' or 'Nothing can be further from the truth,' e.g.) included clarifications which Silverman conveniently ignored in his letter.

My presentation, like the abstract, pointed out that the word, 'truth,' and therefore its acquisition, have different connotations in different cultures, a result molded in large part by their respective religious bases. What Silverman has conveniently omitted to say is that I cited in the post-session discussion the current 'evolutionists-creationists debate' as yet another example of 'truth' suffering abuse because of the archaic definition of that term as it applies to the Hebraic Old Testament ['unwavering conformity with God's will as made known in the (Hebraic/Talmudic/Mosaic) law']. He also ignored the abstract's penultimate reference and its referents, in which it is made clear not only that the Western/Christian connotation of 'truth' follows that of the New Testament (in Greek, 'truth' means 'the actual state of affairs') but also that this connotation of truth has as *its* established motivation: *survival.* Einstein's relativity theories are like that of the creationists: if true, only of a prophetic, not a scientific, nature.

Silverman commences his letter with one paragraph of political diatribe, interspersing more of the same into his false account of my presentation at Fairfield, and then concludes in his third paragraph with a request that our AMS *Abstracts* not contain 'political diatribe,' the overall effect of his letter being an implication that my own abstract [No. 806-83-56] is 'political diatribe' [!] Neither my abstract nor its presentation discussed politics.

Silverman's invective, if left uncorrected, would establish a policy of permitting mathematicians to be assailed if ever they seek to evaluate the truth content, if any, of one of our major subject categories (i.e., Relativity). However, we mathematicians can, I believe, sustain any discussion, at our AMS meetings, regarding the truth about truth.

G. Arthur Mihram
Princeton, New Jersey
(Received June 25, 1984)

NSF Evaluation of Research Institutes

The Mathematical Sciences Research Institute (MSRI) in Berkeley, California, and the Institute for Mathematics and Its Applications (IMA) in Minneapolis, Minnesota, were approved by the National Science Board (NSB) in April 1981, after an evaluation process that took over three years. The Institutes were approved for a start-up period, plus five full years of operation. Full operation at each Institute commenced in September 1982 and each is now in its third year of activity. The NSB will consider any renewal of these Institutes in the Fall of 1985. Accordingly, we are at present actively engaged in the evaluation of these Institutes.

Any input from the mathematical science community involving the scientific activity at the Institutes or the operation of them is welcome. We are also interested in suggestions of factors to be considered in the evaluation. Items may be sent to the undersigned at the Division of Mathematical Sciences, National Science Foundation, Washington, D.C. 20550.

John C. Polking, Division Director
Alvin Thaler, Program Director

Grants for Scientific Computing Research Equipment

The Division of Mathematical Sciences of the National Science Foundation plans a limited number of grants for the purchase of computing equipment for research in the mathematical sciences.

These grants are for the purchase of special-purpose equipment dedicated to the support of research in the mathematical sciences. The equipment should be necessary for the pursuit of specific research projects, rather than intended to provide general computing capacity. These grants are intended for researchers of high quality and productivity whose research has been handicapped or limited due to lack of access to suitable equipment.

U.S. graduate-degree-granting institutions with departments or research programs in mathematics, applied mathematics, or statistics may submit proposals; proposals involving inter-institutional or inter-departmental sharing arrangements are welcome.

The deadline for proposals is **December 1, 1984.** Proposals received after this date will be returned.

–NSF Announcement

NSF Awards Visiting Professorships for Women

The National Science Foundation (NSF) has announced twenty-nine awards designed to help make full use of the Nation's scientific and technical resources by encouraging women to develop careers in science and engineering research.

The awards, called Visiting Professorships for Women, will enable experienced women scientists and engineers to participate in the research and teaching programs of a host institution. The visiting professors will also serve as advisors and counselors to students and provide encouragement to other women to pursue careers in science. Among the recipients are nine mathematical scientists. These scientists, their home institutions, fields of study and the institutions they will attend are as follows:

SUN-YUNG ALICE CHANG (University of California, Los Angeles), *Applications of modern real analysis methods,* California Institute of Technology; GRACIELA CHICHILNSKY (Columbia University), *Topology and its applications to economic equilibrium, game theory and social choice,* University of California, Berkeley; PATRICIA J. EBERLEIN (State University of New York, Buffalo), *Norm-reducing methods for algebraic eigenproblems for parallel and micro computation,* Cornell University; JULIA F. KNIGHT (University of Notre Dame), *Recursion theoretic problems in model theory,* University of Illinois, Urbana-Champaign; DIANE LAMBERT (Carnegie-Mellon University), *Nonparametric mixtures of logistic regression models,* University of Chicago; JANE CRONIN SCANLON (Rutgers University), *Mathematical models of electrically active cells: Problems in singularly perturbed equations,* Courant Institute of Mathematical Sciences, New York University; MARIA E. SCHONBEK (Duke University), *Nonlinear dispersive and diffusive equations,* Princeton University; NELL SEDRANSK (State University of New York, Albany), *Statistical theory for combining experiments and implications for experimental design,* Yale University; and SUSAN SZCZEPANSKI (Lehigh University), *Topology of singularities,* Courant Institute of Mathematical Sciences, New York University.

–NSF News Release

Queries

Edited by Hans Samelson

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

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

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

Queries

316. Joseph DiGiallonardo (16 Metcalf Avenue, Milford, MA 01757). For the equation (E) $L_n y = lpy$ (where $L_i y = \rho_i(L_{i-1}y)'$, $L_0 y = \rho_0 y$, $i = 1,2,\ldots,n$, $\rho_i(x) > 0$, $p(x) > 0$, $\rho_i(x) \in C^{(n-i)}$, and $p(x) \in C$ for $i = 0,1,\ldots,n$ and $x \in (0,\infty)$) consider the eigenvalue problem (P) $\sum_{k=1}^{k=n-1} A_{ik}(L_k y)(a) = 0$, $i = 1,2,\ldots,p$, $\sum_{k=1}^{k=n-1} B_{ik}(L_k y)(b) = 0$, $i = 1,2,\ldots,q$, with $0 < a \le x \le b < \infty$ and $p+q = n$. When do the eigenfunctions, $y_t(x)$, of (E)–(P) have $t-1$ simple zeros on (a,b)? Are there any references that answer this question other than in the case $(L_k y)(a) = 0$, $k \in \{k_1, k_2, \ldots, k_p\}$ or $(L_k y)(b) = 0$, $k \in \{k_1, k_2, \ldots, k_q\}$, where $k_i \in \{0,1,\ldots,n-1\}$? Also we want $n > 4$.

317. John O. Kiltinen (Department of Mathematics, Northern Michigan University, Marquette, MI 49855). We state the following conjecture: For every odd integer m, at least 9, there are odd primes p, q, r, and s and positive integers j and k such that $m = 2p+q$, $2+pq = 2^j + r$, and $2q+p = 2^k + s$. L. Dickson in his *History of the theory of numbers* (Vol. I, p. 424) credits E. Lemoine with conjecturing the first equation in 1894. The second two are important for some of our recent work. We have verified the claim to 53,000 on a computer. Erdös and others have studied numbers expressible as a power of 2 plus a prime. (cf. P. Erdös, *On integers of the form* $2^k + p$ *and some related problems*, Summa Brasil. Math. **2** (1950), 133–123. MR **13**, 437). Has this conjecture occurred before? If so, related to what?

Responses

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

303. (vol. 31, p. 282, April 1984, Pavel G. Todorov) The Galois group of $(n+1)x^n + n \cdot x^{n-1} + \cdots + 2x + 1$. See Responses in Notices Amer. Math. Soc. **31** (1984), 480. **Additional Reply:** The group is the full symmetric group S_n for $n \le 12$, except for $n = 6$, for which it is S_5 (as a transitive subgroup of S_6) (J. Thompson and L. Soicher). The discriminant is a square for $n = 8l(l+1)$ or $8l(l+1)+1$, $l \ge 1$; thus, for those n the group is a subgroup of the alternating group A_n (McKay). (Contributed by J.-P. Serre)

305. (vol. 31, p. 376, June 1984, A. Wilansky) With the measure μ induced by the outer measure μ^*, and the outer measure μ^+ induced by μ, is every μ^+-measurable set μ^*-measurable? **Reply:** (1) If μ^* is induced by a measure then $\mu^+ = \mu^*$ (well known). (2) Let μ^* be arbitrary. Then if M is μ^+-measurable and $\mu^+(M) < \infty$, M is μ^*-measurable (see Hahn and Rosenthal, *Set functions*, Univ. of New Mexico Press, 1948, Theorem 6.2.43, pp. 65–67). If $\mu^+(M) = \infty$, then M is not always μ^*-measurable (p. 67n, loc. cit.). (3) The answer is *yes* if μ^* is σ-finite (well known). (4) An explicit example where the answer is *no* is as follows: For $A \subset \mathbf{R}$ put $\mu^*(A) = 0$ if A is countable, 1 if A is uncountable and of first category in $\mathbf{R}$, and ∞ if A is of second category. Uncountable first category sets give a negative answer. (Contributed by G. Bachman, J. Oxtoby, M. Rolenz)

306. (vol. 31, p. 376, June 1984, Boris Reichstein) For $W(x,y,z)$ symmetric trilinear on $\mathbf{C}^n$ with $W = 0$ for all x, y only if $z = 0$, does there exist c such that $W(x,y,c)$ is nondegenerate? **Reply:** Not in general. A counterexample is the W derived from the (irreducible) cubic $x_1^2 x_5 - 2x_1x_2x_4 + x_2^2 x_3$ on $\mathbf{C}^5$. Details available from AMS office. (Contributed by G. Jennings)

307. (vol. 31, p. 480, August 1984, John M. Rassias) Methods for existence of solutions in natural numbers of a system of Diophantine equations and inequalities. **Reply:** The given system is easily shown to have no such solution. As for methods, there are many techniques, often using computer programs, in integral programming. (Contributed by E. Pinney, L. L. Vaserstein, M. Newman, O. Krafft, J. Longyear, P. Flor, P. L. Montgomery)

308. (vol. 31, p. 480, August 1984, Francis D. Lonergan) Techniques for determining whether a group, given by generators and relations, is finite. **Reply:** The two given groups can be shown to be infinite by using the fact that amalgamated products are "usually" infinite; details available from AMS office. As for techniques (which, however, seem not to answer the given cases), there are an algorithm similar to Todd-Coxeter in R. Gilman, *Presentation of groups and monoids*, J. Algebra **57** (1969), 544–554 and

the Evans-Knuth-Bendix completion procedure in T. Evans, *On multiplication systems...*, Proc. Cambridge Philos. Soc. **47** (1951), 637–649 and D. Knuth–P. Bendix, *Simple word problems...*, Computational Problems in Abstract Algebras (J. Leech, ed.), Pergamon, New York, 1970, pp. 263–297. (Contributed by S. Bergman, D. S. Lankford, R. H. Gilman, Anonymous)

Problem List

Combinatorial Ring Theory

The following problems were introduced at a special session on Combinatorial Ring Theory organized by Amitai Regev and held at the AMS meeting in Plymouth, New Hampshire, June 29–July 1, 1984.

1. (George M. Bergman, University of California, Berkeley). From George M. Bergman, *Embedding rings in completed graded rings.* I: *Triangular embeddings*, J. Algebra **84** (1983), 14–24.

(1) Let k be a field and D a small k-linear nontrivial category, i.e., not all spaces $D(X,Y)$ are 0. We seek necessary and sufficient conditions for the existence of a *faithful* functor from D into a *commutative* k-algebra, considered as a 1-object k-linear category. Clearly, necessary conditions, for all objects $X, Y, \ldots$ of D, are

(a) For $a_i \in D(X,Y)$, $b_i \in D(Y,X)$ $(i = 1,\ldots,n)$, $\alpha \in k$,

$$\sum a_i b_i = \alpha 1_X \Rightarrow \sum b_i a_i = \alpha 1_Y.$$

(b) For $a_i \in D(X,Y)$, $b \in D(Y,Y)$, $c_i \in D(Y,Z)$,

$$\sum a_i c_i = 0 \Rightarrow \sum a_i b c_i = 0.$$

(c) In $D(Z,Z)$, $1_Z \neq 0$.

Are these conditions sufficient?

REMARK. One can deduce the commutativity of each algebra $D(X,X)$ from either (a) or (b).

(2) (ibid.). More generally we may ask for such necessary and sufficient conditions on a k-linear category D when k is an *arbitrary* commutative ring. There is no hope of sufficiency unless we strengthen (c) to the condition (clearly necessary, and equivalent to (c) when k is a field):

(c′) For all X, Y, $Z_1,\ldots,Z_n$, the map

$$D(X,Y) \to D(X,Y)\otimes_k D(Z_1,Z_1)\otimes_k \cdots \otimes_k D(Z_n,Z_n)$$

taking a to $a \otimes 1_{Z_1} \otimes \cdots \otimes 1_{Z_n}$ is one-to-one.

Are (a), (b), (c′) sufficient?

REMARK. In Bergman (op. cit.) (c′) was stated only for $n = 1$ (as (6.3)) because we thought this might be equivalent to the case of general n. The condition that would have made them equivalent is there noted as question (6.4). W. Dicks and D. Saltman have each given me examples answering that question in the negative; hence, the strong form of condition (c′) used here.

2. (Amitai Regev, Weizmann Institute). (1) Decompose $n^2 = 1 + 3 + 5 + \cdots + (2n-1)$; then construct the following polynomial in $2 \cdot n^2$ noncommutative variables:

$$p(x_1,\ldots,x_{n^2},y_1,\ldots,y_{n^2}) = \sum_{\sigma,\eta\in S_{n^2}} \operatorname{sgn}(\sigma)\cdot\operatorname{sgn}(\eta)\cdot x_{\sigma(1)}y_{\eta(1)} \cdot (x_{\sigma(2)}\cdots x_{\sigma(4)})(y_{\eta(2)}\cdots y_{\eta(4)})\cdots (x_{\sigma((n-1)^2+1)}\cdots x_{\sigma(n^2)})(y_{\eta((n-1)^2+1)}\cdots y_{\eta(n^2)})$$

(S_k is the symmetric group on $1,\ldots,k$).

CONJECTURE. $p(x_1,\ldots,x_{n^2},y_1,\ldots,y_{n^2})$ is *not* an identity for $n \times n$ matrices (over a field). (This was checked for $n = 1,2,3$.)

(2) Let λ be a partition of n, $\lambda \vdash n$, and let d_λ denote the number of standard tableaux of shape λ. Let $\alpha > 1$ and define $f_\alpha(n) = \operatorname{card}\{\lambda \vdash n \mid d_\lambda \leq \alpha^n\}$.

Prove or disprove: There exist k such that for all n, $f_\alpha(n) \leq n^k$ (i.e., $f_\alpha(n)$ is polynomially bounded).

3. (Warren Dicks, Pennsylvania State University). Let k be a field, X a set, $F = k\langle x\rangle$ the free associative k-algebra. Let $b \in F$ and let $S = \{f \in F \mid fb \in bF\}$, the idealizer of b in F. Is F free as right S-module? This is the analogue for one-relator associative algebras of the Cohen-Lyndon Theorem for one-relator groups. It is known that the answer is *yes* if b is homogeneous, for example.

Corrections to Problem List on Partial Differential Operators

(vol. 31, p. 631, October 1984)

In Problem 4, line 4, for "ρ" read "ρ_0".

Problem 10, beginning with the word *Problem*, should read as follows:

Show $\rho(r)$ is nonincreasing in $r \in (0,\infty)$. *Partial answers.* Two are known: (1) $\rho(r)$ is nonincreasing for sufficiently large r; (2) ρ_{TF} (= Thomas-Fermi approximation to ρ) is nonincreasing in r for all $r > 0$ provided $N \leq Z$.

AMS Election 1984

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Anaheim Meetings, January 7–13, 1985

Supplement to Announcement in October Notices

Please refer to the Preliminary Announcement for this meeting which appears on pages 651–680 of the October 1984 issue of the *Notices*. The Table of Contents for the preliminary announcement is reproduced below for convenience.

AMS Invited Address

The title of the invited address to be given by RUTH M. CHARNEY has been changed to *Some new approaches to moduli spaces.*

AMS Special Sessions

Updated lists of speakers are now available for some of the Special Sessions.

Finite group theory, MICHAEL ASCHBACHER, California Institute of Technology, 2:15 p.m. Friday and 3:30 p.m. Saturday. Alberto L. Delgado, Richard Foote, J. Lepowski, George Lusztig, Richard Lyons, Geoffrey Mason, Gary M. Seitz, Stephen D. Smith, Ronald Solomon, and John H. Walter.

Asymptotic properties of hyperbolic groups, JAMES W. CANNON, University of Wisconsin, Madison, 8:00 a.m. Wednesday and Thursday. Max L. Benson, James W. Cannon, William J. Floyd, N. Smythe, D. Sullivan, and K. Tatsuoka.

Teichmuller theory for surfaces, graphs and hyperbolic manifolds, RUTH M. CHARNEY, Ohio State University, 8:00 a.m. Thursday and 1:00 p.m. Friday. Henry Glover, Lisa R. Goldberg, William M. Goldman, Steve Kirkhoff, Ronnie Lee, John Millson, and Karen Vogtmann.

Algebraic deformation theory, MURRAY GERSTENHABER, University of Pennsylvania, 3:30 p.m. Wednesday and 8:00 a.m. Thursday. W. Arvenson, Murray Gerstenhaber, Alexander Lubotzky, Andy Magid, Joyce O'Halloran, Richard Rochberg, S. D. Shack, James Stasheff, and C. Wilkerson.

Analytic number theory, DORIAN GOLDFELD, Harvard University, 2:15 p.m. Wednesday, 8:00 a.m. Thursday, and 1:00 p.m. Friday. Krishnaswami Alladi, Enrico Bombieri, Boris Datskovsky, Leon Ehrenpreis, G. Freiman, Solomon Friedberg, Patrick Gallagher, Dorian Goldfeld, D. A. Goldston, Mait Ghosh, H. Halberstam, Jeffrey Hoffstein, Henryk Iwaniec, Gerald Myerson, Andrew Odlyzko, Ilya Piatetski-Shapiro, Ralph Phillips, Peter Sarnak, H. M. Stark, Audrey Terras, Jeffrey D. Vaaler, and David Wright.

Ordinary differential equations, WILLIAM A. HARRIS, JR., University of Southern California; and GEORGE R. SELL, University of Minnesota, 8:00 a.m. and 2:15 p.m. Wednesday, and 8:00 a.m. and 7:30 p.m. Thursday. Werner Balser, Hyman Bass, C. C. Conley, Jack K. Hale, R. A. Johnson, D. A. Lutz, J. J. Mallet-Paret, Lawrence Markus, K. R. Meyer, Y. Sibuya, and Barry Simon.

Infinite dimensional topology, JAMES P. HENDERSON, Texas A & M University; and DENNIS J. GARITY, Oregon State University, 7:30 p.m. Thursday, 3:30 p.m. Friday, and 1:00 p.m. Saturday. F. D. Ancel, R. D. Anderson, Mladen Bestvina, Phillip L. Bowers, Doug Curtis, Jan Dijkstra, Tadeusz Dobrowolski, Terry L. Lay, J. Mogilski, Leonard R. Rubin, R. M. Schori, Frederick C. Tinsley, H. Torunczyk, J. J. Walsh, and David Wright.

Celestial mechanics, NEAL D. HULKOWER, Jet Propulsion Laboratory, 1:00 p.m. Saturday and 9:00 a.m. Sunday. Edward A. Belbruno, Roger Broucke, John G. Bryant, Robert L. Devaney, Robert W. Easton, Joseph L. Gerver, Martin P. Kummer, Ernesto Lacomba, K. R. Meyer, Richard Moeckel, Filomena Pacella, Julian I. Palmore III, Dieter Schmidt, and John Urenko.

IMPORTANT DEADLINES

AMS Abstracts,	
For consideration for special sessions	**Expired**
Of contributed papers	**Expired**
MAA Abstracts,	
Of contributed papers	**November 15**
Employment Register (Applicants & Employers)	**November 15**
EARLY Preregistration and Housing	**Expired**
Preregistration and Housing	**November 15**
Motions for AMS Business Meeting	**December 10**
Preregistration cancellations (50% refund)	**January 4**
Dues credit for nonmembers/students	**February 13**

Nonstrictly hyperbolic conservation laws, BARBARA L. KEYFITZ, University of Houston, University Park, 8:00 a.m. and 2:15 p.m. Wednesday and 8:00 a.m. Thursday. J. Goodman, Eduard Harabetian, Harumi Hattori, E. Isaacson, Daniel D. Joseph, Barbara Lee Keyfitz, Herbert C. Kranzer, R. LeVeque, Brent Lindquist, D. Marchesin, Ben-Artzi Matania, Stanley Osher, R. Saxton, Michael Shearer, M. Slemrod, B. Temple, and Cheng Chin-Wu.

Stochastic differential geometry, MARK A. PINSKY, Northwestern University, 8:00 a.m. Wednesday and 10:15 a.m. Thursday. R. Chacon, I. Chavel, R. W. R. Darling, Jozef Dodziuk, Richard Durrett, Gerard G. Emch, Samuel Goldberg, Leon Karp, Peter March, M. Ann Piech, Dennis Sullivan, and Daniel Stroock.

Algebraic combinatorics, RICHARD P. STANLEY, Massachusetts Institute of Technology, 1:00 p.m. Friday, 3:30 p.m. Saturday, and 9:00 a.m. Sunday. Louis J. Billera, Anders Björner, Paul H. Edelman, Adriano Garsia, Ira M. Gessel, Curtis Greene, Mark Haiman, Phil Hanlon, Jeff Kahn, Gil Kalai, Robert A. Proctor, David P. Robbins, Gian-Carlo Rota, Bruce Sagan, Richard P. Stanley, Dennis Stanton, Michelle Wachs, Jim Walker, Dennis White, Dale R. Worley, and Thomas Zaslavsky.

Differential geometry, KAREN K. UHLENBECK, University of Chicago; PETER LI, Purdue University; and WILLIAM H. MEEKS, III, Rice University; 1:00 p.m. and 3:30 p.m. Friday, 1:00 p.m. Saturday, and 9:00 a.m. Sunday. Stephanie Alexander, Tom Branson, Robert Brooks, Shiu-Yuen Cheng, Hyeong-In Choi, Christopher Croke, Doris Fischer-Colbrie, Gregory J. Galloway, Robert Greene, Joel Hass, David A. Hoffman, Qi-Keng Lu, Robert C. Reilly, Steven Rosenberg, Ernst A. Ruh, Luen-Fai Tam, Chuu-Lian Terng, Walter Wei, B. Wong, and Stephen S. T. Yau.

Other AMS Sessions

MathSci (formerly MATHFILE)

MATHFILE is expanding its subject and time coverage and adding new subfiles. The database has been renamed MATHSCI to indicate its broader scope. A presentation of the new features and additions in MATHSCI will be held on Friday, January 11 at 4:45 p.m.

Other MAA Sessions

The Panel on Remediation will sponsor a Panel Discussion on *Is there an alternative to remediation?* on Saturday, January 12, at 7:00 p.m. The moderator is DONALD W. BUSHAW, Washington State University.

Activities of Other Organizations

The **Rocky Mountain Mathematics Consortium** (RMMC) Board of Directors will meet on Thursday, January 10, from 2:00 p.m. to 4:00 p.m.

Other Events of Interest

Special Session for Mathematics Department Chairmen

The Joint Policy Board for Mathematics, AMS, MAA, and the Society for Industrial and Applied Mathematics, will sponsor a Special Session for Mathematics Department Chairmen on Friday, January 11 at 7:30 p.m. The Special Session is being arranged for all Mathematics Department Chairmen on topics requested by them through a national survey. The session will be keynoted by LESTER H. LANGE, Dean of the College of Science at San Jose State University, who will speak on relations between Chairmen, Deans, and Presidents. The session will split into two parallel sessions from which Department Chairmen can choose one.

Session A: *How to Build a Successful Research Program*

Session B: *How to Manage a Computer Science Program in a Mathematics Department*

This was announced in the October *Notices* as the National Meeting of Department Chairs.

The Preregistration/Housing Form, Employment Register Applicant Résumé Form, Employer Form, and instructions to complete the résumé form can be found at the back of this issue.

Amendments to the Bylaws at the Business Meeting of 10 January 1985 in Anaheim

There are three amendments to consider. In the first, it is recommended by the Council that the name *Mathematical Surveys* be changed to *Mathematical Surveys and Monographs.* This corresponds to a modest redirection of the nature of the series. The change occurs in two places in the bylaws, to wit, in the name of the publication committee in Article III, Section 2, and in the name of the publication in Article IX, Section 1.

The second amendment concerns the Executive Committee, which consists of four members elected from the Council by the Council and three members *ex officiis.* The term of office is prescribed in Article VII, Section 1 where it is stated that "[t]he term of office for elected members of the executive committee shall be two years, two of the elected members retiring annually." The Council recommends that the term be changed to four years, with one elected member retiring annually. The proposed change embodies the view of the executive committee and of the board of trustees (with whom the executive committee frequently meets jointly) that the turnover in the executive committee has been too rapid for its members to gather experience and for the Society to profit from that experience.

The third amendment is under consideration at the time of writing of this notice to the membership. It is written as though approved by the Council but will be presented to the business meeting only if that approval is forthcoming. The reason for this accelerated process is the wish to make the proposed change effective in 1985.

The format of Article IX on Dues and Privileges of Membership is that classes of membership are handled in consecutive pairs of Sections, one on dues and the next on privileges. There is a break in format in that Section 4 sets dues of institutional members, Section 5 sets dues of corporate members, and Section 6 sets privileges of both by the same formula. It develops that the figure of $1,000 for minimum dues of corporate members set in Section 5 is too low and that the formula for their privileges in Section 6 does not correspond to their needs. The proposed change is to follow the format of the rest of the article without affecting privileges of institutional membership but to alter the rules concerning corporate membership. The new Section 5 is to consist of the old Section 6 with the bracketed words deleted, so that the new Section 5 is as follows:

> Section 5. The privileges of [a corporate or] an institutional member shall depend on its dues in a manner to be determined by the Council, subject to approval by the Board of Trustees. These privileges shall be in terms of Society publications to be received by the institution and of the number of persons it may nominate for ordinary membership in the Society.

The new Section 6 shall replace the old Section 5 in its entirety by the following:

> Section 6. Dues and privileges of corporate members of the Society shall be established by the Council subject to approval by the Board of Trustees.

Everett Pitcher
Secretary

Chicago, March 22–23, 1985, University of Illinois

First Announcement of the 817th meeting

The eight hundred and seventeenth meeting of the American Mathematical Society will be held at the University of Illinois, Chicago, Illinois, on Friday and Saturday, March 22 and 23, 1985. All sessions will be held in the Lecture Center on the University campus.

Invited Address

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

GRAHAM HIGMAN, University of Oxford, England, and the University of Illinois, Urbana-Champaign, *Inflexions in characteristic 3*, 11:00 a.m. Saturday.

MICHAEL MARCUS, Texas A & M University, College Station, *Random Fourier series*, 1:30 p.m. Friday.

J. MARSHALL OSBORN, University of Wisconsin, Madison, *What are nonassociative algebras?*, 1:30 p.m. Saturday.

ROGER PENROSE, University of Oxford, England, and Rice University, *Title to be announced*, 11:00 a.m. Friday.

Special Sessions

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

Plethysms, JOSEPH BRENNAN, Michigan State University, The tentative speakers include Peter Hoffman, J. Patera, R. C. Read, Frank J. Servedio, and Hiroshi Uehara.

Periodic and almost periodic solutions of differential equations, T. A. BURTON, Southern Illinois University, Carbondale. The tentative speakers include Stephen Bernfeld, C. Corduneanu, John Graef, Louis Grimm, John Haddock, Carl E. Langenhop, Warren S. Loud, W. Mahfoud, Stephen J. Merrill, Allan Peterson, Jane Cronin Scanlon, George Seifert, Alfredo Somolinos, and Lian Wang.

History of logic, THOMAS L. DRUCKER, University of Wisconsin Extension, Madison.

K-theory, HENRI GILLET, University of Illinois, Chicago. The tentative speakers include W. Dwyer, D. Grayson, J. Jardine, M. Stein, R. Thomason, and C. Weibel.

Mathematical computer science, WOLFGANG MAASS, University of Illinois, Chicago. The tentative speakers include Eric Bach, Joel Berman, Andreas R. Blass, Allan Borodin, John W. Case, Harvey Friedman, Merrick L. Furst, Yuri Gurevich, Kenneth Kunen, Jeffery S. Leon, Angus MacIntyre, Glenn K. Manacher, Vera Pless, Franco Preparata, and Georg Schnitger.

Semi-martingales and stochastic analysis, PHILIP PROTTER, Purdue University. The tentative speakers include K. Bichteler, D. Burkholder, E. Cinlar, J. Mitro, P. Protter, and T. Salisbury.

Borel structures and classical measure theory, K. P. S. BHASKARA RAO and RAE MICHAEL SHORT, Michigan Technological University. The tentative speakers include T. Armstrong, Jack Brown, R. B. Darst, N. Dinculeanu, Gerald A. Edgar, Thomas Jech, Roy A. Johnson, R. Daniel Mauldin, Arnold Miller, John C. Morgan II, V. S. Pasad, Karel Prikry, D. Ramachandran, Cesar Silva, Arthur H. Stone, and Dorothy Stone.

Groups and geometries, MARK A. RONAN and STEPHEN D. SMITH, University of Illinois, Chicago. The tentative speakers include M. Aschbacher, J. Hall, R. Liebler, G. Mason, S. Rees, and E. Shult.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these special sessions should indicate this clearly on the abstract form and submit it by **January 2, 1985**, three weeks before the deadline for contributed papers, in order that it may be considered for inclusion. All abstracts must be accompanied by payment of $15 to cover a portion of the processing costs. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the American Mathematical Society, P. O. Box 6248, Providence, RI 02940, so as to arrive before the **January 23, 1985**, abstract deadline. All abstracts must be accompanied by payment of the $15 processing charge. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

Registration and Local Information

Information concerning registration, travel, food services, and accommodations will be included in the January issue of the *Notices*.

Urbana, Illinois

Robert M. Fossum
Associate Secretary

Tucson, April 12–13, 1985, University of Arizona

First Announcement of the 818th meeting

The eight hundred eighteenth meeting of the American Mathematical Society will be held at the University of Arizona, Tucson, on Friday and Saturday, April 12 and 13, 1985. This meeting will be held in conjunction with meetings of the Mathematical Association of America and the Sociedad Matematica Mexicana.

Invited Addresses

By invitation of the Committee to Select Hour Speakers for Far Western Sectional Meetings, there will be two invited one-hour addresses. The speakers are:

GEORGE M. BERGMAN, University of California, Berkeley, title to be announced.

GREGORY BRUMFIEL, Stanford University, *Modern real algebra.*

Special Sessions

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

Abelian group theory, ROSS BEAUMONT, University of Washington.

The arithmetic of algebraic function fields of one variable, DANIEL J. MADDEN, University of Arizona.

Galois module structure of algebraic number fields, ALBRECHT FRÖHLICH, King's College, University of London, England, and the University of Arizona.

New ideas in nonlinear science, ALAN C. NEWELL, University of Arizona.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these sessions should indicate this clearly on the abstract form and submit it by **January 4, 1985**, three weeks before the deadline for contributed papers, in order that it may be considered for inclusion. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940. Each abstract must be accompanied by payment of $15 to cover a portion of the processing costs. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. They should be sent to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940, so as to arrive prior to the **January 25, 1985**, abstract deadline. These abstracts must also be accompanied by payment of the $15 processing charge. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form. Late papers will be accepted for presentation at the meeting, but will not appear in the printed program.

MAA Program

The MAA Program will include two invited speakers. IVAN NIVEN of the University of Oregon will deliver an address titled *Some observations on mathematics and mathematicians.* CONSTANCE REID, San Francisco, will also deliver an address; the title is not yet available. A panel discussion on *The history of the mathematical relations between Mexico and the United States* will also take place, and a banquet will be held on Friday evening.

Registration

The meeting registration desk will be located in the main lobby of the Mathematics Building, and will be open from 1:00 p.m. to 4:30 p.m. on Friday, and from 8:30 a.m. until noon on Saturday. The registration fees are $6 for members of the AMS or MAA, $8 for nonmembers, and $2 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about the petition table can be found in the Anaheim meeting announcement in the October issue of the *Notices.*

Accommodations

The following motels are located five miles or less from the campus. Participants should make their own reservations directly with the motel of their choice. Rates are subject to possible change, and do not include any applicable local taxes.

Arizona Inn (One mile from campus)
2200 East Elm Street
Telephone: 602-325-1541
Toll free in Arizona: 800-421-1093

Single $75 and up Double $80 and up

Limousine fare from the airport to hotel is $5 per person.

Motel 6 (Five miles from campus)
960 South Freeway
Telephone: 602-624-6345

Single $16.95 Double $20.95

Limousine fare from the airport to motel is approximately $5.25 per person.

Santa Rita Hotel and Conference Center
(Two miles from campus)
88 East Broadway
Telephone: 602-791-7581 or toll free 800-528-3444
Toll free in Arizona: 800-362-3470

Single $34 Double $38

Complimentary limousine service from airport to the hotel. Limousine service also provided between hotel and campus; the fare is $1.50 per person. A welcome reception with complimentary margarita cocktails and dry snacks will be provided for hotel guests at poolside from 8:30 to 9:30 p.m. on Thursday, April 11.

Western 6 (Five miles from campus)
1338 West Grant Road
Telephone: 602-622-4784

Single $21.95 Double $25.95

Limousine fare from airport to motel is $6.25 per person. Limousine service also available between motel and campus.

Food Service and Travel

Information about food service, parking, and travel will be published in the January issue of the *Notices*.

Salt Lake City, Utah

Hugo Rossi
Associate Secretary

Worcester, April 20–21, 1985, College of the Holy Cross

First announcement of the 819th meeting

The eight hundred and nineteenth meeting of the American Mathematical Society will be held at the College of the Holy Cross in Worcester, Massachusetts, on Saturday and Sunday, April 20 and 21, 1985. All scientific sessions will be held in Haberlin Hall in the science and mathematics complex at the College.

Invited Addresses

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

WILLIAM ABIKOFF, University of Connecticut, Storrs, *Kleinian groups–an invitation to mathematics*, 1:30 p.m. Saturday.

IRA M. GESSEL, Brandeis University, *Recent work in enumerative combinatorics*, 11:00 a.m. Sunday.

ROBERT W. THOMASON, Johns Hopkins University *Algebraic and topological K-theory*, 1:30 p.m. Sunday.

STEPHEN S.-T. YAU, University of Illinois at Chicago and Yale University, *Isolated singularities and finite dimensional solvable Lie algebras*, 11:00 a.m. Saturday.

Special Sessions

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

Geometric function theory, WILLIAM ABIKOFF and IRWIN KRA, SUNY at Stony Brook. The tentative speakers include William Abikoff, Lipman Bers, Clifford Earle, Fred Gardiner, Fred Gehring, Jane Gilman, Linda Keen, Irwin Kra, and Bernard Maskit.

Differential geometry of submanifolds, THOMAS E. CECIL, College of the Holy Cross and STEPHEN S.-T. YAU.

Singularities and complete geometry, THOMAS E. CECIL and STEPHEN S.-T. YAU.

Enumerative combinatorics, IRA M. GESSEL.

Fractal geometry, BENOIT B. MANDELBROT, IBM T. J. Watson Research Center and Harvard University. The tentative list of speakers includes M. Barnsley, R. L. Dezaney, A. Douady, J. Hubbard, C. Itzykson, Benoit Mandelbrot, David Mumford, M. Taqqu, S. J. Taylor, and C. Tricot.

Methods of K-theory, ROBERT W. THOMASON. The tentative speakers include T. Fischer, H. Gillet, H. Hiller, D. Ramakrishnan, K. Vogtmann, and C. Weibel.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these special sessions should indicate this clearly on the abstract form and submit it by **January 7, 1985**, three weeks before the deadline for contributed papers, in order that it may be considered for inclusion. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940. Each abstract must be accompanied by payment of $15 to cover a portion of the processing costs. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940, so as to arrive before the **January 28, 1985**, abstract deadline. These abstracts must also be accompanied by payment of the $15 processing charge. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

It appears unlikely that late papers can be accommodated.

Registration

The registration desk will also be located in Haberlin Hall, and will be open from 8:15 a.m. until 1:45 p.m. on both Saturday and Sunday. The registration fees are $10 for members, $16 for nonmembers, and $5 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about the petition table can be found in the Anaheim meeting announcement in the October issue of the *Notices*.

Accommodations

Rooms have been blocked at the Howard Johnson's Motor Lodge adjacent to the campus, and at the Quality Inn which is about a mile from the campus in downtown Worcester. Participants should make their own reservations directly with the motel of

their choice and identify themselves as attending the meeting of the American Mathematical Society at the College of the Holy Cross. The cutoff date for reservations at these two locations is **February 15, 1985**. The rates listed below are subject to change and do not include applicable taxes.

Howard Johnson's Motor Lodge
800 Southbridge Street
Worcester, MA 01610
Telephone: 617-791-5501
Single $41 Double $51

Quality Inn
70 Southbridge Street
Worcester, MA 01610
Telephone: 617-791-2291
Single $42 Double $48

The following motels are located between two and five miles from campus. Although rooms have not been blocked at any of these locations, they are included here for information purposes.

Best Western Centrum Inn
110 Summer Street
Worcester, MA 01610
Telephone: 617-757-0400
Single $45 Double $51

Days Lodge of Worcester
50 Oriol Drive
Worcester, MA 01610
Telephone: 617-852-2800
Single $42.88 Double $47.88

Howard Johnson's Motor Lodge
West Boylston Street
West Boylston, MA 01583
Telephone: 617-835-4456
Single $47 Double $54

Sheraton–Lincoln Inn
500 Lincoln Street
Worcester, MA 01610
Telephone: 617-852-4000
Single $67–$73 Double $76–$81

Worcester Marriott
10 Lincoln Square
Worcester, MA 01610
Telephone: 617-791-1600
Single $77 Double $89

Yankee Budget Motor Lodge
531 Lincoln Street
Worcester, MA 01610
Telephone: 617-852-5800
Single $26.96 Double $30.94

Yankee Drummer Inn
624 Southbridge Street
Auburn, MA 01501
Telephone: 617-832-3221
Single $49.90 Double $52.90

Food Service

A variety of options will be available for luncheon in Hogan Center on Saturday and Sunday. A special section in the Center will be designated as the dining area for meeting participants, where meal service is cafeteria-style. Those who prefer to do so may wish to eat at Kimball Hall instead. Information about various restaurants in the Worcester area will be available at the meeting registration desk.

Social Event

The Local Arrangements Committee, Thomas E. Cecil and Leonard Sulski (chairman), is planning a beer and pizza party at the Hogan Center on Saturday evening. Although tickets may be purchased at the door, the Committee requests that those who can conveniently do so should purchase their tickets in advance at the meeting registration desk.

Travel

The Worcester Airport is located about five miles from the Holy Cross campus. Airline service to Worcester is provided by Bar Harbor Airlines, with flights from Logan Airport in Boston and Laguardia Airport in New York. Tri State Airlines also provides service from Newark Airport, however, service on both of these carriers is very limited or nonexistent on Saturday and Sunday. Participants who fly to Logan Airport should make use of the Worcester Limousine Service, which will transport passengers directly to the campus or elsewhere in Worcester. The cost is $17 one way, but reduced rates usually apply when two or more passengers are transported to the same destination in Worcester. Reservations are necessary and may be obtained by calling 617-756-4834; at the same time information will be provided concerning passenger pickup at Logan.

Worcester is also served by both Greyhound and Trailways bus lines. The bus station is about one mile from the campus. Taxicab service is available from the bus station, and the cost for transportation to the campus is approximately $3.

Participants driving to the meeting should use Auburn Exit No. 10 from the Massachusetts Turnpike, then take Route 290 East to Worcester. The College Square Exit from Route 290 is a block from the campus.

Parking

Free parking is available at several lots located on the Holy Cross campus.

W. Wistar Comfort
Middletown, Connecticut Associate Secretary

Mobile, May 3–4, 1985, University of South Alabama

First Announcement of the 820th meeting

The eight hundred twentieth meeting of the American Mathematical Society will be held at the University of South Alabama in Mobile, Alabama, on Friday and Saturday, May 3 and 4, 1985. Sessions will be held at the Brookley Center, which also has guest rooms.

Invited Addresses

By invitation of the Committee to Select Hour Speakers for Southeastern Sectional meetings, there will be four invited one-hour addresses. The speakers, their affiliations, and the general areas of their talks (not the titles) are as follows:

FRED COHEN, University of Kentucky, *Topology.*

DENNIS DETURCK, University of Pennsylvania, *Geometry and partial differential equations.*

JOHN GILBERT, University of Texas, Austin, *Analysis on homogeneous spaces.*

JEFFERY LAGARIAS, AT & T Bell Laboratories, *Number theory and cryptography.*

Complete titles will be announced in the January issue of the *Notices.*

Special Sessions

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

Discrete mathematics, TOM BRYLAWSKI, University of North Carolina, Chapel Hill.

Classical homotopy theory and loop spaces, FRED COHEN.

Nonlinear problems in geometry, DENNIS DETURCK,

Analysis on homogeneous spaces, RAYMOND KUNZE, University of Georgia, Athens.

Number theory and its applications, JEFFERY LAGARIAS.

Ergodic theory and dynamical systems, SUSAN WILLIAMS, University of South Alabama, and BRUCE KITCHENS, IBM T. J. Watson Research Center.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these sessions should indicate this clearly on the abstract form and submit it by **January 9, 1985**, three weeks before the deadline for contributed papers, in order that it may be considered for inclusion. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940. Each abstract must be accompanied by payment of $15 to cover a portion of the processing costs. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940, so as to arrive before the **January 30, 1985**, abstract deadline. These abstracts must also be accompanied by payment of the $15 processing charge. Participants are reminded that a charge of $12 is also imposed for retyping abstracts that are not in camera-ready form.

Registration and Local Information

Information concerning registration, travel, food services, and accommodations will be included in the January issue of the *Notices.*

Frank T. Birtel
Associate Secretary

New Orleans, Louisiana

Invited Speakers and Special Sessions

Invited Speakers at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings, the list of speakers is incomplete.

Anaheim, January 1985

Ruth M. Charney
Louis de Branges
Ron Donagi
Lawrence Craig Evans
Dorian Goldfeld
Daniel Gorenstein (Colloquium Lecturer)
William M. Kantor
William H. Meeks III
Michael O. Rabin (Gibbs Lecturer)
Laurence C. Siebenmann
W. Hugh Woodin

Chicago, March 1985

Michael Marcus
J. Marshall Osborn
Roger Penrose

Tucson, April 1985

George M. Bergman
Gregory Brumfiel

Worcester, April 1985

William Abikoff
Ira M. Gessel
Robert W. Thomason
Stephen S.-T. Yau

Mobile, May 1985

Fred Cohen
Dennis deTurck
John Gilbert
Jeffery Lagarias

Laramie, August 1985

Stuart S. Antman
Richard E. Block
Robert L. Bryant
David B. MacQueen
David E. Rohrlich
Ronald J. Stern
Karen K. Uhlenbeck (Colloquium Lecturer)
Lai-Sang Young

Columbia, November 1985

Eric Friedlander
Carlos Kenig
M. Talagrand

Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of the *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

January 1985 Meeting in Anaheim

Associate Secretary: Hugo Rossi

Deadline for organizers: Expired
Deadline for consideration: Expired

Michael Aschbacher, *Finite group theory*

James W. Cannon, *Asymptotic properties of hyperbolic groups*

Ruth M. Charney, *Teichmuller theory for surfaces, graphs and hyperbolic manifolds*

Murray Gerstenhaber, *Algebraic deformation theory*

Dorian Goldfeld, *Analytic number theory*

William A. Harris, Jr. and George R. Sell, *Ordinary differential equations*

James P. Henderson and Dennis J. Garity, *Infinite dimensional topology*

Neal D. Hulkower, *Celestial mechanics*

Barbara L. Keyfitz, *Nonstrictly hyperbolic conservation laws*

Mark A. Pinsky, *Stochastic differential geometry*

Richard P. Stanley, *Algebraic combinatorics*

Karen K. Uhlenbeck, Peter Li, and William H. Meeks III, *Differential geometry*

March 1985 Meeting in Chicago

Central Section

Deadline for organizers: Expired
Deadline for consideration: January 2

Joseph Brennan, *Plethysms*

T. A. Burton, *Periodic and almost periodic solutions of differential equations*

Thomas L. Drucker, *History of logic*

Henri Gillet, *K-theory*

Wolfgang Maass, *Mathematical computer science*

Philip Protter, *Semimartingales and stochastic analysis*

K.P.S. Bhaskara Rao and Rae Michael Short, *Borel structures and classical measure theory*

Mark A. Ronan and Stephen D. Smith, *Groups and geometries*

April 1985 Meeting in Tucson

Far Western Section

Deadline for organizers: Expired
Deadline for consideration: January 4

Ross Beaumont, *Abelian group theory*

Daniel J. Madden, *The arithmetic of algebraic function fields of one variable*

Albrecht Fröhlich, *Galois module structure of algebraic number fields*

Alan C. Newell, *New ideas in nonlinear science*

April 1985 Meeting in Worcester

Eastern Section

Deadline for organizers: Expired
Deadline for consideration: January 7

William Abikoff and Irwin Kra, *Geometric function theory*

Thomas E. Cecil and Stephen S.-T. Yau, *Differential geometry of submanifolds*

Thomas E. Cecil and Stephen S.-T. Yau, *Singularities and complex geometry*

Ira M. Gessel, *Enumerative combinatorics*

Benoit B. Mandelbrot, *Fractal geometry*

Robert W. Thomason, *Methods of K-theory*

May 1985 Meeting in Mobile

Southeastern Section

Deadline for organizers: Expired
Deadline for consideration: January 9

Tom Brylawski, *Discrete mathematics*

Fred Cohen, *Classical homotopy theory and loop spaces*

Dennis deTurck, *Nonlinear problems in geometry*

Raymond Kunze, *Analysis on homogeneous spaces*

Jeffery Lagarias, *Number theory and its applications*

Susan Williams and Bruce Kitchens, *Ergodic theory and dynamical systems*

August 1985 Meeting in Laramie

Associate Secretary: Robert M. Fossum

Deadline for organizers: February 15, 1985
Deadline for consideration: To be announced

Fall 1985 Meeting in Amherst

Eastern Section

Deadline for organizers: April 15, 1985
Deadline for consideration: To be announced

Fall 1985 Meeting in Columbia

Central Section

Deadline for organizers: April 15, 1985
Deadline for consideration: To be announced

Fall 1985 Meeting

Far Western Section

Deadline for organizers: April 15, 1985
Deadline for consideration: To be announced

Fall 1985 Meeting

Southeastern Section

Deadline for organizers: April 15, 1985
Deadline for consideration: To be announced

January 1986 Meeting in New Orleans

Associate Secretary: Frank T. Birtel

Deadline for organizers: April 15, 1985
Deadline for consideration: To be announced

Information for Organizers

Special Sessions at Annual and Summer meetings are held under the general supervision of the Program Committee. They are administered by the Associate Secretary in charge of the meeting with staff assistance from the Society office in Providence.

Some Special Sessions arise from an invitation to a proposed organizer issued through the Associate Secretary. Others are spontaneously proposed by interested organizers or participants. Such proposals are welcomed by the Associate Secretaries.

The number of Special Sessions at a Summer or Annual Meeting is limited to twelve. Proposals, invited or offered, which are received at least nine months prior to the meeting are screened for suitability of the topic and of the proposed list of speakers, and for possible overlap or conflict with other proposals (specific deadlines for requesting approval for Special Sessions at national meetings are given above). If necessary, the numerical limitation is enforced.

Proposals for Special Sessions should be submitted directly to the Associate Secretary in charge of the meeting (at the address given in the accompanying box). If such proposals are sent to the Providence office, addressed to the *Notices*, or directed to anyone other than the Associate Secretary, they will have to be forwarded and may not be received before the quota is filled.

In accordance with an action of the Executive Committee of the Council, no Special Session may be arranged so late that it may not be announced in the *Notices* early enough to allow any member of the Society, who wishes to do so, to submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration.

Special Sessions are effective at Sectional Meetings and can usually be accommodated. They are arranged by the Associate Secretary under the supervision of the Committee to Select Hour Speakers for the section. The limitation on the number of sessions depends on the space and time available. The same restriction as for national meetings applies to the deadline for announcing Special Sessions at sectional meetings: no Special Session may be approved too late for its announcement to appear in time to allow a reasonable interval for members to prepare and submit their abstracts prior to the special early deadline set for consideration of papers for Special Sessions.

The Society reserves the right of first refusal for the publication of proceedings of any special session. These proceedings appear in the book series *Contemporary Mathematics*.

Information for Speakers

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, RI 02940) by the special deadline for Special Sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Send Proposals for Special Sessions to the Associate Secretaries

The programs of sectional meetings are arranged by the Associate Secretary for the section in question:

Far Western Section (Pacific and Mountain)
Hugo Rossi, Associate Secretary
Department of Mathematics
University of Utah
Salt Lake City, UT 84112
(Telephone 801-581-8159)

Central Section
Robert M. Fossum, Associate Secretary
Department of Mathematics
University of Illinois
1409 West Green Street
Urbana, IL 61801
(Telephone 217-333-3975)

Eastern Section
W. Wistar Comfort, Associate Secretary
Department of Mathematics
Wesleyan University
Middletown, CT 06457
(Telephone 203-347-9411)

Southeastern Section
Frank T. Birtel, Associate Secretary
Department of Mathematics
Tulane University
New Orleans, LA 70118
(Telephone 504-865-5646)

As a general rule, members who anticipate organizing Special Sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

Joint Summer Research Conferences in the Mathematical Sciences

Humboldt State University, Arcata, California, June 23 to August 31, 1985

The 1985 Joint Summer Research Conferences in the Mathematical Sciences will be held at Humboldt State University, Arcata, California, between June 23 and August 31, 1985. It is anticipated that the series of week-long conferences will be supported by a grant from the National Science Foundation.

There will be ten one-week conferences in ten different areas of mathematics. Each week participants will arrive on Sunday and leave the following Saturday. Lectures will begin on Monday morning and end Friday afternoon. The topics and organizers for the ten conferences were selected by the AMS-IMS-SIAM Commmittee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee and others. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and paid careful attention to subjects in which there is important interdisciplinary activity at present.

The conferences will be similiar in structure to those held throughout the year at Oberwolfach. These conferences are intended to complement the Society's program of annual Summer Institutes and Summer Seminars, which have a larger attendance and are substantially broader in scope. The conferences are research conferences, and are not intended to provide an entree to a field in which a participant has not already worked.

It is expected that funding will be available for a limited number of participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. Up to about 100 participants can be accommodated at each conference. Housing accommodations will be available on campus for those attending the conferences, and daily meals will be served in the Jolly Giant Conference Center near the dormitories. A brochure describing the facilities available at Humboldt State University will be available from the AMS office in March 1985. The brochure will include information on firm room rates, the residence and dining hall facilities, as well as local information and a reservation form to be used for requesting accommodations on campus. Each participant will pay a registration fee and a social fee to cover the cost of refreshments served at breaks and for social events.

Those interested in attending one of the conferences should request an application form from Carole Kohanski, Summer Research Conference Coordinator, American Mathematical Society, Post Office Box 6248, Providence, RI 02940 (401-272-9500, extension 286), specifying which conference they wish to attend. Selection of the participants and approval of participant support will be made by the Organizing Committee for each conference. Women and members of minority groups are encouraged to apply and to participate in these conferences. The deadline for receipt of applications is **January 27, 1985**. Those who wish to apply for a grant-in-aid should so indicate on the application form; however, funds available for these conferences are limited and so individuals who can obtain support from other sources should do so.

The Joint Summer Research Conferences in the Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences which includes: Ronald L. Graham, Benedict H. Gross, Malcolm R. Leadbetter, Angus J. Macintyre, Jerrold E. Marsden, John R. Martin, James McKenna, Tilla Klotz Milnor, Evelyn Nelson, Katsumi Nomizu, and R. O. Wells, Jr. (chairman).

Descriptions of the subject matter of each of the 1985 Conferences appeared in the October *Notices*, pages 686 to 688; they were accompanied by lists of members of the respective organizing committees.

June 23 to June 29

Brown-Gitler spectra and applications

R. JAMES MILGRAM (Stanford University), Chairman

June 30 to July 6

Applications of Lie groups in differential geometry

WOLFGANG ZILLER (University of Pennsylvania), Chairman

July 7 to July 13

Numerical simulations of fluid flow

GREGORY BAKER (University of Arizona), Chairman

July 14 to July 20

Multiparameter bifurcation theory

MARTIN GOLUBITSKY (University of Houston), Co-Chairman

JOHN M. GUCKENHEIMER (University of California, Santa Cruz), Co-Chairman

July 21 to July 27

Harmonic analysis in $\mathbf{R}^n$

ELIAS M. STEIN (Princeton University), Chairman

July 28 to August 3

Function estimates

MURRAY ROSENBLATT (University of California, San Diego), Chairman

August 4 to August 10

Applications of mathematical logic to finite combinatorics

STEPHEN G. SIMPSON (Pennsylvania State University), Chairman

August 11 to August 17

Combinatorics and ordered sets

IVAN RIVAL (University of Calgary), Chairman

August 18 to August 24

Current trends in arithmetical algebraic geometry

KENNETH A. RIBET (University of California, Berkeley), Chairman

August 25 to August 31

Computational number theory

ANDREW M. ODLYZKO (AT&T Bell Laboratories), Chairman

1985 Summer Seminar In Applied Mathematics, June 30–July 13

Reacting Flows: Combustion and Chemical Reactors

The seventeenth AMS-SIAM Summer Seminar in Applied Mathematics will be held June 30–July 13, 1985, at Cornell University, Ithaca, New York. The seminar will be sponsored jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. It is anticipated that it will be supported by a grant from a federal agency. The topic *Reacting Flows: Combustion and Chemical Reactors* was selected by the AMS-SIAM Committee on Applied Mathematics whose members at the time were Roger W. Brockett, C. K. Chu, A. K. Konheim, Alan C. Newell (chairman), George C. Papanicolaou, and Robert F. Warming. The proceedings of the seminar will be published by the Society in the series *Lectures in Applied Mathematics*. A copy of the proceedings will be available to registered participants as a privilege of participation in the seminar.

The seminar is the culmination of the Special Year 1984–85 on the same subject held at the Center for Applied Mathematics of Cornell University. The theory of reacting flows has finally blossomed as a mathematical science in the last decade, and an attempt will be made to synthesize it into a firm foundation for future large-scale computing. The seminar will not, however, be aimed at computational fluid mechanics as a whole, but only those parts peculiar to reacting flows.

A series of five lectures each will be given by Rutherford Aris (University of Minnesota, Minneapolis), G. S. S. Ludford (Cornell University), and Andrew Majda (University of California, Berkeley); shorter series will be presented by Harry Dwyer (University of California, Davis), and A. F. Ghoniem (Massachusetts Institute of Technology). There will also be lectures by John D. Buckmaster (University of Illinois, Urbana), Donald Cohen (California Institute of Technology), John Guckenheimer (University of California, Santa Cruz), Ingo Müller (Berlin), Basil Nicolaenko (Los Alamos National Laboratory), Herschel Rabitz (Princeton University), and Forman A. Williams (Princeton University). Together, these lectures will summarize the Cornell Special Year and sharpen the focus onto computational questions.

The remaining speakers will be selected by the Organizing and Advisory Committees on the basis of abstracts submitted and commitments to a timely written version. The Organizing Committee consists of Donald Cohen, G. S. S. Ludford, (chairman), Andrew Majda, and Forman A. Williams; the members of the Advisory Committee are Rutherford Aris, John D. Buckmaster, H. Dwyer, John Guckenheimer, Ingo Müller, Basil Nicolaenko, and Herschel Rabitz. A list of topics at which abstracts should be aimed can be obtained from: Professor G. S. S. Ludford, Theoretical & Applied Mechanics, Thurston Hall, Cornell University, Ithaca, New York 14853.

In the early spring a brochure will be available from the AMS office which will include a description of the scientific program, as well as information on the residence and dining hall facilities, with firm room and board rates, local information, and a reservation form to be used to obtain accommodations on campus. Each participant will pay a social fee to cover the cost of refreshments served at breaks and for social events. There will also be a meeting registration fee.

Application blanks for admission and/or financial assistance can be obtained from the Meetings Department, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940. An applicant should have completed at least one year of graduate school and will be asked to indicate his or her scientific background and interest. A graduate student's application must be accompanied by a letter from his or her faculty advisor concerning the applicant's ability and promise. Those who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are limited and individuals who can obtain support from other sources should do so.

Topics for AMS/SIAM Summer Seminar

(Reviews preferred)

Laminar Combustion
- Diffusion flame structure, extinction and spread
- Deflagration structure, stability and extinction
- Ignition and explosion development
- Detonation structure, initiation and failure
- Deflagration-to-detonation transition
- Multiple-step kinetics
- Fluid-dynamical effects

Turbulent Combustion

Reactors (stirred tank, tubular, countercurrent, two-phase)
- Fluidized and packed beds
- Control, multiplicity of states, oscillations, stability

Pyrolysis and Gasification
- Gas-solid reactions, autocatalysis, catalyst preparation
- Polymerization, mass-action kinetics

Mathematical Questions
- Existence, uniqueness and stability of combustion structures
- Ignition modeling
- Analysis of complex reactions
- Governing equations of reacting flows
- Sensitivity analysis
- Qualitative methods and transition to chaos in reactive systems

Computational Questions
- Laminar-flame structure
- Detonation-wave structure
- Transition to detonation
- Statistical calculations of turbulent flames
- Large-eddy simulations (vortex dynamics)
- Adaptive-mesh techniques
- Elliptic free-boundary problems
- Numerical bifurcation and instability in reactors and combustion
- Sensitivity analysis

Special Meetings

THIS SECTION contains announcements of meetings of interest to some segment of the mathematical public, including *ad hoc*, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in the *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year and page of the issue in which the complete information appeared.

IN GENERAL, announcements of meetings held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. All communications on special meetings should be sent to the Editor of the *Notices*, care of the American Mathematical Society in Providence.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

October 7, 1984–December 14, 1985. **Mathematisches Forschungsinstitut Oberwolfach** (Weekly Conferences), Federal Republic of Germany. (October 1984, p. 689)

1985. **European Mechanics Colloquia**, Various locations. (October 1984, p. 690)

August 21, 1984–May 20, 1985. **Special Year in Logic**, University of Illinois, Urbana, Illinois. (August 1984, p. 521)

September 1, 1984–August 31, 1985. **Program on Continuum Physics and Partial Differential Equations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. (August 1984, p. 521)

1984–1985. **Special Year Devoted to Minimal Surfaces and their Applications to Low-Dimensional Topology**, Department of Mathematics, University of California, Santa Barbara, California. (October 1984, p. 690)

1984–1985. **Academic Year Devoted to Nonlinear Differential Equations**, The Mittag-Leffler Institute, Djursholm, Sweden. (February 1984, p. 194)

1984–1985. **Special Year Devoted to Reacting Flows: Combustion and Chemical Reactors**, Center for Applied Mathematics, Cornell University, Ithaca, New York. (April 1984, p. 333)

Spring 1985. **Special Semester in the Theory of Singularities**, Banach Center, Warsaw, Poland. (August 1984, p. 521)

NOVEMBER 1984

7–9. **Symposium on Foundations of Computer Science**, Tucson, Arizona. (February 1984, p. 200)

7–10. **Journées d'Arithmétique et Analyse Harmonique**, Université Paris VII, Paris, France. (August 1984, p. 523)

12–December 14. **Autumn Course on Semigroups, Theory and Applications**, Miramare-Trieste, Italy. (August 1984, p. 523)

14–19. **Computer Graphics '85**, Dallas Convention Center, Dallas, Texas. (April 1984, p. 337)

17–19. **Symposium on Complexity of Approximately Solved Problems**, Columbia University, New York, New York. (April 1984, p. 338)

22–23. **Fifth Rencontre Franco-Belge de Statistique**, CIRM-Luminy, France. (June 1984, p. 389)

23–25. **Fourth Mathematics Conference**, Rajshahi, Bangladesh. (October 1984, p. 691)

26–December 7. **Workshop on the Theory of Valuated Abelian Groups**, University of Colorado, Colorado Springs, Colorado. (August 1984, p. 523)

DECEMBER 1984

4–7. **Second Colloque sur la Diffusion des Ondes Ultrasonores**, Paris, France. (October 1984, p. 691)

9–12. **Canadian Mathematical Society Winter Meeting**, University of Western Ontario, London, Ontario, Canada. (October 1984, p. 691)

10–12. **Journées Probabilistes**, CIRM-Luminy, France. (June 1984, p. 398)

10–14. **International Conference on Algebraic Geometry, Algebraic Topology and Differential Equations**, Mexico City, Mexico. (October 1984, p. 691)

10–20. **Second International Conference on Algebraic Geometry**, La Rabida, Spain. (June 1984, p. 398)

15–18. **International Conference on Foundation of Statistical Inference: Applications in Medicine, Social Science and Industry**, Jerusalem, Israel. (October 1984, p. 691)

JANUARY 1985

7–11. **NSF-CBMS Regional Conference on Multivariate Estimation**, University of Florida, Gainesville, Florida. (June 1984, p. 398)

9–19. **Workshop on Three-Manifolds**, Berkeley, California. (August 1984, p. 524)

10–19. **Conference on Solitons and Coherent Structures**, The Institute for Theoretical Physics, University of California, Santa Barbara, California. (August 1984, p. 524)

12–13. **Association for Symbolic Logic Annual Meeting**, Anaheim, California.

Program: The meeting is being held in conjunction with a meeting of the American Mathematical Society. Invited speakers will include Howard Becker, Kit Fine, John McCarthy, Lou van den Dries, and Theodore Slaman. Hugh Woodin will also be giving a talk at the AMS meeting.

Program Committee: A. Kechris (Chairman), D. A. Martin and T. Parsons.

Information: A. Kechris, Mathematics Department, California Institute of Technology, Pasadena, California 91125.

14–February 1. **Twenty-fifth Summer Research Institute of the Australian Mathematical Society**, Auckland, New Zealand. (October 1984, p. 691)

21–24. **SEG-SIAM-SPE Conference on Mathematical and Computational Methods in Seismic Exploration and Reservoir Modeling**, Houston, Texas. (August 1984, p. 524)

21–25. **Workshop on Liquid Crystals and Liquid Crystal Polymers**, University of Minnesota, Minneapolis, Minnesota. (October 1984, p. 691)

Invited Participants: E. DiBenedetto, G. Berry, P. Cladis, J. Ferguson, F. M. Leslie, R. Schoen, J. Sethna, J. Spruck, and W. Ziemer.

FEBRUARY 1985

3–7. **1985 Applied Mathematics Conference**, Australian Maritime College, Launceston, Tasmania. (October 1984, p. 692)

11–15. **Sixteenth Southeastern International Conference on Combinatorics, Graph Theory and Computing**, Florida Atlantic University, Boca Raton, Florida. (October 1984, p. 692)

18–21. **Conference on Mathematical Analysis and its Applications**, Kuwait University, Kuwait. (August 1984, p. 524)

28–March 1. **Reasoning and Higher Education: A Multidisciplinary Experiential Conference**, Boise, Idaho.

Co-Sponsors: Boise State University Center for the Study of Thinking and the Northern Rockies Consortium of Higher Education.

Program: The conference will provide workshops and presentations designed to help higher education faculty promote the development of reasoning in college students.

Information: Dewey Dykstra, Center for the Study of Thinking, Boise State University, 1910 University Drive, Boise, Idaho 83725, 208-385-1934.

MARCH 1985

18–22. **Short Course on Numerical Methods for Partial Differential Equations**, University of Tennessee Space Institute, Tullahoma, Tennessee. (October 1984, p. 692)

18–22. **NSF-CBMS Regional Conference on Mathematical Ecology**, University of California, Davis, California. (October 1984, p. 692)

20–22. **GI-Fachtagung "Datenbanksysteme in Büro, Technik und Wissenschaft"**, Karlsruhe, Federal Republic of Germany. (October 1984, p. 692)

22–24. **Conference on Automorphic Forms and L-Functions**, Purdue University, West Lafayette, Indiana. (October 1984, p. 692)

25–29. **Conference on Chaotic Dynamics**, Georgia Institute of Technology, Atlanta, Georgia. (October 1984, p. 692)

26–28. **M. C. Escher: An Interdisciplinary Congress**, University of Rome, Rome, Italy. (August 1984, p. 524)

27–29. **Conference on Information Sciences and Systems**, The Johns Hopkins University, Baltimore, Maryland. (October 1984, p. 692)

28–31. **Sixteenth Annual Iranian Mathematics Conference**, Zahedan, Iran. (October 1984, p. 692)

APRIL 1985

1–3. **EUROCAL '85: European Conference on Computer Algebra (Symbolic and Algebraic Computation)**, Linz, Austria. (October 1984, p. 692)

8–13. **Third Easter Conference on Model Theory**, Berlin, German Democratic Republic.

Organizers: Logic Research Group, Department of Mathematics, Humboldt University, Berlin.

Instructions for Participants: Interested participants should send the following information to the address below by December 1, 1984: title of paper, date of arrival and departure, information necessary for visa application (family name, first name, date and place of birth, permanent address, name and address of employer, number of passport and country, citizenship, present occupation, profession).

Information: Hans-Joachim Goltz, Sektion Mathematik der Humboldt-Universität, 1086 Berlin, PSF 1297, German Democratic Republic.

8–19. **International Seminar on Algebraic and Topological Graph Theory**, Dubrovnik, Yugoslavia.

Sponsor: Inter-University Centre for Post-Graduate Studies.

Topics: Graph spectra and matching polynomials; combinatorial group theory; harmonic analysis on trees; graph embeddings; embeddings of Cayley graphs and group actions on surfaces; and coverings and generalizations of coverings.

Co-Directors: Wilfried Imrich (Leoben, Austria), T. D. Parsons (California State University, Chico, California 95929), and Tomaž Pisanski (University of Ljubljana, Yugoslavia).

12–13. **Workshop on Numerical Fluid Dynamics**, Georgia Institute of Technology, Atlanta, Georgia. (October 1984, p. 692)

17–19. **Symposium on Complexity of Approximately Solved Problems**, Columbia University, New York, New York. (August 1984, p. 524)

18–20. **Applications of Harmonic Measure: Annual Lecture Series in the Mathematical Sciences**, Fayetteville, Arkansas.

Program: The principal lecturer will be John Garnett, University of California at Los Angeles. There will be other invited speakers and contributed talks.

Deadline for Abstracts: February 15, 1985.

Information: D. Khavinson or D. Luecking, Department of Mathematical Sciences, University of Arkansas, Fayetteville, Arkansas 72701, 501-575-6331 or 6327.

25–26. **Sixteenth Annual Pittsburgh Conference on Modeling and Simulation**, University of Pittsburgh, Pittsburgh, Pennsylvania. (October 1984, p. 692)

25–27. **Geometric Topology Conference Honoring the Sixty-fifth Birthday of Professor C. E. Burgess**, Brigham Young University, Provo, Utah.

Speakers: F. D. Ancel (University of Oklahoma), J. L. Bryant (Florida State), J. W. Cannon (University of Wisconsin), R. J. Daverman (University of Tennessee), W. T. Eaton (University of Texas), R. D. Edwards (UCLA), S. C. Ferry (University of Kentucky), R. Fintushel (Tulane), D. J. Garity (Oregon State), C. M. Gordon (University of Texas), J. P. Hempel (Rice University), C. B. Hughes (University of Utah), P. B. Shalen (Rice University), L. C. Siebenmann (Universite de Paris-Sud), R. J. Stern (University of Utah), G. A. Venema (Calvin College), J. J. Walsh (University of Tennessee), J. E. West (Cornell University).

Information: D. G. Wright, Department of Mathematics, Brigham Young University, Provo, Utah 84602.

26–27. **Association for Symbolic Logic Spring Meeting**, Palmer House, Chicago, Illinois.

Deadline for Abstracts: January 31, 1985.

Information: P. Hinman, Program Chairman, Mathematics Department, University of Michigan, Ann Arbor, Michigan 46106.

MAY 1985

1–3. **Alaska Statistics Conference**, Juneau, Alaska. (August 1984, p. 524)

5–11. **Third International Conference on Complex Analysis and Applications**, Varna, Bulgaria.

Program: There will be invited lectures and short talks, seminars, problem and poster sessions on current problems in complex analysis and applications. A seminar on the theory of complex deformations will be held within the conference.

Information: T. Tonev or N. Bozhinov, Institute of Mathematics, Bulgarian Academy of Sciences, P. O. Box 373, 1090 Sofia, Bulgaria.

6–8. **Seventeenth Annual ACM Symposium on Theory of Computing**, Providence, Rhode Island. (October 1984, p. 692)

16–17. **European Conference on TEX For Scientific Documentation**, Varenna, Italy.

Topics: TEX system integration and improvement; font design; macro packages and development methodology; document structure standards; end-users interfaces and work stations; preprinting, printing and typesetting; implementation of output drivers; integration of text and graphics; filing, retrieval and delivery of TEX documents; transporting text; document preparation environments; electronic publishing applications.

Deadline for Papers: December 1, 1984.

Information and Papers: D. Lucarella, Istituto di Cibernetica, Università di Milano, via Viotti 3/5, 20133 Milano, Italy.

16–21. **Workshop on Differential Geometry**, Berkeley, California. (August 1984, p. 524)

17–19. **Conference on the History and Philosophy of Modern Mathematics**, Minneapolis, Minnesota.

Sponsors: Alfred P. Sloan Foundation, the University of Minnesota.

Topics: Historical and philosophical perspectives on modern logic; relations between history and philosophy of mathematics; case studies in the history and philosophy of mathematics; conceptual development of nineteenth century mathematics; mathematical perspectives on the history and philosophy of mathematics.

Information: William Aspray, Charles Babbage Institute, 104 Walter Library, 117 Pleasant Street SE, University of Minnesota, Minneapolis, Minnesota 55455; or Philip Kitcher, Minnesota Center for the Philosophy of Science, Ford Hall, University of Minnesota, Minneapolis, Minnesota 55455.

20–24. **Fifth Annual Conference on Evolution, Games and Learning: Models for Adaptation in Machines and Nature**, Los Alamos, New Mexico.

Sponsor: Center for Nonlinear Studies of the Los Alamos National Laboratory.

Information: Center for Nonlinear Studies, MS B258, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, 505-667-1444.

23–June 1. **Workshop on Four-Manifolds and Geometry**, Berkeley, California. (August 1984, p. 524)

26–June 2. **International Conference on Functional-Differential Systems and Related Topics IV**, Jachranka, Poland. (August 1984, p. 524)

28–June 1. **Colloque de Combinatoire Énumérative**, Montréal, Québec, Canada. (October 1984, p. 693)

JUNE 1985

5–14. **Conference on Geometry and Operator Algebras**, Berkeley, California. (August 1984, p. 525)

10–14. **Third International Conference on Combinatorial Mathematics**, New York, New York.

Topics: Graph theory, combinatorics, optimization, discrete and computational geometry, robotics.

Invited Lecturers: L. Lovasz (Eötvös University, Hungary), J. Schwartz (Courant Institute), P. Seymour (Bell Communications Research), R. Stanley (MIT), R. Tarjan (AT&T Bell Laboratories), F. Yao (Xerox Parc). There will also be about 40 invited short talks.

Sponsor: New York Academy of Sciences.

Information: Conference Director, New York Academy of Sciences, 2 East 63rd Street, New York, New York 10021, 212-838-0230.

10–14. **Seventh International Symposium on the Mathematical Theory of Networks and Systems**, Royal Institute of Technology, Stockholm, Sweden. (October 1984, p. 693)

10–15. **Conference on Topology**, National University of Singapore.

Information: Jon Berrick, Department of Mathematics, National University of Singapore, Kent Ridge 0511, Republic of Singapore.

19–21. **Fourth International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits**, Dublin, Ireland. (June 1984, p. 398)

20–July 5. **Third Workshop on Nonlinear Evolution Equations and Dynamical Systems**, Lecce, Italy. (October 1984, p. 693)

24–28. **Aspects of Positivity in Functional Analysis**, Mathematisches Institut der Universität Tübingen, Federal Republic of Germany. (August 1984, p. 525)

JULY 1985

1–5. **International Conference on Classical and Categorical Algebra**, University of Natal, Durban, Republic of South Africa. (October 1984, p. 693)

1–6. **First International Fuzzy Systems Association Congress**, Palma de Mallorca, Balearic Islands, Spain. (October 1984, p. 693)

2–6. **Fifteenth Conference on Stochastic Processes and their Applications**, Nagoya, Japan. (October 1984, p. 693)

5–6. **International Colloquium on Applications of Mathematics**, Hamburg, Federal Republic of Germany. (October 1984, p. 693)

7–13. **Logic Colloquium 85: European Summer Meeting of the Association for Symbolic Logic**, University of Paris XI, Orsay, France. (October 1984, p. 693)

8–20. **Conference on Logic, Language and Computation**, Stanford University, Stanford, California.

Program: The first week will consist of a summer school with courses on various topics; the second week will be an Association for Symbolic Logic meeting including invited lectures, symposia, and sessions for contributed papers.

Information: Ingrid Deiwiks, Center for the Study of Language and Information, Ventura Hall, Stanford University, Stanford, California 94305.

16–19. **Second International Conference on the Teaching of Mathematical Modelling**, University of Exeter, Exeter, England. (August 1984, p. 525)

22–26. **Tenth British Combinatorial Conference**, Glasgow, Scotland, United Kingdom. (October 1984, p. 693)

27–August 3. **Groups 1985**, St. Andrews, Scotland. (October 1984, p. 694)

28–August 10. **Conference on Banach Spaces and Classical Analysis**, Kent State University, Kent, Ohio.

Information: Banach Space Conference, c/o Richard M. Aron and Joe Diestel, Department of Mathematics, Kent State University, Kent, Ohio 44242, 216-672-2430.

31–August 8. **Symposium on the Transmission of Mathematical Science**, Berkeley, California. (June 1984, p. 398)

AUGUST 1985

5–9. **Second Seminar on Random Graphs and Probabilistic Methods in Combinatorics**, Poznań, Poland. (October 1984, p. 694)

5–16. **Georgia Topology Conference**, University of Georgia, Athens, Georgia. (October 1984, p. 694)

12–16. **Workshop/Conference on Hydrocodes and Other Codes on Parallel Processors**, Michigan Technological University, Houghton, Michigan. (October 1984, p. 694)

26–30. **Colloquium on Ordered Sets**, Szeged, Hungary.
Organizers: The Bolyai János Mathematical Society.
Topics: The major areas covered will be ordered sets; lattice theory; and algebraic aspects of matroid theory.
Information: G. Czédli and A. Huhn, Colloquium on Ordered Sets, Bolyai Institute, Aradi vértanuk tere 1., H-6720 Szeged, Hungary.

SEPTEMBER 1985

2–12. **NATO Advanced Study Institute: Advances in Microlocal Analysis**, Il Ciocco, Castelvecchio-Pascoli, Italy. (August 1984, p. 525)

16–21. **Eleventh International Congress of the Österreichische Mathematische Gesellschaft**, Graz, Austria. (October 1984, p. 694)

17–19. **International Symposium on Numerical Analysis**, Madrid, Spain. (August 1984, p. 525)

OCTOBER 1985

22–24. **Seventeenth National SAMPE Technical Conference**, Kiamesha Lake, New York. (October 1984, p. 694)

MAY 1985

18–21. **International Symposium on Flood Frequency and Risk Analyses**, Louisiana State University, Baton Rouge, Louisiana. (October 1984, p. 694)

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AUGUST 1986

3–11. **International Congress of Mathematicians**, Berkeley, California. (February 1984, p. 159)

Combined Membership List, 1984-1985

The Combined Membership List is a comprehensive directory of the membership of the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics. This edition will have names and addresses (and in many instances telephone numbers) of the membership as of July 1, 1984. The list is distributed as a privilege of membership to AMS members in even-numbered years (this edition) and to MAA members in odd-numbered years.

Following the alphabetic listing of individual members (which lists address, title, department, institution, membership in which of the three organizations, and, if available, a telephone number), there are geographic listings of individual members, academic and institutional members and other categories of membership. The geographic listing is alphabetical by state, city, and institution; in Canada, by province, city, and institution. This is followed by listings for the rest of the world — Algeria to Zambia. The list of Academic and Institutional Members follows with institution, main switchboard and department telephone numbers, and membership in which organizations. Other categories of member include corporate members, institutional associates, patrons and sustainers.

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To order, please specify CML/84/85N

Measurable Selectors of PCA Multifunctions with Applications

Marian Srebrny

(Memoirs of the AMS, Number 311)

In this Memoir, measurable selection theory is investigated from the modern descriptive set theory point of view. This approach leads to a general measurable selection theorem-scheme. A necessary and sufficient condition is given for the existence of a measurable selector. In the case of a multifunction F from X to subsets of Y, both Polish spaces, it is shown that F admits a universally measurable selector with the property of Baire whenever the graph of F is a C-set of Selivanovskii (or a Borel-programmable set of Blackwell, or an $\mathcal{R}$-set of Kolmogorov, or a Borel-game set of Vaught) and whose value of F is either nonmeager or nonnull with respect to a given Borel probability measure distribution.

1980 *Mathematics Subject Classifications*:
28A05, 04A15, 03E15
ISBN 0-8218-2299-3, LC 84-18464
ISSN 0065-9266
iv + 50 pages (softcover), November 1984
List price $9, Institutional member $7,
Individual member $5
Shipping and handling charges must be added
To order, please specify MEMO/311N

Qualitative Analysis of the Anisotropic Kepler Problem

Josefina Casasayas and Jaume Llibre

(Memoirs of the AMS, Number 312)

This Memoir is devoted to the qualitative analysis of the anisotropic Kepler problem. It also surveys the recent results obtained, and the techniques that have been developed for attacking this new problem, which was introduced by Gutzwiller in order to study bound states of an electron near a donor impurity of a semiconductor. The book exhibits many qualitative phenomena of interest in the theory of differential equations (non-integrability, chaotic behavior, ...) as was already seen in the works of Gutzwiller and Devaney.

The anisotropic Kepler problem is a one-parameter family (of parameter μ) of Hamiltonian systems with two degrees of freedom. When $\mu = 1$ it becomes the Kepler problem (an integrable system), and the authors show the global orbit structure by taking into account the blow-up of the singularities at the origin and at infinity. When $\mu \in (9/8, \infty)$, symbolic dynamics allow the authors to classify its solutions. In fact, they prove that the dynamic behavior contains a subshift with an infinite alphabet. The symbols of this alphabet take into account the symmetries of the problem. For each periodic sequence of this subshift, Casasayas and Llibre show the existence of a symmetric periodic orbit which realizes it. The transition from $\mu = 1$ (integrable) to $\mu > 9/8$ (chaotic) is such that the chaos does not appear until $\mu = 9/8$.

1980 *Mathematics Subject Classifications*:
34C35, 58F15
ISBN 0-8218-2309-4, LC 84-18521
ISSN 0065-9266
viii + 115 pages (softcover), November 1984
List price $13, Institutional member $10,
Individual member $8
Shipping and handling charges must be added
To order, please specify MEMO/312N

Noncommutative Microlocal Analysis, Part I

Michael E. Taylor

(Memoirs of the AMS, Number 313)

Pseudodifferential operators on $\mathbf{R}^n$ in $OPS^m_{\rho,0}$ are built out of smooth families of convolution operators on $\mathbf{R}^n$. Similarly important classes of operators can be built out of smooth families of convolution operators on a noncommutative Lie group G. When the representation theory and harmonic analysis on G are well understood, one can construct a noncommutative symbol calculus. This paper develops some aspects of the resulting noncommutative microlocal analysis. Chapter I treats operators on general Lie groups. The details of the symbol calculus depend on the particular representation theory of the group G, and such a theory is worked out for the Heisenberg group in Chapter II. In Chapter III this theory is applied to a systematic study of operator classes on contact manifolds, including parametrices for naturally occurring subelliptic operators, heat asymptotics, and a study of the Szegö projectors.

1980 *Mathematics Subject Classification*:
35H05
ISBN 0-8218-2314-0, LC 84-18500
ISSN 0065-9266
iv + 182 pages (softcover), November 1984
List price $17, Institutional member $14,
Individual member $10
Shipping and handling charges must be added
To order, please specify MEMO/313N

Boundary Value Problems of Mathematical Physics, XII

O. A. Ladyzhenskaya

(Proceedings of the Steklov Institute of Mathematics, Volume 159)

The papers of this collection are devoted to hydrodynamics and problems of quantum scattering. The solvability of steady-state and time-dependent problems for viscous incompressible fluids is studied, mainly in domains with noncompact boundaries. In addition, the solvabiltiy of an initial-boundary value problem for viscoelastic fluids is studied, as well a steady-state problem for linearized Boltzmann equations in unbounded domains. A scattering theory is constructed for potentials depending on the time, and the dependence of the poles of the scattering matrix on a parameter is investigated, along with the resonance states for the Schrödinger operator.

Contents

1980 *Mathematics Subject Classifications*:
35J10, 35P25, 35Q10, and others
ISBN 0-8218-3002-3, LC 67-6187
ISSN 0081-5438
vi + 226 pages (softcover), June 1984
List price $56, Institutional member $45,
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To order, please specify STEKLO/159N

Personal Items

Myron B. Allen of the University of Wyoming, has been appointed Assistant Professor of Mathematics and Adjunct Assistant Professor of Petroleum Engineering at that institution.

Douglas I. Bauer of Stevens Institute of Technology has been appointed Associate Professor at that institution.

Jahed Djomehri of the University of California, Berkeley, has been appointed Assistant Professor of Mathematics at the University of Wyoming.

Richard E. Ewing Professor of Mathematics and Petroleum Engineering at the University of Wyoming, has been named as the first recipient of the J. E. Warren Chair in Energy and Environment. He has also been appointed Co-director of the Institute for Enhanced Oil Recovery, recently established by the Wyoming State Legislature.

Francis T. Hannick of Mankato State University, has been named Chairman of the Department of Mathematics at that institution.

Eli L. Isaacson of the University of Wyoming, has been promoted to Associate Professor of Mathematics with tenure.

Haim Reingold has been appointed to Professor and Chairperson of the Mathematics Department at Mundelein College.

John Selden, Jr., of Bayero University, Kano, Nigeria, has been appointed Acting Director of the Computer Services Department at that institution. This is in addition to his responsibilities as Head of the Department of Mathematics and Dean of the Faculty of Science.

Charles W. Waters of the University of Wyoming, has been appointed to an assistant professorship at Mankato State University.

Deaths

Leonard M. Blumenthal of Columbia, Missouri, died on August 11, 1984, at the age of 83. He was a member of the Society for 31 years.

John W. Brookes of Fairfield, Connecticut, died on August 21, 1984, at the age of 41. He was a member of the Society for 16 years.

Sister M. Cordia Karl of Baltimore, Maryland, died on August 30, 1984, at the age of 91. She was a member of the Society for 60 years.

Anne Morel of Seattle, Washington, died on July 22, 1984, at the age of 39. She was a member of the Society for two years.

Visiting Mathematicians
(Supplementary List)

Mathematicians visiting other institutions during the 1984-1985 academic year have been listed in recent issues of the *Notices*: June 1984, pages 403–405; August 1984, pages 536-537; and October 1984, pages 708-709. The list below gives the name and home country, the host institution, period of visit, and field of special interest of additional visiting mathematicians.

Anatole Beck (U.S.A.), London School of Economics, University College and Imperial College, England, January 1985 to June 1985, analysis, topological dynamics.

Fred Brauer (U.S.A.), Weizmann Institute for Science; Hebrew University of Jerusalem, January 1985 to June 1985, ordinary differential equations, population biology.

Edward Fadell (U.S.A.), Universität Heidelberg, West Germany, July 1984 to January 1985; L'Universita della Colabria, Spain, February 1985 to June 1985, algebraic topology, fixed point theory.

S. Konishi (Japan), Bowling Green State University, August 1984 to May 1985, statistics.

Pieter Maritz (South Africa), University of Kansas, August 1984 to May 1985, analysis.

Richard E. Meyer (U.S.A.), University of London; University of Manchester, England; and University of Dundee, Scotland, August 1984 to June 1985, applied mathematics and mathematical physics.

S. Nambooripad (India), Bowling Green State University, August 1984 to December 1984, semigroups.

Steven Purisch (U.S.A.), Czechoslovakian Academy of Sciences, September 1984 to April 1985; Hungarian Academy of Sciences, May 1985 to August 1985, general topology.

Application Deadlines for Grants and Assistantships

Many fellowship programs have deadlines for receipt of applications. These deadlines are noted in news items and in the Stipends Section of the December *Notices*. They are listed below for your convenience, and as a reminder since many of these deadlines occur before the publication date of the special December issue on *Assistantships and Fellowships*. Dates taken from the 1983 special issue have been updated with information received in preparation for the December 1984 issue. For information about the various programs, the reader is referred to the appropriate part of the Stipends Section of the December 1983 *Notices* as follows: [GS] = Graduate Support Section; [PS] = Postdoctoral Support Section; [TSA] = Travel and Study Abroad Section; [SFN] = Study in the U.S. for Foreign Nationals.

* Information from the December 1983 issue not yet confirmed for this year.

• Refers to a news item in this issue of the *Notices*.

October 1

American Philosophical Society [PS]

John Simon Guggenheim Memorial Foundation Fellowships [PS]

Rotary Foundation (Graduate and Undergraduate Scholarships) [TSA]

October 6

National Academy of Sciences (Exchange Programs with China) [TSA]

October 15

Bunting Institute of Radcliffe College (Science Scholar Fellowships) [PS]

Fulbright Scholar in Residence Program [TSA]

October 31

Kennedy Scholarships [SFN]

November 1

American-Scandinavian Foundation [TSA]

Fannie and John Hertz Foundation Fellowships [GS]

November 15

Kenneth O. May Fellowship in the History of Mathematics [PS]

NSF Mathematical Sciences Postdoctoral Research Fellowships [PS]

Weizmann Institute of Sciences (Feinberg Graduate School Postdoctoral Fellowships) [TSA]

November 21

NSF Graduate Fellowships [GS]

NSF Minority Graduate Fellowships [GS]

November 30

North Atlantic Treaty Organization [TSA]

December 1

American Philosophical Society [PS]

Lady Davis Fellowship Trust [TSA]

Lady Davis Visiting Professorships [TSA]

Royal Norwegian Council for Scientific and Industrial Research (Postdoctorate Fellowships) [TSA]

* Sigma Delta Epsilon, Graduate Women in Science (Eloise Gerry Fellowship) [GS]

University of California, San Diego (S. E. Warschawski Assistant Professorship) [PS]

December 3

AMS Research Fellowships [PS]

December 15

Los Alamos National Laboratory (J. Robert Oppenheimer Research Fellowship) [PS]

December 31

Institute for Advanced Study Memberships [PS]

Massachussetts Institute of Technology (C. L. E. Moore Instructorships in Mathematics) [PS]

University of Wisconsin, Madison (Van Vleck Assistant Professorship in Mathematics) [PS]

January 1

AMS-MAA-SIAM Congressional Science Fellowship [PS]

Brown University (Jacob David Tamarkin Assistant Professorships) [PS]

Courant Institute (Instructorships in Mathematics) [PS]

Courant Institute (Postdoctoral Visiting Memberships) [PS]

Harvard University (Benjamin Peirce Lectureships) [PS]

Indiana University, Bloomington (Václav Hlavatý Research Assistant Professorships) [PS]

Mathematical Sciences Research Institute [PS]

January 2

University of Michigan, Ann Arbor (T. H. Hildebrandt Research Assistant Professorships) [PS]

January 15

Dartmouth College (John Wesley Young Research Instructorships) [PS]

IBM Thomas J. Watson Research Center (Mathematical Sciences Department Postdoctoral and Junior Faculty Research Fellowships) [PS]

Institute for Mathematics and its Applications [PS]

Kosciuszko Foundation [GS] [SFN]

Kosciuszko Foundation (Graduate and Postgraduate Exchange with Poland) [TSA]

• National Research Council (Research Associateship Programs) [PS]

Natural Sciences and Engineering Research Council of Canada (Visiting Fellowships) [TSA]

Rice University (Griffith Conrad Evans Instructorships) [PS]

Rutgers University (Hill Assistant Professorships) [PS]

• Smithsonian Institution (Predoctoral Fellowships) [GS]

• Smithsonian Institution (Postdoctoral Fellowships) [PS]

University of California, Los Angeles (Earle Raymond Hedrick Assistant Professorships in Mathematics) [PS]

University of Chicago (Leonard Eugene Dickson Instructorships in Mathematics) [PS]

University of Pittsburgh (Andrew Mellon Postdoctoral Fellowships) [PS]

January 16

California Institute of Technology (Harry Bateman Research Instructorships) [PS]

Fulbright Program (Collaborative Research Grants) [TSA]

National Research Council (Postdoctoral Fellowships for Minorities) [PS]

January 18

Committee on Institutional Cooperation (Minorities Fellowships in the Sciences, Mathematics and Engineering) [GS]

January 28

National Center for Atmospheric Research (Advanced Study Program) [PS]

January 30

Centro de Investigacion del IPN (Solomon Lefschetz Research Instructorships) [TSA]

January 31

Yale University (Josiah Willard Gibbs Instructorships) [PS]

February 1

* AAAS Science, Engineering and Diplomacy Fellowships [PS]

AAAS Summer Fellowship [GS]

American Philosophical Society [PS]

American Society for Engineering Education (NASA-ASEE Summer Faculty Fellowships) [PS]

American Society for Engineering Education (Navy- and DOE-ASEE Summer Faculty Research Programs) [PS]

American Society for Engineering Education (ONR Graduate Fellowship Program) [GS]

Minna-James-Heinemann-Stiftung (Research Abroad) [TSA]

* Sigma Delta Epsilon, Graduate Women in Science (Grants-in-Aid) [GS]

University of Cincinnati (Charles Phelps Taft Postdoctoral Fellowships) [PS]

February 11

California State Graduate Fellowships [GS]

February 15

University of California, Irvine (Visiting Irvine Lectureship) [PS]

February 28

Australian Institute of Nuclear Science and Engineering (Research Fellowships) [PS]

March 1

American Philosophical Society [PS]

March 14

NSF United States-India Exchange [TSA]

March 31

Hubert H. Humphrey Doctoral Fellowships [GS]

North Atlantic Treaty Organization [TSA]

April 1

American Philosophical Society [PS]

June 15

Indo-American Fellowship Program [TSA]

August 1

American Philosophical Society [PS]

August 15

North Atlantic Treaty Organization [TSA]

August 31

Australian Institute of Nuclear Science and Engineering (Research Fellowships) [PS]

September 14

NSF United States-India Exchange [TSA]

Classified Advertisements

SUGGESTED USES for classified advertising are books or lecture notes for sale, books being sought, positions available, exchange or rental of houses, and typing services.

THE RATE IS $.55 per word with a minimum of $5.00. The same ad in 7 consecutive issues is $3.50 per word. Type will be set solid unless centering and spacing are requested. A centered line of any length or the equivalent in white space is $5.00. A word is defined as a group of characters with space at each end. Prepayment is required of individuals but not of institutions. For an additional $10.00 charge, announcements can be placed anonymously. Correspondence will be forwarded.

DEADLINES are listed on the inside front cover.

U. S. LAWS PROHIBIT discrimination in employment on the basis of color, age, sex, race, religion or national origin. "Positions Available" advertisements from institutions outside the U. S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds, whether or not it is subject to U. S. laws. Details and specific wording may be found following the Classified Advertisements in the January and August issues of the *Notices*.

SITUATION WANTED advertisements are accepted under terms spelled out on page A-355 of the April 1979 *Notices*. (Deadlines are the same as for other classified advertisements.)

SEND AD AND CHECK TO: Advertising Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940. Individuals are requested to pay in advance, institutions are not required to do so.

POSITIONS AVAILABLE

UNIVERSITY OF OTTAWA (ONTARIO)

Department of Mathematics

Applications are invited for a tenure-track position commencing July 1, 1985. Rank according to qualifications. Requirements are a Ph.D. in mathematics and demonstrated research ability. For this position, ability to teach in English and French is a requirement for tenure.

Applicants should send a curriculum vitae and arrange for at least three letters of reference to be sent to: M. Déruaz, Chairman, Department of Mathematics, University of Ottawa, Ottawa, Ontario, K1N 9B4. Closing date for applications is December 15, 1984.

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents.

OKLAHOMA STATE UNIVERSITY

Tenured, Tenure-Track, and Visiting Positions

Several tenured, tenure-track, and visiting positions at all professorial ranks for fall, 1985. The minimum qualifications are a Ph.D. in Mathematics, evidence of research achievement or potential and a commitment to teaching; preference will be given to individuals with post-doctoral or similar experience. Normal duties include an active program in research and a teaching load of at most six hours per semester. In order to receive full consideration, applications, résumé, and three references should be sent by January 15, 1985 to

William Jaco, Head
Department of Mathematics
Oklahoma State University
Stillwater, Oklahoma 74078

Mathematics at Oklahoma State University is an active department that is undergoing growth and expansion in research.

O.S.U. is an equal opportunity employer. Female and minority applicants are encouraged.

ST. OLAF COLLEGE

Applications are invited for 2 tenure track positions at the assistant professor level, beginning September 1, 1984. Ph.D. in mathematics or computer science required. All areas considered, but special consideration given to candidates in areas of modern applied mathematics or computer science. Candidates should have a record of excellence in teaching and a commitment to the liberal arts. St. Olaf anticipates two additional leave replacement positions. Individuals at any rank who wish to visit for a year are encouraged to apply. Send a vita and three letters of recommendation to Theodore A. Vessey, Chair, Department of Mathematics, St. Olaf College, Northfield, MN 55057. St. Olaf is an Equal Opportunity, Affirmative Action Employer.

MATHEMATICAL SCIENCES
CENTRE COLLEGE

Tenure-track position beginning January or September 1985 for assistant or associate professor, Ph.D. in mathematics, to teach in undergraduate mathematics program. Ability to teach computer programming and/or statistics courses desirable. Teaching experience preferred. Salary commensurate with background and experience. Excellent fringe benefits. Centre seeks faculty members with a strong commitment to the liberal arts and to undergraduate teaching. E.O.E. Applications, résumés, transcripts, and references should be sent to Leonard M. DiLillo, Vice President and Dean, Centre College, Danville, Kentucky 40422.

THE OHIO STATE UNIVERSITY
CHAIR IN APPLIED MATHEMATICS

The Department of Mathematics of The Ohio State University has been awarded a Chair in Scientific Computation. This Chair is funded jointly by the Ohio Eminent Scholars Program and The Ohio State University and has an initial endowment of $1,000,000.

The Department seeks applicants with outstanding credentials in Computational Mathematics and Scientific Computation to fill this Chair. The recipient will hold the academic rank of Professor of Mathematics and will also serve as the Director of a newly established Center of Scientific Computation.

The University has also committed funds to purchase the computing equipment required for the center and the Mathematics Department has allocated four new junior positions to be filled by young researchers working in this or closely related areas.

Individuals interested in this position should contact

Professor James M. Greenberg, Chairman
Eminent Scholar Search Committee
The Ohio State University
Department of Mathematics
231 West 18th Avenue
Columbus, Ohio 43210
Telephone: 614/422-5255

Tenure-track and visiting positions in mathematics, statistics and computer science are available beginning September 1985. Excellent teaching and a commitment to research are required. Some three-year instructorships may be open. The department offers B.S. and M.S. degrees in mathematics and computer science. MTU is a state supported university emphasizing science and engineering. To apply, write: Dr. Deborah Frank Lockhart, Acting Head, Mathematical and Computer Sciences, Michigan Technological University, Houghton, MI 49931.

Michigan Technological University is an equal opportunity educational institution/equal opportunity employer.

POSITIONS AVAILABLE

Chairperson
Department of Mathematics & Computer Science
Southwest Texas State University

Southwest Texas State University invites applications for the position of chairperson of the Department of Mathematics and Computer Science. (Preliminary plans are underway to create a separate Department of Computer Science.) Candidates should have an outstanding record of scholarly research and high quality instruction as well as related professional activities. They must be able to provide strong academic leadership for a diverse department which is involved in both pure and applied mathematics, mathematical education, and diagnostic testing and placement of students. The Department currently has almost fifty FTE faculty with over 200 majors in mathematics and over 500 majors in computer science at the bachelors and masters levels. Some 6500 students per semester enroll in the Department's courses; a large number of these are in service courses for the School of Business and the School of Education.

Southwest Texas is a regional university of over 19,000 undergraduate and graduate students in eight schools. It is located in San Marcos, a friendly residential community of 35,000 located midway between Austin and San Antonio in the hill and lake country of Texas.

The position of chairperson at Southwest Texas State is a twelve-month appointment with a rank of associate or full professor depending upon qualifications. The current salary range for chairpersons is $52,392 to $55,092. Nominees and applicants should send a letter of intent. a complete vita, and should arrange to have at least three current letters of reference sent to:

Mathematics and Computer Science Search Committee
c/o Dean, School of Science
Southwest Texas State University
San Marcos, Texas 78666

The closing date is February 1, 1985. The position will become available no later than September 1, 1985.

Southwest Texas State University is an Affirmative Action, Equal Opportunity Educational Institution.

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF CALIFORNIA
RIVERSIDE, CALIFORNIA

Applications are invited for a faculty position in Mathematics beginning September 1985. This position is unrestricted as to level of appointment and area of specialization. Candidates must have demonstrated research ability and a commitment to excellence in teaching at the undergraduate and graduate levels. Candidates should send a vita and arrange for at least three letters of recommendation to be sent to: Professor James D. Stafney, Chair, Search Committee, Department of Mathematics, University of California, Riverside, California 92521.

The University of California is an Equal Opportunity/Affirmative Action Employer.

The Department of Mathematics of the University of Colorado invites applications for faculty positions beginning in the fall of 1985. Although these positions are primarily at the assistant professor level, we also welcome strong applications at the associate professor level. Preference will be given to those whose research would complement the interests of our current faculty. Salary range – $24,000 to $35,000. Applications should be completed by January 1, 1985, or by March 1, 1985 for any positions not filled from the initial group of applicants.

The University of Colorado is an Affirmative Action/Equal Opportunity Employer.

Inquiries should be addressed to: New Appointments, Department of Mathematics, Box 426, University of Colorado, Boulder, CO 80309.

Assistant Professor in Applied Mathematics
University of Maryland, College Park
Department of Mathematics
and
Institute for Physical Science and Technology

The University of Maryland seeks a Ph.D. with outstanding research potential in applied mathematics for appointment as Assistant Professor. The initial three year appointment would be joint with the Department of Mathematics and the Institute for Physical Science and Technology and would have a one course teaching load per semester. The appointment could be continued in the Department of Mathematics with tenure possible at some future time. Applicants should send a vita and a brief description of current work and arrange to have three letters of recommendation sent to either Professor J. R. Dorfman, Director, Institute for Physical Science and Technology, or Professor J. E. Osborn, Chairman, Department of Mathematics, University of Maryland, College Park, MD 20742.

The University of Maryland is an equal opportunity, affirmative action employer.

THE UNIVERSITY OF FLORIDA
DEPARTMENT OF MATHEMATICS

announces the opening of two new tenure-track assistant professorships beginning August, 1985. Those applying for these positions should have demonstrable research potential. In particular the search committee encourages applications from mathematicians with postdoctoral experience and from those whose research interests are compatible with the interests of current department members. Priority areas include algebra/combinatorics, analysis, differential equations, logic, and numerical analysis/approximation theory. The salaries will be highly competitive. Applicants should provide a résumé (including a list of publications) and should arrange for at least three letters of reference to be sent to:

David A. Drake
Chair, Search and Screen Committee
Department of Mathematics
University of Florida
Gainesville, Florida 32611

University of Wisconsin-Madison, Mathematics Department
480 Lincoln Drive, Van Vleck Hall, Madison, WI 53706

The Department of Mathematics solicits applications from mathematicians of established excellence for a possible tenure-track appointment commencing in the fall of 1985. Salary will be based on the applicant's qualifications and experience. Applications should be received no later than January 31, 1985 by Professor J. Marshall Osborn, Chairman, Department of Mathematics (address above). The University of Wisconsin is an Equal Opportunity Employer.

Van Vleck Assistant Professorship in Mathematics
University of Wisconsin-Madison, Mathematics Department
480 Lincoln Drive, Van Vleck Hall, Madison, WI 53706

Applications are invited from outstanding mathematicians (of any age) who are recent recipients of a doctorate. People are sought who will interact well with members of the department, who care about teaching, and who can contribute to the research and instructional programs. The regular teaching load is two courses per semester, with at least one in the applicant's specialty every other year. There is a high probability of additional income through research or teaching during summer between consecutive years of appointment. The salary will be dependent on experience and will be at least $23,500 per academic year. All positions are for specified two- or three-year terms. Deadline for applications is December 31, 1984. Application forms may be obtained by writing J. Marshall Osborn, Chairman (address above). The University of Wisconsin-Madison is an Equal Opportunity Employer.

POSITIONS AVAILABLE

UNIVERSITY OF IOWA
Department of Mathematics

Applications are encouraged for anticipated tenure-track, tenured positions, and visiting positions at all levels for the academic year 1985-86. Application, vita, and three letters of recommendation should be sent to Robert H. Oehmke, Department of Mathematics, University of Iowa, Iowa City, Iowa, 52242. Selections will be based on evidence of the applicants' effective teaching and research achievements and potential; instructional needs of the Department; and the potential for interaction with the faculty at the research level. Special attention will be given to applicants in differential equations. The selection process will begin on December 18, 1984. The University of Iowa is an Affirmative Action and Equal Opportunity Employer and specifically encourages applications from women and minorities.

UNIVERSITY OF VERMONT – DEPARTMENT OF MATH. AND STAT., 16 COLCHESTER AVENUE, BURLINGTON, VT. 05405

One tenure-track Assistant or Associate Professorship starting September 1985. Three year initial appointment, two course teaching load. Ph.D. and teaching experience required. Application accepted in all areas, but preference will be given to candidates whose research is compatible with department interest: approximation theory, numerical analysis, biomath, applied D.E., control theory, operations research, number theory, group theory and combinatorics. Send résumé, names of three references, and description of research plans to: Roger L. Cooke, Chairman. An equal opportunity/affirmative-action employer. Women and minorities are encouraged to apply.

DEAN, SCHOOL OF SCIENCE AND MATHEMATICS CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO

Applications and nominations are invited through January 15, 1985 for the position of Dean of the School of Science and Mathematics.

Qualifications include: a doctorate in one of the school disciplines (Biological Sciences, Chemistry, Mathematics, Physics, or Statistics); a strong concern for academic excellence; demonstrated evidence of academic leadership; professional achievement; administrative experience; and excellence in teaching.

Anticipated appointment date is July 1, 1985.

Information and application instructions may be obtained from:

Dr. Tomlinson Fort, Jr., Provost
California Polytechnic State University
San Luis Obispo, California 93407

AFFIRMATIVE ACTION/EQUAL OPPORTUNITY/
TITLE IX EMPLOYER

STATE UNIVERSITY OF NEW YORK AT BINGHAMTON

The Department of Mathematical Sciences expects to have tenure track junior positions open in Fall 1985. A senior or visiting appointment is also a possibility. Applications are invited from candidates having excellent research records or potential. All areas of pure and applied mathematics, including computer science, will be considered. The department has considerable computer science responsibilities, so applicants with computer science experience, at whatever level, are asked to describe it. Send vita and letters of recommendation to:

David L. Hanson, Chairman
Department of Mathematical Sciences
State University of New York at Binghamton
Binghamton, NY 13901

An Equal Opportunity/Affirmative Action Employer

TENNESSEE TECHNOLOGICAL UNIVERSITY
Department of Mathematics and Computer Science

The Tennessee Tech Department of Mathematics and Computer Science anticipates having three open tenure-track positions beginning September 1985.

ASSISTANT PROFESSOR OF MATHEMATICS

Candidates for this position should have a Ph.D. in Mathematics or Statistics, a strong commitment to teaching at both the undergraduate and the graduate levels, and a genuine interest in research and scholarly activity.

INSTRUCTOR OF MATHEMATICS (2)

Candidates for these positions should have at least a master's degree in Mathematics or Statistics, and a dedication to teaching undergraduate mathematics. Preference in filling one of these positions will be given to applicants with specialization in Applied Mathematics or Statistics.

To apply, send a letter stating which position is being sought, a transcript and a detailed résumé, and arrange to have three letters of recommendation sent to:

Dr. Leland L. Long, Chairman
Department of Mathematics & CSC
Box 5054, TTU
Cookeville, TN 38505

Evaluation of Applicants will begin on February 1, 1985.

TTU is an Affirmative Action/Equal Opportunity Employer.

EMORY UNIVERSITY
Department of Mathematics and Computer Science

Applications are invited for a position as (tenure track) assistant professor with interests in numerical analysis/scientific computation beginning August 1985. Requirements are a Ph.D. in mathematics or computer science and a strong research commitment.

EMORY UNIVERSITY, located in suburban Atlanta, is enlarging the faculty of the Department of Mathematics and Computer Science in response to the growth of both the graduate and undergraduate programs. The teaching environment (small classes, able students, no remedial programs) is unusually good. All applications should include a vita, a publication list, and at least three letters of reference. These should be submitted to:

Paul Waltman, Chairman
Department of Mathematics and Computer Science
Emory University
Atlanta, GA 30322

Applications will be reviewed beginning January 1, 1985.

EMORY UNIVERSITY is an affirmative action/equal opportunity employer. Applications from members of minority groups and women are particularly encouraged.

EMORY UNIVERSITY
Department of Mathematics and Computer Science

Tenure-track assistant professor in applied mathematics (beginning August 1985). A strong background in analysis and good computer skills are required.

EMORY UNIVERSITY, located in suburban Atlanta, is enlarging the faculty of the Department of Mathematics and Computer Science in response to the growth of both the graduate and undergraduate programs. The teaching environment (small classes, able students, no remedial programs) is unusually good. All applications should include a vita, a publication list, and at least three letters of reference. These should be submitted to:

Paul Waltman, Chairman
Department of Mathematics and Computer Science
Emory University
Atlanta, GA 30322

Applications will be reviewed beginning December 1, 1984.

EMORY UNIVERSITY is an affirmative action/equal opportunity employer. Applications from members of minority groups and women are particularly encouraged.

POSITIONS AVAILABLE

LOYOLA COLLEGE
DEPARTMENT OF MATHEMATICAL SCIENCES
4501 N. Charles Street
Baltimore, Maryland 21210-2699

A tenure-track assistant professorship is available for Fall '85. Candidates should have a Ph.D. in a mathematical science with a background in one or several of the following areas: combinatorics, graph theory, mathematical programming, numerical analysis, computational complexity, or algorithm design. The Department offers a strong undergraduate program in the Mathematical Sciences. Teaching duty is 3 courses/semester. Moderate amount of research required. Applicants should submit a current curriculum vitae, three letters of recommendation submitted independently of the candidate, transcripts of all college and graduate level work, and a copy of at least one recent publication or research proposal to: Dr. John Hennessey, Chairman. Résumés received after December 15, 1984 may not be considered.

Affirmative Action Employer

LOYOLA COLLEGE
DEPARTMENT OF MATHEMATICAL SCIENCES
4501 N. Charles Street
Baltimore, Maryland 21210-2699

A permanent full-time position is available at the Instructor level. Candidate should have a Masters degree in a mathematical science and a desire to teach basic undergraduate mathematics to qualify for this non-tenure track position. The college offers a strong undergraduate program in Math Sciences. Teaching duty is 4 courses/semester. Applicants should send vita, three letters of recommendation, and transcripts of all college and graduate level work to Dr. John Hennessey, Chairman. Applications received after January 18, 1985 may not be considered.

Affirmative Action Employer

LOYOLA COLLEGE
DEPARTMENT OF MATHEMATICAL SCIENCES
4501 N. Charles Street
Baltimore, Maryland 21210-2699

A possible tenure track Assistant Professorship will be available for Fall '85. Candidate should have a Ph.D. in Statistics or some related Mathematical Science with the ability to teach basic and upper level Statistics courses. The Department offers a strong undergraduate program in the Mathematical Sciences with concentrations including Statistics and Operations Research. Teaching duty is 3 courses/semester. Excellence in teaching and a moderate amount of research is required. Applicants should submit a current vita, three letters of recommendation and transcripts of all college and graduate level work to Dr. John Hennessey, Chairman. Résumés received after February 20, 1985, may not be considered.

Affirmative Action Employer

CARNEGIE-MELLON UNIVERSITY
Department of Mathematics
Numerical Analysis Position

The Department of Mathematics has openings at the Assistant Professor level for the Fall of 1985. The main area of interest is Numerical Analysis, especially in areas which complement existing strengths within the Department. These include numerical methods for partial differential equations with applications to fluid mechanics. Outstanding applicants in other areas will also be considered. Salaries, as well as other conditions of employment, are highly competitive. Interested candidates should send résumés, a copy of their transcript and three reference letters to George J. Fix, Professor and Head, Department of Mathematics, Carnegie-Mellon University, Schenley Park, Pittsburgh, PA 15213. Carnegie-Mellon University is an Affirmative Action/Equal Opportunity Employer.

MATHEMATICS DEPARTMENT
UNITED STATES NAVAL ACADEMY
ANNAPOLIS, MARYLAND 21402-1385

Applications are invited for a three year tenure-track appointment as Assistant Professor commencing August 1985. Ten month salary $21,000–$30,000, commensurate with experience and qualifications. Research opportunities exist for augmenting salary during summer. Specialization in combinatorics or applied mathematics preferred. Applicants must possess Ph.D., have a commitment to excellence in teaching, be capable of pursuing independent research, and have U.S. Citizenship. Send inquiries and applications not later than February 1, 1985 to Prof. F. I. Davis, Chairman. Required of each applicant are a résumé, transcripts, and three letters of recommendation discussing applicant's teaching and research. The Naval Academy is an EO/AA employer.

Department of Mathematics
The Ohio State University

The Department of Mathematics of The Ohio State University hopes to fill several positions at all ranks, both visiting and permanent, effective Autumn Quarter 1985. Candidates in areas of applied and pure mathematics are invited to apply. Significant research accomplishments or exceptional research promise and evidence of good teaching ability will be expected of successful applicants.

Please send credentials and have letters of recommendation sent to Professor Alan Woods, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210. Review of résumés will begin immediately.

The Ohio State University is an Equal Opportunity/Affirmative Action Employer.

MICHIGAN TECHNOLOGICAL UNIVERSITY
HEAD – DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

We invite applications and nominations for the position of department head. Candidates should have a well-established reputation in research and scholarship and a special interest in applied mathematics, statistics or computer science. A commitment to active research and effective teaching is necessary. The department has 40 faculty members and offers B.S. and M.S. degrees in mathematics and computer science. MTU is a state-supported university (enrollment 7000) emphasizing science and engineering. Applicants should send a résumé and arrange to have at least three letters of recommendation sent to: MACS Search Committee, c/o Department of Mathematical and Computer Sciences, Michigan Technological University, Houghton, MI 49931. Michigan Technological University is an equal opportunity educational institution/equal opportunity employer.

UNIVERSITY OF CENTRAL FLORIDA
Department of Mathematics

Applications are invited for several tenure-track and visiting positions at the Associate or Assistant professor, or Instructor level, beginning August, 1985. Ph.D. degree with strong research potential or experience, and dedication to teaching required for appointment at associate or assistant level. Candidates with substantial completion of Ph.D. requirements will be considered for assistant or instructor level. Preferred research areas include applied mathematics, ordinary or partial differential equations, applicable mathematics, continuum mechanics, and applied analysis. The visiting positions are unrestricted as to area of specialization within mathematical sciences. Candidate should send a detailed résumé and arrange to have at least three letters of recommendation and a transcript sent to: Professor Lokenath Debnath, Chairman, Department of Mathematics, University of Central Florida, Orlando, Florida 32816, postmarked by January 15, 1985. The University is an equal opportunity/affirmative action employer.

POSITIONS AVAILABLE

INDIANA STATE UNIVERSITY

Department of Mathematics and Computer Science

The Mathematics and Computer Science Department is extending its search to fill two Assistant Professor positions beginning either in January or September of 1985. The Department has twenty-two full-time faculty members and offers BA and BS degrees in Mathematics and in Computer Science, and the MA and MS in Mathematics. Applicants should have a Ph.D., preferably with documented competencies in Computer Science.

Indiana State University has extensive computing facilities, including a CYBER 720, an IBM 4361, two PRIME 750's and several microcomputer laboratories. The Department operates its own microcomputer laboratory and a VAX-11/750 with both Bell and Berkeley UNIX available.

Send vita and three letters of recommendation to:

Dr. Donald F. Reynolds, Chairperson
Department of Mathematics and Computer Science
Indiana State University
Terre Haute, IN 47809

Applicants should be U.S. citizens or hold a resident visa. Applications received after December 31, 1984 cannot be guaranteed consideration. Indiana State University is an EO/AA employer.

STAFF DIRECTOR – MATHEMATICS

The National Academy of Sciences/National Research Council seeks a Staff Director for its Board on Mathematical Sciences. Extensive working familiarity with research in pure and applied mathematics and statistics, and experience with study project management are required.

A Ph.D. in a directly relevant field and 7–10 years' relevant professional experience are strongly preferred. Evidence of management and communications skills are required. The incumbent will have responsibility for designing, securing funding for, and managing an important program of studies.

Please submit résumé to:

Dr. Lawrence E. McCray
Associated Executive Director
Commission on Physical Sciences,
Mathematics, and Resources
National Academy of Sciences/
National Research Council
2101 Constitution Avenue, N.W.
Washington, DC 20418

An Equal Opportunity Employer M/F/H

TRW INCORPORATED
ADVANCED TECHNOLOGY RESEARCH

Applications are invited for a position in Mathematics/Computer Science for an individual with at least eight years of industry experience (or a more junior individual with exceptional academic preparation) for research and project work in multi-level computer security. Special technology experience of relevance includes: guards/downgraders, security kernels, communications security, automatic theorem proving, cryptography, artificial intelligence, formal verification, fault tolerant computing, networking, and data base management. Individual should have a balance of hardware and software skills. Individual will have the opportunity to work in a new, well-equipped MLS laboratory in Redondo Beach, California. Activities have a product orientation within an overall MLS architecture framework. TRW, a recognized industry leader in advanced systems development, is an equal opportunity/affirmative action employer offering competitive benefits and salary structure. Send résumé to: Dr. B. K. Richard, Advanced Technology Manager, TRW-DSG, 02/1305, Redondo Beach, CA 90278. (213) 536-8564. U.S. Citizenship Required.

LAMAR UNIVERSITY

Department of Mathematics

Three tenure track positions and one Visiting Professorships available in 1985: two in January; two, August. The Department seeks faculty in applied mathematics, statistics, and mathematics computer-aided instruction. Salary and rank commensurate with qualifications. Expected: Teaching excellence and commitment to creative, scholarly activities. Visiting Professor will teach two courses each semester and interact with research faculty. Application deadlines: December 1, 1984, for January positions; February 15, 1985, for August. Send résumé and three letters of recommendation to Dr. George Poole, Head, Department of Mathematics, P.O. Box 10047, Lamar University, Beaumont, TX 77710. Lamar University is an Equal Opportunity/Affirmative Action Employer.

Eminent Scholar in Science: Applications and nominations are invited for the Glenwood and Martha Creech Eminent Scholar Chair in Science at Florida Atlantic University. This position is supported by a one million dollar endowment and will be filled at the senior level in the College of Science, which consists of Departments of Physics, Mathematics, Chemistry, Psychology, Biology, and Geology. Individuals with broad interdisciplinary research interests among the traditional science areas as well as computer science are encouraged to apply.

Applicants and nominees should have a distinguished academic and research reputation that includes a successful record in obtaining contract and grant support. The primary responsibilities of the successful candidate will be to significantly contribute to the expansion of the research program in the College of Science and to provide graduate level training in his or her field of expertise.

Completed applications must be received by January 31, 1985.

Florida Atlantic University is an affirmative action/equal opportunity employer.

THE GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have available some visiting and tenure-track positions beginning in the fall quarter of 1985. Excellent accomplishments or potential in research is required. Applications should be made to the Director, School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia 30332. Georgia Tech, a unit of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

ARIZONA STATE UNIVERSITY

Department of Mathematics

Applications are invited for anticipated positions at ranks of Assistant and Associate Professor. There is a possibility of appointments at Professor rank. Visiting positions are also expected. Send vita and direct three letters of recommendation to J. Bustoz, Chair, Department of Mathematics, Arizona State University, Tempe, AZ 85287. A.S.U. is an equal opportunity employer.

Department of Mathematical Sciences

University of North Florida

Applications are invited for a Visiting Assistant or Associate Professor for the Spring Semester, 1985 (January–May). The Ph.D. in Mathematics or Statistics is strongly preferred, although others who can teach upper level major courses will be considered. The Department offers the B.A. and B.S. degrees in mathematics and statistics, and the M.A. with tracks in mathematics, statistics, and computer science.

Send résumé and three letters of recommendation by December 3, 1984, to Leonard J. Lipkin, Chairperson, Department of Mathematical Sciences, University of North Florida, 4567 St. Johns Bluff Road, Jacksonville, Florida 32216. For further information, phone (904) 646-2653. An AA/EEO Employer.

POSITIONS AVAILABLE

UNIVERSITY OF SOUTH ALABAMA
Department of Mathematics and Statistics

Applications are being accepted for at least one tenure-track position at the rank of Assistant Professor. A successful applicant must possess a Ph.D. in Mathematics. Preferred specialties include differential equations, dynamical systems, ergodic theory, functional analysis, geometric topology, number theory, and numerical analysis. The duties include teaching undergraduate and graduate mathematics courses, and carrying out research or other creative activity. The appointment will begin September, 1985. Applicants should send a detailed résumé, transcripts, and three letters of recommendation to Dr. S. Gene Crossley, Chairman, Department of Mathematics and Statistics, University of South Alabama, Mobile, AL 36688. Screening will begin on February 1, 1985. USA is an equal opportunity/affirmative action employer.

The Department of Mathematics and Statistics at Mississippi State University anticipates two or more tenure track positions at the Assistant Professor level for the 1985-86 academic year. A Ph.D. is preferred. Responsibilities include teaching and research. Candidates should submit a vita and three letters of recommendation to Professor Roger C. McCann, Chairman Screening Committee, Department of Mathematics and Statistics, Mississippi State, MS 39762. Screening will begin on December 15, 1984, and continue until positions are filled. Mississippi State University is an equal opportunity/affirmative action employer.

IUPUI DEPARTMENT OF MATHEMATICAL SCIENCES
INDIANAPOLIS, INDIANA 46223

The Department of Mathematical Sciences at IUPUI has one or more tenure-track positions at the assistant professor level for August, 1985. The Ph.D. and strong research credentials are required. Applications are encouraged in all areas of the Mathematical Sciences.

IUPUI offers B.S., M.S., and Ph.D. degrees from Purdue University. Salaries are competitive. The fringe benefits package, which includes TIAA, is excellent. Send résumé and three letters of recommendation to:

Neal J. Rothman, Chairman
Department of Mathematical Sciences
IUPUI
P.O. Box 647
Indianapolis, Indiana 46223

IUPUI IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

MATHEMATICS
UNIVERSITY OF MARYLAND BALTIMORE COUNTY

The UMBC Mathematics and Computer Science Department invites applications for positions at the assistant, associate, or full professor level in Mathematics or Applied Mathematics. Candidates should have Ph.D. in Mathematics or Applied Mathematics and research and teaching experience commensurate with position. The department offers M.S. and Ph.D. programs in Applied Mathematics, Computer Science, and Statistics and undergraduate major programs in mathematics and computer science leading to the baccalaureate degrees. Current faculty strengths are in analysis (including probability theory), communication and control, operations research, and scientific computing. Candidates with strengths in these or supporting areas will be preferred. Applications should be received by January 15, 1985. Send a curriculum vita, reprints and/or preprints, names of at least three references to: Nam P. Bhatia, Chairman Faculty Recruiting, Department of Mathematics and Computer Science, University of Maryland Baltimore County, Catonsville, Maryland 21228. Telephone 301-455-2407. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. MINORITIES AND WOMEN ARE ENCOURAGED TO APPLY.

UNIVERSITY OF CONNECTICUT, Department of Mathematics, Storrs, CT 06268. Assistant/Associate/Full Professor-tenure track or visiting positions expected to be available fall 1985.

Teach courses in mathematics at graduate and under-graduate levels. Participate in Department research effort in areas of expertise. Ph.D. in mathematics required. Demonstrated commitments to research and to teaching. Preference given to an applicant with ability and background to contribute to the development of Department's program in Applied and Computational Mathematics. Preferred areas of research are numerical analysis, combinatorics, coding theory, dynamical systems, probability, algorithms or complexity theory. Salary negotiable. Screening begins February 15, 1985.

Contact Howard Roberts, Acting Department Head. University of Connecticut is an equal opportunity/affirmative action employer.

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1) Southern Illinois University-Carbondale. Applications are invited for a tenure-track, Assistant Professor, position in Statistics in the Department of Mathematics, starting August 16, 1985. Minimum qualifications are a Ph.D. with a strong background in mathematical statistics and broad interests in applied statistics. Closing date is December 15, 1984, or until the position is filled. Applications plus three letters of recommendation should be sent to Statistics Position; c/o Alphonse Baartmans, Chairman; Department of Mathematics; Southern Illinois University; Carbondale, Illinois 62901. SIU-C is an Equal Opportunity/Affirmative Action Employer.
2) Southern Illinois University-Carbondale. Applications are invited from qualified candidates for a tenure-track position in the Department of Mathematics, starting August 16, 1985. Ph.D. in mathematics required. Rank and area open. Preference will be given to candidates in Numerical Analysis. However, all qualified applicants will be considered. Candidates must have demonstrated evidence of excellence in research and potential for such in an area of mathematics. Evidence of teaching effectiveness is preferred. Substantial research record is required for appointment at the senior level. Closing date is December 15, 1984, or until position is filled. Applications plus three letters of recommendation should be sent to Continuing Position; c/o Alphonse Baartmans, Chairman; Department of Mathematics; Southern Illinois University; Carbondale, Illinois 62901. SIU-C is an Equal Opportunity/Affirmative Action Employer.
3) Southern Illinois University-Carbondale. Applications are invited for a continuing (tenure-track) position at the Assistant Professor level in the Department of Mathematics, starting August 16, 1985. Ph.D. in mathematics required. Area open. Candidates must have demonstrated evidence of excellence in research and potential for such in an area of mathematics. Evidence of teaching excellence is preferred. Closing date is December 15, 1984, or until position is filled. Applications plus three letters of recommendations should be sent to: Asst. Prof. Position; c/o Alphonse Baartmans, Chairman; Department of Mathematics; Southern Illinois University; Carbondale, Illinois 62901. SIU-C is an Equal Opportunity/Affirmative Action Employer.

ROCHESTER INSTITUTE OF TECHNOLOGY
Department of Mathematics
Rochester, NY 14623

At least one asst/assoc prof., tenure-track position anticipated for Sept., 1985. Ph.D. in math or statistics preferred, MS with extensive applied experience considered. Preferred specialties: Applied prob/stat, or, computational math, graph theory, discrete math. Applicant must have primary interest in teaching undergrad math, as well as doing some research or consulting. Salary: Competitive, negotiable. Contact: Prof. James Glasenapp, Chairman, Faculty Recruiting Committee. RIT is affirmative action/equal opportunity employer.

POSITIONS AVAILABLE

School of Operations Research and Industrial Engineering, Cornell University.

Applications are invited for a tenured or tenure track position beginning Fall, 1985. Preference will be given to recent Ph.D.'s in theoretical areas related to optimization, combinatorics, game theory, or computation, but applications at all levels and in all areas of concern to operations research will be welcome. Applicants should have a Ph.D. in operations research, mathematics, statistics, computer science or related area, show evidence or promise of strong research ability, and be capable of teaching at all levels. Please send vita to: Professor Howard M. Taylor, 343 Upson Hall, Ithaca, New York 14853. AA/EOE

ILLINOIS WESLEYAN UNIVERSITY
BLOOMINGTON, IL 61702

The Mathematics Department has a tenure track position for Assistant professor (Ph.D.) or Instructor (near Ph.D.). Responsibilities: teach undergraduate mathematics (plus some computer science). Advancement depends upon good teaching as well as research. Salary competitive. Send applications, have three references; write to W. K. Smith, Chairman, Mathematics Department. Deadline: 31 December 1984. Equal opportunity employer.

The Ohio State University
Department of Mathematics
Research Instructorships in Mathematics

Applications are invited for the position of research instructor in mathematics for the academic year 1985-86. Candidates should hold a Ph.D. (or equivalent) in mathematics and show strong research promise.

Please send credentials and have letters of recommendation sent to Professor Alan Woods, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210. The Ohio State University is an Equal Opportunity/Affirmative Action Employer.

Columbia University
Department of Computer Science
Lectureships

Positions as Lecturer or Senior Lecturer will be offered to excellent teachers with superior research and academic backgrounds. Faculty of all ranks in other mathematical disciplines, as well as computer science, are encouraged to apply for these non-tenured term appointments, whose duration will typically be three to six years. Pay is comparable to professorial levels.

These lectureships provide an opportunity for teacher/scholars with some substantial prior computing experience to make a transition to computer science. Columbia University has an outstanding young research faculty and facilities, now working in a five-million dollar office and research-laboratory building. Lecturers will be encouraged to participate fully in departmental activities.

Lecturers will teach two undergraduate courses each semester. They must be able to make highly effective presentations to large classes. The University has several DEC 2060 computer systems dedicated to instructional use. Many terminals for students are in dormitories and other convenient locations. Knowledge of innovative uses of technology for teaching is desirable.

Send résumé and names of three references by February 15, 1985, if possible, to Professor Jonathan Gross, Vice-Chairman, Department of Computer Science, Columbia University, New York, New York 10027. Please write "Re Lectureship" on the envelope of your letter of inquiry or application.

COLUMBIA UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. WE ARE INTERESTED IN RECEIVING APPLICATIONS FROM QUALIFIED WOMEN AND MINORITIES.

THE CHINESE UNIVERSITY OF HONG KONG

Applications are invited for the following post:

Professor of Mathematics – Applicants should have outstanding academic qualifications, considerable university teaching, research and administrative experience and have published scholarly works of originality and merit in the discipline.

Date of Assumption of Duty: August 1, 1985.

Annual Salary: HK$328,560 or above. (Exchange rate approximately: US$1 = HK$7.8, £1 = HK$9.8.) Starting salary will depend on qualifications and experience.

Conditions of Service: Benefits include sick leave, vacation leave, long leave with pay, superannuation (University 15%, appointee 5%), housing allowance, and for appointees on overseas terms, passage benefits for themselves and their dependents as well.

Application Procedure: Applications should be made out in duplicate, giving full particulars, experience and the names and addresses of three persons to whom reference may be made, and sent together with copies of certificates/diplomas/testimonials and recent publications to the Personnel Section, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong not later than December 31, 1984. Please quote reference number 65/509/2/84 and mark 'Recruitment' on cover.

THE CITADEL

Applications are invited for tenure-track positions at the assistant or associate level. Teaching responsibilities at all undergraduate levels of Computer Science and Mathematics. Qualifications include a Ph.D. in Mathematics, Statistics, or Computer Science with a capacity for research and a dedication to undergraduate teaching. At least one position will be filled with someone who has a strong background in computing. Salary negotiable. Liberal benefits include possible resources for assistance to pursue advanced computer science degrees.

The Citadel is a state-supported, liberal arts, military college offering undergraduate degrees in the Arts, Sciences, Engineering, Education and Business Administration.

Please send résumé and three letters of reference to Charles E. Cleaver, Head, Department of Mathematics and Computer Science, The Citadel, Charleston, South Carolina 29409. Applications should be received by February 15, 1985, to insure consideration.

HOBART AND WILLIAM SMITH COLLEGES
Department of Mathematics and Computer Science

Applications are invited for two tenure-track positions, beginning September 1985.

Position 1: Assistant or Associate Professor; Ph.D. in Mathematics with strong background (preferably a Master's) in Computer Science required; teach all levels of undergraduate mathematics and computer science and participate in the General Curriculum.

Position 2: Assistant Professor; Ph.D. in Mathematics with some background and strong interest in Computer Science required; teach all levels of undergraduate mathematics and some computer science, and participate in the General Curriculum.

For both positions, candidates should have strong commitment to excellence in teaching and promise of continued scholarly activity. Teaching load two courses per trimester. Salary negotiable and competitive.

Applicants should send detailed résumé, three letters of recommendation (at least one including comments on teaching ability), and undergraduate and graduate transcripts (photocopies) to:

Professor Irving Bentsen, Chairman
Department of Mathematics and Computer Science
Hobart and William Smith Colleges
Geneva, New York 14456

An Equal Opportunity Employer.

POSITIONS AVAILABLE

THE UNIVERSITY OF ALABAMA
MATHEMATICS DEPARTMENT

The mathematics department is awaiting the approval of the administration for two new senior positions for mathematics. If approved, we expect to hire at the rank of associate professor. We invite applications from experienced mathematicians in applied mathematics with excellent records in research and teaching. We are looking for two people who will help us develop our research group and our graduate programs in applied mathematics. Applications or inquiries should be sent to: Alan Hopenwasser, P.O. Box 1416, University, AL 35486. THE UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

SYRACUSE UNIVERSITY
Department of Mathematics

Syracuse University invites applications for a tenure-track position with rank and salary to be determined by qualifications of appointee. Outstanding candidates having potential for strengthening any existing research area will be seriously considered, but preference will be given to candidates in the broad area of analysis. Potential for excellence in research and teaching is required. For a senior level appointment proven excellence in research and teaching is expected. Send vita and arrange for three reference letters (also a transcript if recent Ph.D.) to be sent to L. J. Lardy, Chairman, Department of Mathematics, Syracuse University, Syracuse, NY 13210. Syracuse University is an AA/EEO Employer.

THE UNIVERSITY OF ALABAMA IN BIRMINGHAM
DEPARTMENT OF MATHEMATICS

Applications are invited for tenure track positions in the Department of Mathematics. Applicants with research in any area are welcome, but mathematicians with major research interests in the areas of dynamical systems, mathematical physics, nonlinear analysis on Riemannian manifolds, differential topology-geometry and nonlinear differential equations are particularly encouraged to apply. Successful applicants will be expected to be strong or promising researchers, good teachers, and to significantly interact with other members of the department. Rank and salary are open. The teaching load for research faculty normally does not exceed two courses per term. Fringe benefits are excellent. Applicants should send résumé and three letters of recommendation to Roger T. Lewis, Department of Mathematics, University of Alabama in Birmingham, Birmingham, AL 35294. This information should be received by January 1, 1985, but will be considered until position is filled. UAB is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF CALIFORNIA, SANTA BARBARA
DEPARTMENT OF MATHEMATICS

UCSB Department of Mathematics has designated 1985-1986 as a special year in minimal surfaces and their applications to low-dimensional topology. The department anticipates making up to four visiting faculty appointments of candidates possessing a Ph.D. in mathematics, a commitment to excellence in teaching, and research expertise in minimal surfaces or low-dimensional topology. A number of distinguished visitors are expected to be in residence for various time periods during the year. Applicants should send vitae and publication list, and should arrange for three letters of recommendation to be sent to:

Professor James Robertson, Chairman
Department of Mathematics
University of California
Santa Barbara, CA 93106

Applications will be accepted until January 15, 1985, or until the positions are filled. UCSB is an affirmative action/equal opportunity employer.

Southern Illinois University-Carbondale. Visiting positions starting August 16, 1985, in the Department of Mathematics. Appointments will be at the Lecturer, Visiting Assistant Professor or Visiting Associate Professor level depending on qualifications. Significant scholarly record required for appointment at the senior rank. Admission to candicacy required; Ph.D. preferred. Applicants should have recommendations in teaching. Research interests compatible with the research interests of our faculty are preferred. The duties will consist of up to 12 hours of undergraduate mathematics instruction each semester (usually 3 courses) and active participation in research seminars of the department. Closing date: February 15, 1985, or until positions filled. SIU-C is an Equal Opportunity/Affirmative Action Employer. Application, résumé and three letters of recommendation should be sent to Visiting Positions; c/o Alphonse Baartmans, Chairman; Department of Mathematics; Southern Illinois University; Carbondale, Illinois 62901.

STATISTICS
UNIVERSITY OF MARYLAND BALTIMORE COUNTY

The UMBC Mathematics and Computer Science Department invites applications for positions at the assistant, associate, and full professor levels beginning September, 1985. Candidates should have Ph.D., strong teaching ability and demonstrable research potential in either mathematical or applied statistics. The department offers M.S. and Ph.D. programs in Applied Mathematics, Computer Science, and Statistics and undergraduate major programs in mathematics and computer science leading to the baccalaureate degrees. The department has a faculty of about 25 at present. Applications should be received by January 15, 1985. Send a curriculum vita, reprints and/or preprints, names of at least three references to: Nam P. Bhatia, Chairman Faculty Recruiting, Department of Mathematics and Computer Science, University of Maryland Baltimore County, Catonsville, Maryland 21228. Telephone 301-455-2407. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. MINORITIES AND WOMEN ARE ENCOURAGED TO APPLY.

SOUTHWEST TEXAS STATE UNIV., DEPT. OF MATH/CS, SAN MARCOS, TX 78666. One or more assist. or assoc. professorships expected for fall 1985. Possibility of tenure track appointments. Ph.D. (or equiv.) and potential for excellence in research and teaching required. Limited to those in math. ed., applied math., computer science, diff. eq. (o.d.e. or p.d.e.), dynamical systems. Contact Chairman, Southwest Texas State University, San Marcos, TX 78666. Application deadline: 2/1/85, late applications considered if openings exist. SWTSU is an equal opportunity/affirmative action employer.

SOUTHWEST TEXAS STATE UNIV., DEPT. OF MATH/CS, SAN MARCOS, TX 78666. One or more non-tenure track instructorships expected for fall 1985. Master's degree in mathematics or computer science and potential for excellence in teaching required. Contact Chairman, Department of Mathematics and Computer Science, Southwest Texas State University, San Marcos, TX 78666. Application deadline: 2/1/85. Late applications considered if openings exist. Southwest Texas State University is an equal opportunity/affirmative action employer.

COMPUTER SCIENCE

Tenure-track faculty position beginning January, 1985. Responsibilities – undergraduate teaching (12 semester hours per semester) in a program leading to a B.A. or a B.S. in Computer Science. Required: M.S. in Computer Science. Rank and salary dependent on qualifications and experience. Send résumé, three letters of reference and graduate transcripts prior to November 22, 1984 to Personnel Coordinator, St. Ambrose College, 518 West Locust Street, Davenport, Iowa 52803. EQUAL EMPLOYMENT OPPORTUNITY.

POSITIONS AVAILABLE

THE UNIVERSITY OF ALABAMA
DEPARTMENT OF MATHEMATICS

The Mathematics Department expects to have at least four tenure-track positions beginning August 16, 1985. Rank and salary will depend upon qualifications. A Ph.D. (or the equivalent) is required. Applications in all areas will be considered. Areas of particular interest include Algebra, Applied Mathematics, Differential Equations, Topology and Analysis. At least three letters of recommendation which address teaching and research should be sent to the department. Send a curriculum vita and reprints/preprints to: A. Hopenwasser, P.O. Box 1416, University, AL 35486. THE UNIVERSITY OF ALABAMA IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

DEPARTMENT HEAD
DEPARTMENT OF MATHEMATICAL SCIENCES

Purdue University Calumet seeks applicants for the position of Head of the Department of Mathematical Sciences, which is responsible for Mathematics, Statistics, and Computer Science. A doctorate in one of these areas is required. Applicants should have a successful record of teaching and research, and qualify for appointment as Professor or Associate Professor. Substantial interpersonal and administrative skills are required.

Duties include administration of a Department of twenty, teaching appropriate courses, and leading the continuing development of programs in applied mathematics and computer science. The Department currently offers a variety of programs at the Baccalaureate and Master's Degree levels. Salary is open and competitive. TIAA/CREF is included in an excellent fringe-benefit package.

The campus serves nearly eight thousand commuter students at a suburban location in Northwest Indiana, approximately 45 minutes from downtown Chicago.

Applicants should forward a résumé and the names of three references by January 25, 1985 to:

Professor D. J. Troy, Chairperson
Department Head Selection Advisory Committee
Department of Mathematical Sciences
Purdue University Calumet
Hammond, Indiana 46323

Telephone (219) 844-0520, ext. 273

Purdue University Calumet is an Equal Opportunity/Affirmative Action Employer.

CHAIRPERSON
DEPARTMENT OF MATHEMATICS
WEST VIRGINIA UNIVERSITY

Applications and nominations are invited for the position of Chairperson of the Department of Mathematics at West Virginia University. The Chair is the chief administrative officer of the department. The search is for a person who has a strong research record, a commitment to excellence in instruction, and the ability to provide scientific and administrative leadership of the 35-member department, which offers B.S. and M.S. degrees.

West Virginia University is the state's sole comprehensive, land-grant, doctoral institution with an enrollment of 20,000 students. The Department of Mathematics is part of the College of Arts and Sciences.

A complete application consists of a vita and the names and addresses of at least four references. Applications will be received until the position is filled but should arrive by February 1, 1985, to insure consideration.

Applications and nominations should be addressed to Dr. Emory Kemp, Chair, Mathematics Department Chair Search Committee, 201 Woodburn Hall, West Virginia University, Morgantown, West Virginia 26506.

West Virginia University is an Affirmative Action/Equal Opportunity Employer.

COMPUTER SCIENCE
UNIVERSITY OF MARYLAND BALTIMORE COUNTY

The UMBC Mathematics and Computer Science Department anticipates having several tenure-track and tenured faculty positions at the assistant, associate, or full professor level beginning September 1985. Candidates should have Ph.D. in computer science or in a closely related field, demonstrable research potential, and strong ability to teach a broad range of basic computer science courses and graduate courses in one's field of specialty. The department offers M.S. and Ph.D. programs in Applied Mathematics, Computer Science, and Statistics and undergraduate major programs in mathematics and computer science leading to the baccalaureate degrees. Application should be received by January 15, 1985. Send a curriculum vita, reprints and/or preprints, name of at least three references to: Nam P. Bhatia, Chairman of Faculty Recruiting, Department of Mathematics and Computer Science, University of Maryland Baltimore County, Catonsville, Maryland 21228. Telephone 301-455-2407. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. MINORITIES AND WOMEN ARE ENCOURAGED TO APPLY.

FACULTY POSITION IN MATHEMATICS
FLORIDA INTERNATIONAL UNIVERSITY

The Department of Mathematical Sciences at Florida International University announces tenure-track positions at all levels beginning in January and/or August, 1985. Candidates must have a Ph.D. in Mathematics, research potential, and demonstrated teaching ability. Teaching load is fifteen semester-hours per academic year; summer teaching available. Preferred areas of specialization include harmonic analysis, algebra, and mathematical logic; qualified candidates in other areas will be considered. Send résumé and three letters of reference to Dr. David Barton, Mathematics Recruitment, Department of Mathematical Sciences. Florida International University, Miami, FL33199. F.I.U. is a member of the State University System of Florida and an equal opportunity/affirmative action employer.

UNIVERSITY OF CENTRAL FLORIDA
Department of Mathematics

Applications are invited for several tenure-track and visiting positions at the Associate or Assistant Professor, or Instructor level, beginning August, 1985. Ph.D. degree with strong research potential or experience, and dedication to teaching required for appointment at associate or assistant level. Candidates with substantial completion of Ph.D. requirements will be considered for assistant or instructor level. Preferred research areas include applied mathematics, ordinary or partial differential equations, applicable mathematics, continuum mechanics, and applied analysis. The visiting positions are unrestricted as to area of specialization within mathematical sciences. Candidate should send a detailed résumé and arrange to have at least three letters of recommendation and a transcript sent to: Professor Lokenath Debnath, Chairman, Department of Mathematics, University of Central Florida, Orlando, Florida, 32816, postmarked by January 15, 1985. The University is an equal opportunity/affirmative action employer.

UNIVERSITY OF CALIFORNIA, LOS ANGELES
DEPARTMENT OF MATHEMATICS

Three or four E. R. Hedrick Assistant Professors. Applicants must show strong promise in research and must have received the Ph.D. after 1 January 1984 (but may be of any age); no restrictions as to field; salary $30,800. Three year appointment; research supplement of $3,400 first summer. Teaching load: Four quarter courses per year, including one advanced course in candidates field. Deadline for applications is January 15, 1985. To apply, write to Yiannis N. Moschovakis, Chair, Los Angeles, CA 90024.

UCLA is an equal opportunity affirmative action employer.

POSITIONS AVAILABLE

LAWRENCE UNIVERSITY
DEPARTMENT OF MATHEMATICS

Tenure-track position at the assistant professor level starting fall 1985. The Department seeks candidates specializing in graph theory or combinatorics, but will consider especially strong candidates in any area. Lawrence is a liberal arts college with a national reputation, small classes, and excellent students. Teaching load two courses each ten week term. Salary competitive. Send résumé, transcripts, and three or four supporting letters to Bruce Pourciau, Chairman, Department of Mathematics, Lawrence University, Appleton, WI 54912. These letters should provide specific evidence on the candidate's potential for outstanding undergraduate teaching and continued research. Deadline January 20 but application by December 20 makes possible an interview at the January AMS meeting. Equal Opportunity Employer.

FACULTY POSITION
UNIVERSITY OF LOUISVILLE
DEPARTMENT OF MATHEMATICS

The University of Louisville, Department of Mathematics, is seeking a junior level person. Candidates should have an active research program and other scholarly interests, an interest in undergraduate and graduate (Master's and Ph.D.) program development. Doctorate in Mathematics required. Depending upon experience, appointment will be at Assistant or Associate Professor level. Interested candidates should send letter of application with vitae, official transcripts, and at least three letters of recommendation to Dr. Michael S. Jacobson, Vice Chair, Department of Mathematics, University of Louisville, Louisville, KY 40292. Consideration will begin on December 1, 1984, and continue until position is filled. AA/EOE.

UNIVERSITY OF MASSACHUSETTS AT AMHERST, CENTER FOR APPLIED MATHEMATICS AND MATHEMATICAL SCIENCE

Subject to budgetary limitations, the Center, in conjunction with the Department of Mathematics and Statistics, expects to have tenure-track positions in Numerical Analysis/Scientific Computation/Analysis beginning Fall 1985, rank to be determined by qualifications. Candidates with a promising research record and a keen interest in pursuing research and teaching in applied math in an expanding scientific environment should apply by February 15, 1985, to Georgette Healy, Coordinator, Center for Applied Mathematics and Mathematical Science, 1521B Lederle GRC, University of Massachusetts, Amherst, MA 01003.

The University of Massachusetts is an Affirmative Action/Equal Opportunity Employer.

THE DEPARTMENT OF MATHEMATICS, UNIVERSITY OF CALIFORNIA, SANTA BARBARA invites applications for the KY FAN ASSISTANT PROFESSORSHIP. The KY FAN Assistant Professorship is a special two-year position which carries a research stipend. Candidates should possess a recent Ph.D. degree in mathematics or expect to receive one prior to September 1985. Selection will be based primarily on demonstrated research achievement. Teaching experience is desirable. Teaching load will consist of four to five quarter courses per year including graduate seminars in candidate's field of interest. To apply, have at least three letters of reference, vita and publications sent to the "Faculty Search Committee", Department of Mathematics, University of California, Santa Barbara, CA 93106. We expect the candidate to have referees write to us directly. All applications received by January 15, 1985 will be given thorough consideration. UCSB is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
RIVERSIDE

Faculty Position in Computer Science

Applications are invited for a tenure-track position in Computer Science beginning with the 1985-86 academic year. Applicants must have a Ph.D. in Computer Science and a demonstrated commitment to teaching and research. Candidates from all areas of specialization in Computer Science will be considered.

Rank and salary are open; candidates for senior rank must have leadership ability and a proven research record.

The Computer Science program at Riverside is housed in the well-established Department of Mathematics, which offers bachelor's, master's, and doctoral degrees in Mathematics as well as the B.S. and M.S. in Computer Science. The Department owns four VAX 11/750s and various microcomputers. General campus facilities include an IBM 4341-2, a PRIME 750, and two VAXs.

To apply, send résumé with names of three references to:

Professor Theodore J. Barth, Chair
Computer Science Search Committee
Department of Mathematics and Computer Science
University of California
Riverside, CA 92521

The University of California is an Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF TORONTO

Applications are invited for two limited term Assistant Professorships, beginning July 1, 1985, for a term of up to three years. Duties consist of research and teaching and candidates must demonstrate clear strength in both.

Applications should be sent to Professor S. Halperin, Associate Chairman, Department of Mathematics, University of Toronto, Toronto, Ontario, Canada M5S 1A1, and should include a complete curriculum vitae, and the names of at least three references. The deadline is February 1, 1985.

In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents.

UNIVERSITY OF CALIFORNIA, LOS ANGELES
DEPARTMENT OF MATHEMATICS

Subject to administrative approval, a few assistant professorships, with special attention given to candidates in applied mathematics, algebraic number theory/modular forms, several complex variables and topology. Strong research and teaching background required. Sufficiently outstanding candidates in other fields and/or at higher levels will also be considered. Salary $26,600 for academic year. Teaching load: Five quarter courses per year. Also several positions for visitors and lecturers. To apply, write to Yiannis N. Moschovakis, Chair, Los Angeles, CA 90024.

UCLA is an equal opportunity affirmative action employer.

UNIVERSITY OF KANSAS

Applications are invited for tenure-track and temporary positions at all levels, commencing 8/16/85 or as negotiated. Field is unrestricted but preference will be given to numerical analysis, probability/statistics, algebra, and to areas meshing well with the department's needs. Require Ph.D. or Ph.D. dissertation accepted with only formalities to be completed. Send detailed résumé with description of research; arrange for three letters of recommendation to be sent directly to C. J. Himmelberg, Chairman, Department of Mathematics, University of Kansas, Larwence, KS 66045-2142. Deadline date: 12/1/84 for first consideration; then monthly until 8/20/85. University of Kansas is an Affirmative Action/Equal Opportunity Employer.

POSITIONS AVAILABLE

Eastern Kentucky University

Applications are invited for the position of Chair, Department of Mathematics, Statistics, and Computer Science. Qualifications include a Ph.D. in Mathematics, Statistics or Computer Science; at least seven years teaching experience, in the mathematical sciences, at the college/university level; and evidence of scholarly activity. At least three years of the teaching experience must be at the rank of Assistant Professor or above. Administrative experience and knowledge of academic programs in Mathematics, Statistics, and Computer Science are desirable. Send a letter of application, detailed résumé, graduate transcripts, and three letters of recommendation by January 21, 1985 to:

Search Committee
Department of Mathematics, Statistics and Computer Science
Wallace 402
Eastern Kentucky University
Richmond, KY 40475-0959

EKU is an Equal Opportunity, Affirmative Action Employer.

Dept. of Math. Murray State University, Murray, Ky. 42071

Applications are encouraged from persons in all areas of Mathematics for tenure-track positions beginning Aug. 1985. Selections will be based on evidence of applicants' teaching effectivemess and research achievements or potential. Special attention will be given to applicants in areas of applied mathematics, especially statistics. The selection process will begin immediately and end when the positions are filled.

Application letter, vita, and three letters of recommendation should be sent to:

Donald Bennett
Chairman
Department of Mathematics
Murray State University
Murray, Ky. 42071

MSU is an equal opportunity/affirmative action employer.

CARNEGIE-MELLON UNIVERSITY
Department of Mathematics
Operations Research Position

The Mathematics Department expects to have one tenure-track position at the Assistant Professor level available in the Fall of 1985. Preference will be in the general area of operations research. Candidates for this position should have a strong mathematical background and research interests in one or more of the following areas: mathematical programming, applied probability, convex analysis; candidates should be prepared to take an active part in the Department's undergraduate and graduate teaching efforts in operations research. In exceptional circumstances, an appointment at a higher level will be considered. Interested candidates should send résumés, a copy of their transcript, and three reference letters to Professor George J. Fix, Head, Department of Mathematics, Carnegie-Mellon University, Schenley Park, Pittsburgh, PA 15213. Carnegie-Mellon University is an Affirmative Action/Equal Opportunity Employer.

Chairperson – Department of Mathematics.
East Tennessee State University.

Applicants must have a Ph.D., an established record of research, a commitment to quality education, and demonstrated administrative and leadership ability. Position available August 1, 1985. A vita and three letters of recommendation should be sent to Personnel Office, Box 24070A, ETSU, Johnson City, Tennessee 37614. Review of applications will begin on January 2, 1985 and will continue until the position is filled. An Equal Opportunity, Affirmative Action Employer (M/F).

CLEVELAND STATE UNIVERSITY. DEPARTMENT OF MATHEMATICS, 1983 E. 24th St., Cleveland, OH 44115. 2 tenure track positions for 1985 (subject to budgetary approval). Rank open. Preference will be given to candidates in numerical analysis, partial differential equations, operations research, statistics, or other applied areas. Field is open for the other position but preference will be given to candidates in fields compatible with current research interests of the department. PhD with established record and/or strong potential in research required. Commitment to excellence in teaching necessary. Department offers course through the Master's level. Normal teaching load of 2 courses per quarter. Application deadline Jan. 4, 1985. Late Applications cannot be guaranteed full consideration. Send curriculum vitae and at least 3 letters of recommendation to: T. W. Hungerford, Chairperson, Department of Mathematics. An equal opportunity employer m/f/h.

CARNEGIE-MELLON UNIVERSITY
Department of Mathematics
Logic and Discrete Mathematics Position

The Mathematics Department expects to have one tenure-track position at the Assistant Professor level available in the Fall of 1985. Preference will be in the areas of applied logic and discrete mathematics; candidates should be prepared to teach courses in logic, combinatorics, and graph theory which support the Department's undergraduate track in computer science. In exceptional circumstances, an appointment at a higher level will be considered. Interested candidates should send résumés, a copy of their transcript, and three reference letters to Professor George J. Fix, Head, Department of Mathematics, Carnegie-Mellon University, Schenley Park, Pittsburgh, PA 15213. Carnegie-Mellon University is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF KANSAS

Anticipate several instructorships beginning Fall semester 1985, which are normally renewable for second and third year. Salary to be determined. Research interests should be in areas closely related to those of current staff. Ph.D. or dissertation accepted with only formalities to be completed. Send detailed résumé and dissertation abstract; arrange for three letters of reference to be sent directly to C. J. Himmelberg, Chairman, Department of Mathematics, University of Kansas, Lawrence, KS 66045-2142. Deadline date: 12/1/84, then monthly until 8/20/85.

University of Kansas is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF SOUTH FLORIDA
Department of Mathematics

Tenure-track teaching and research positions are anticipated beginning August, 1985. Applicants must possess a Ph.D. degree. Applicants specializing in Approximation Theory, Computer Science, Numerical Analysis, Probability, or Statistics are preferred. Rank and salary will depend on experience. To apply send résumé to Kenneth Pothoven, Chairman, Tampa, FL 33620. The University of South Florida is an equal opportunity employer.

POSITIONS IN MATHEMATICS

Applications are invited for faculty positions in mathematics, applied mathematics and statistics. Rank and salary depend on experience and qualifications. A strong research record or potential and a dedication to teaching are required. Résumé and four letters of recommendation should be sent to:

Dr. William T. Trotter, Jr., Chairman
Department of Mathematics and Statistics
University of South Carolina, Columbia, SC 29208 AA/EOE

POSITIONS AVAILABLE

UNIVERSITY OF CALIFORNIA, LOS ANGELES
DEPARTMENT OF MATHEMATICS

Subject to administrative approval, a few adjunct assistant professorships; two year appointment only; strong research and teaching background; no restriction as to field. Salary $26,600 for academic year. Teaching load: Five quarter courses per year. To apply, write to Yiannis N. Moschovakis, Chair, Los Angeles, CA 90024.

UCLA is an equal opportunity affirmative action employer.

FOR SALE

MR. MATRIX is matrix manipulation software for the IBM PC. It can multiply, invert, transpose, and keep track of up to 25 matrices. It can handle matrices with real or complex entries, or with entries in (some) finite fields. MR. MATRIX can also test whether matrices are orthogonal, unitary, or symplectic. Price: $20. Polygonal Publication House, 210 Broad Street, Washington NJ 07882.

MATH SCI PRESS, 53 Jordan Rd., Brookline MA 02146, 617-738-0307. Just published: *Proceedings of the Berkeley-Ames Conference on Nonlinear Problems in Control and Fluid Dynamics*, L. R. Hunt and C. F. Martin, (Eds.), 450 pages, $50. (*Lie Groups; Systems Information and Control*, vol. II). *Topics in the Geometric Theory of Linear Systems*, by Robert Hermann, $50. (*Interdisciplinary Mathematics*, vol. 22). In press: *Topics in the Geometric Theory of Integrable Systems*, by Robert Hermann. Special Sale: *Development of Mathematics in the 19th Century*, by Felix Klein, $20. Write or call for other special prices on back list.

1985 MATHEMATICAL CALENDAR

The history of some common mathematical symbols. A Pandect of Pi. Transcendental Poker. Quotes, poems, humor cartoons, biographies. 28 pages, 10" by 12.5". Postpaid prices: US and Canada: $7.25 in US funds; Foreign: $10.75. MasterCard and Visa accepted. ROME PRESS, Box 31451, Raleigh, NC 27622.

Mathematics Colloquium of the University of Cape Town, Vol 13 (1984). 120 pages including papers by Hanno Rund and Ross Street. US $5.00 includes surface mailing. Order from Department of Mathematics, University of Cape Town, Rondebosch 7700, Republic of South Africa.

BOOKS BEING SOUGHT

I'm trying to locate the following three books by A. A. Fraenkel: Abstract Set Theory, First Edition, 1953; Foundations of Set Theory, First Edition, 1958; Axiomatic Set Theory, 1968. (All North-Holland). Please contact: Jacob Salamon, 1228 Georgian Terrace, Lakewood, NJ 08701.

SPECIAL ANNOUNCEMENT

The third annual William H. Roever lectures in Geometry at Washington University in St. Louis will be given by I. M. Singer, John D. MacArthur Professor of Mathematics at MIT.

The lectures are entitled *The Geometric Interpretation of Anomalies in Quantum Field Theory* and will be given daily from January 14–18, 1985.

For further details please contact Professor William M. Boothby, Department of Mathematics, Washington University, St. Louis, MO 63130, (314) 889-6760.

Positions Available, Air Force Office of Scientific Research

The Mathematical Sciences Directorate of the Air Force Office of Scientific Research in Washington, D. C., is looking for several experienced research mathematicians to work with the Directorate. These persons will have an opportunity to help shape the programs of research in applied mathematics, which include applied analysis, computational mathematics, finite mathematics, mathematics of communication and signal processing, and related areas. The positions, which maintain employment status and benefits in the researcher's home institution, are under the Intergovernmental Personnel Act, and are similar to the "rotator" positions at NSF. Appointments are expected to begin between June 1 and September 1, 1985. They are usually for one year, and may be extended to up to two years.

For information please contact David Fox, Director, Mathematical Sciences, Air Force Office of Scientific Research, Bolling Air Force Base, Washington, D. C., 20332. (202-767-5025)

Book Reviews

Reviews in Graph Theory, edited by William G. Brown, American Mathematical Society, 1980. Volumes I, II, III, IV (paperback).

Certainly one of the foremost tasks facing any researcher is to determine what is already known about his problem. This task is particularly difficult in graph theory research as there are many periodicals that publish such work. Of course the American Mathematical Society has been performing a great service for many years by publishing *Mathematical Reviews*. Thus to a large extent this literature search problem has been solved. However if one is specifically interested in graph theory, then one would need all the volumes from the start in 1940 to the present. In addition, one would have to do a great deal of "hunting" to find the references to his problem. William G. Brown has done that job for everyone by publishing a four-volume paperback edition of *Reviews in Graph Theory*, which covers the first 56 volumes of *Mathematical Reviews* (1940–1978). These 7-inch by 10-inch paperbacks are the most handy and useful tools that any graph theorist could own.

Perhaps the content alone of these four volumes explains how worthwhile they are. However, I shall make a few further comments. Clearly the key to the utility of such a compendium is the classification scheme. It becomes obvious by looking at the contents that Brown gave a great deal of thought to the classification process. The entire subject of graph theory is broken down into 27 major categories and 530 subcategories. These major topics are well chosen and agree with many of the chapter headings that one finds in books on graph theory. Since any two people who tried to compile such a list of major topics would probably arrive at different answers, it seems very foolish to comment on the choice. However, I do think that the choice of categories is excellent. In addition to these graph theory subjects, the four volumes contain a general category which includes books and bibliographies. There is an author index and a subject index. Also it contains a "key" index which gives information on collections, conference proceedings, problem lists, and obituaries. There is an extensive section on "information for the reader" and a form for readers comments.

My own personal experience in using these four volumes during the past few months is that of delight. They have become a very important tool for me, and I recommend that every graph theory researcher own them. Examples abound as to their value. Recently I found the answer to a question that was given as an unsolved problem in one of the famous graph theory books. Since I needed the result for something I was doing, I was very pleased to have found it so easily.

The only fault I could find was the difficulty in learning to use the cross references. For example, in subject category 054 on page 222 of Volume I the review numbered 46#5177 refers the reader to an author's related paper only identified as 37#5124. No information is given regarding its location. I had to look in the author index to find that this other work was located in subject category 290. But this is a very minor complaint since I did find what I wanted. In summary, therefore, I would say that these four volumes are very well organized and an indispensable tool.

I hope that they will be updated periodically.

F. T. Boesch

NETWORKS, Vol. 14 (1984) 173-179

MATHFILE —Mathematical Reviews Online

MATHFILE is the online database of **Mathematical Reviews (MR)** produced by the American Mathematical Society. It provides essentially complete worldwide coverage of mathematics as well as mathematical applications in other fields such as statistics, physics, engineering, computer science, biology and operations research.

MATHFILE provides excellent and quick access to the international mathematical research literature. Using Boolean logic, one can identify and intersect mathematical terms and concepts, authors, publishers, journals, and AMS classifications, to produce research information, bibliographies, statistics, etc., about mathematics and related subjects.

Information published in **MR** since 1973 is contained in **MATHFILE**, including the full text of the reviews beginning with July 1979.

MATHFILE is available electronically through online vendors **DIALOG**, **BRS** and **ESA-IRS**. Communicate with the vendors directly to establish accounts. Costs to use **MATHFILE** vary with the vendor. Connect time charge is approximately $60/hour. Professional librarians access the online systems daily and can perform most searches within 5 to 10 minutes.

Low-cost, simplified, evening and weekend systems designed for personal computer users are now available from **BRS** and **DIALOG**. **BRS/After Dark** costs $13/hr with a minimum monthly charge of $12 and a start-up fee of $75. **DIALOG**'s **Knowledge Index** costs $24/hr, has no monthly minimum and the first two hours are free. The start-up fee is $35.

DIALOG Information Services
3460 Hillview Ave.
Palo Alto, CA 94304
(800-227-1960 or
800-982-5838 in California)

BRS and BRS/After Dark
Bibliographic Retrieval Services
1200 Route 7, Latham, NY 12110
(800-833-4707 or
518-783-1161 in New York)

ESA-IRS
ESRIN
Via Galileo Galilei
00044 Frascati (Rome), Italy
Telephone: (06) 94011
Telex 610637 esrin i

MATHFILE User's Guide. This 360-page loose-leaf Guide, which is updated as necessary, is designed to help the user access information more quickly and efficiently. $65 list and $52 for AMS members. See the AMS catalogue for more information.

Document Delivery Service. Mathematical Reviews is offering a document delivery service which will provide copies of original articles reviewed in **MR**. Users of **MATHFILE** may place orders online through **DIALOG** (Dialorder), **BRS** (electronic mail), or directly with Mathematical Reviews (by mail or telephone). Requests to **MR** will be filled and mailed within 48 hours of receipt. If **MR** cannot fill the order, it will be forwarded to an appropriate library for possible inter-library loan.

For each article requested, the first 10 pages or fewer will cost $12. Additional pages beyond the first 10 will be $2 for 10 pages or fewer. Copyright royalties will be added in compliance with Copyright Clearance Center regulations.

For more information:

MATHFILE and user aids
Taissa T. Kusma
Database specialist
American Mathematical Society
201 Charles Street, P.O. Box 6248
Providence, RI 02940
(401) 272-9500 or (800) 556-7774

Document Delivery and MR
Bonita D. Ross
Librarian, Mathematical Reviews
611 Church Street, P.O. Box 8604
Ann Arbor, MI 48107
(313) 764-7228

INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS

UNIVERSITY OF MINNESOTA

STOCHASTIC DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS

August 16, 1985 – August 15, 1986

Organizing Committee: Daniel Stroock (Chairman), Wendell Fleming, Theodore Harris, Pierre-Louis Lions, Steven Orey, and George Papanicolaou. (See the article in the October issue for a description of the program.)

***** VISITING MEMBERSHIPS AVAILABLE *****

POST-DOCTORAL MEMBERSHIPS will carry a stipend of $30,000 (including a relocation allowance) for the 12 month period beginning August 16, 1985. All requirements for a doctorate should be completed by this date. OTHER SUPPORT is available. Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends. Applicants must show evidence of mathematical excellence, but they do not need to be specialists in the field or even "applied mathematicians".

The following materials must be submitted:

(1) Personal statement of scientific interests, research plans, and reasons for wishing to participate in the Institute program. (This is an essential part of the application.)

(2) Curriculum vitae including a list of publications.

(3) Three letters of recommendation.

All material should be received by January 15, 1985.

All correspondence should be sent to:

Hans Weinberger, Director – Institute for Mathematics and its Applications
University of Minnesota – 514 Vincent Hall – 206 Church Street SE
Minneapolis, MN 55455, U.S.A. – Telephone: (612) 373-0355

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The University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities.

PARTICIPATING INSTITUTIONS: Indiana University, Iowa State University, Michigan State University, Northern Illinois University, Northwestern University, Ohio State University, Purdue University, University of Chicago, University of Illinois (Urbana), University of Iowa, University of Michigan,

HONAM MATHEMATICAL JOURNAL

publishes biannually refereed research papers in English on pure and applied mathematics. Papers for publication may be submitted to the editor-in-chief or one of the associated editors.

LA TROBE UNIVERSITY
MELBOURNE, AUSTRALIA
CHAIR IN MATHEMATICS

Applications are invited for appointment to a Chair in Mathematics in the area of applied mathematics. This Chair became vacant upon the recent retirement of Professor C. J. Eliezer.

The appointee will share in the development of a new School of Mathematical and Information Sciences which will comprise the departments of Mathematics, Computer Science and Statistics.

The principal responsibilities of the person appointed will be to supervise and to participate in the teaching and research programme in applied mathematics, and applicants should therefore have appropriate experience and expertise. Evidence of research leadership abilities of the highest level will be expected.

One of the important responsibilities of the new Professor will be to support and foster the continuation and further development of the research and teaching collaboration which has been recently established between applied mathematicians in the University and in local industry.

SALARY $A52026.

Further information may be obtained from Dr. J. Liesegang, Dean of the School of Physical Sciences, La Trobe University. (Phone 61 (Australia) – 3-478.3122)

Applications marked 'In confidence', quoting reference number 150/9/39 including a curriculum vitae and the names and addresses of three referees, should be forwarded to the Registrar, La Trobe University, Bundoora, Victoria 3083, Australia, by 31 January 1985.

UNIVERSITY OF PETROLEUM & MINERALS
DHAHRAN – SAUDI ARABIA
DEPARTMENT OF MATHEMATICAL SCIENCES

POSITIONS AVAILABLE AND REQUIREMENTS:

Faculty positions at all ranks are available for the academic year 1985-86, beginning September 1, 1985. Preferred areas of specialization are in *NUMERICAL ANALYSIS, APPLIED MATHEMATICS, DIFFERENTIAL EQUATIONS and STATISTICS.*

Candidates must have strong research potential or accomplishments and demonstrated excellence in teaching. Ph.D. in Mathematics is required. Applicants for senior positions should have outstanding academic qualifications and a distinguished record of research publications. Duties include teaching at the undergraduate and graduate levels, and research. Salary and position will be commensurate with experience and research credentials.

CONTRACTS AND TERMS:

UPM offers two-year renewable contracts. Salaries are competitive and benefits include free air-conditioned and furnished housing, air transportation to and from Dhahran each year, attractive educational assistance grants for school-age dependent children, and a local transportation allowance. The contract requires ten months duty and provides two months paid vacation each year. There is also the possibility of participation in summer teaching with additional compensation. Exciting opportunities for funded research exist. All earned income is without Saudi taxes.

UPM AND FACILITIES:

The University of Petroleum and Minerals has as its goals the advanced training of students in the fields of science and engineering and the promotion of research. *THE FACULTY IS MULTINATIONAL AND THE INSTRUCTION IS IN ENGLISH.* UPM has about 4000 students and 700 faculty members. UPM offers B.S. and M.S. degrees in several fields of engineering and science, including Computer Science and Systems Engineering, and Ph.D. degrees in Electrical and Chemical Engineering. Ph.D. programs in other areas, including mathematics, are under consideration. The Department of Mathematical Sciences has over forty faculty members and offers B.S. and M.S. degrees in Mathematics. UPM has several computing systems, dedicated to instructional and research use, including the IBM 370/158 and IBM 3033 computers, with VM/CMS and TSO interactive systems. The library has over 5000 journals including about 300 journals in Mathematical Sciences.

APPLICATIONS AND INQUIRIES:

Apply before December 31, 1984, with complete résumé on academic, professional and personal data, list of references, publications and research details, and with photo-copies of degrees and/or transcripts, including home and office addresses and telephone numbers to:

UNIVERSITY OF PETROLEUM & MINERALS
HOUSTON OFFICE, DEPT. 253
5718 WESTHEIMER, SUITE 1550
HOUSTON
TEXAS 77057

HUGHES

SOFTWARE ENGINEERS

New products in Hughes Radar Systems' Tactical Software Departments have created several openings for Software Engineers at various experience levels. A number of challenging assignments are available in developing real-time scientific application software for airborne radar signal and data processors.

A variety of software processing is utilized including the following:

- Forming digital filters for bandpass signal filtering.
- Extracting spectral information from the radar signal using Fast Fourier Transforms.
- Target range and velocity resolving.
- Target detection and thresholding.
- Closed loop target tracking using Kalman filtering.
- Forming two dimensional high resolution maps.
- Detection and tracking of ground moving targets.

Join us and grow professionally in a rewarding career while working on radar systems for the F-14, F-15, F/A-18 aircraft and other advanced applications.

A Bachelor or advanced degree in Mathematics or related technical disciplines is preferred. Real-time software experience is a plus.

Hughes offers a highly competitive salary, excellent benefits including medical and dental coverage, tuition reimbursement and a tax-deferred savings plan.

You are invited to call David Johnson—collect at (213) 648-2913 for more information or send your resume to Ed Smith, Hughes Aircraft Company Radar Systems Group, Employment Department MAN-11, R8/4400, P.O. Box 92426, Los Angeles, California 90009. Proof of U.S. Citizenship Required. Equal Opportunity Employer.

Principals only, please.

HUGHES
AIRCRAFT COMPANY

RADAR SYSTEMS GROUP

Department of Mathematics
UNIVERSITY OF HOUSTON
UNIVERSITY PARK

The Department of Mathematics will have both permanent and visiting positions available for the 1985-86 academic year.

Openings for permanent appointments are at all levels, and strong applicants in all fields are encouraged to apply. Applicants in numerical analysis, analysis, probability, statistics and applied mathematics are especially encouraged. Vitae and three letters of reference should be sent to Professor G. J. Etgen, Chairman, Department of Mathematics, University of Houston, University Park, Houston, Texas 77004. Tel. 713-749-4827.

The Department will also have two visiting faculty positions, and these will be available for visits of either one or two semesters. The visiting faculty members will be named

D. G. Bourgin Visiting Scholars

Some teaching duties will be required, but the main purpose of the visit is to collaborate with the permanent faculty on research centered in the areas of algebra, analysis, or topology. Interested persons should apply by February 15, 1985, to Professor A. Lelek at the address indicated above.

The University of Houston is an equal opportunity/ affirmative action employer

MATHEMATICS
CHAIR AND LECTURESHIP

Applications are invited for appointment to a Chair of Mathematics. The successful applicant will be expected to assume the duties of a Professor, and possibly of Head of the Department of Mathematics at some time in the future. As such the incumbent will be expected to provide leadership in teaching and research.

A lectureship is also available. The appointee will be expected to undertake research, as well as teaching in accordance with needs of the department.

All Academic salaries are currently under review. Details are obtainable on request.

Benefits: annual bonus • generous leave • pension • medical aid • remission of fees for dependants attending the University • housing subsidy (if eligible) • removal, travel and settling-in allowances may be payable.

Applications should be lodged by 31 October 1984.

For detailed information contact the Deputy Registrar, (Academic Staffing),

UNIVERSITY OF THE WITWATERSRAND
1 Jan Smuts Avenue, Johannesburg 2001, South Africa.

It is the policy of the University not to discriminate on grounds of sex, race, colour or national origin.
302759

University of California, Berkeley
Department of Mathematics
Berkeley, CA 94720

Applications are invited for a position which may be available July 1st, 1985, at tenure level (Associate or full Professor) in the areas of algebra, analysis, applied mathematics, foundations, or geometry. Applicants should have demonstrated substantial achievements in research and teaching. Send by January 15, 1985 curriculum vitae, list of publications, a few selected reprints or preprints, and the names of three references to Alan Weinstein, Vice Chair for Faculty Appointments, at the above address. The University of California is an Equal Opportunity, Affirmative Action Employer.

University of California, Berkeley
Department of Mathematics
Berkeley, CA 94720

Applications are invited for a position which may be available July 1st, 1985, at the tenure track Assistant Professor level in the areas of algebra, analysis, applied mathematics, foundations, or geometry. Applicants should have demonstrated substantial potential in research and teaching. Send by January 15, 1985 curriculum vitae, list of publications, a few selected reprints or preprints, and the names of three references to Alan Weinstein, Vice Chair for Faculty Appointments, at the above address. The University of California is an Equal Opportunity, Affirmative Action Employer.

UNIVERSITY OF ILLINOIS AT CHICAGO

Department of Mathematics, Statistics, and Computer Science

The Department invites applications for anticipated positions. Candidates will be considered in (1) pure mathematics—all areas, (2) applied mathematics and numerical analysis, (3) probability and statistics, (4) computer-related mathematics and theoretical computer science, (5) mathematics and computer education. Candidates should have excellent research records and the ability to direct graduate students. Salary and rank will be commensurate with qualifications. Send résumé and have at least three letters of reference sent to:

Louise Hay, Head
Department of Mathematics, Statistics, and Computer Science
University of Illinois at Chicago
Box 4348
Chicago, Illinois 60680

Availability of positions is contingent upon budgetary allocations.

An Affirmative Action/Equal Opportunity Employer.

University of California, Berkeley
Department of Mathematics
Berkeley, CA 94720

Several temporary positions beginning in Fall 1985 are anticipated for new and recent Ph.D.'s of any age in the fields of algebra, analysis, applied mathematics, foundations, or geometry. The term of these appointments may range from one to three years, depending partly on pending administrative decisions. Applicants for NSF or other postdoctoral fellowships are encouraged to apply for these positions; combined teaching/research appointments may be made for up to three years. Mathematicians whose research interests are close to those of regular department members will be given preference. Send by January 15, 1985 resume, reprints, preprints, and/or thesis abstract. Ask three people to send letters of recommendation to Alan Weinstein, Vice Chair for Faculty Appointments at the above address. The University of California is an Equal Opportunity, Affirmative Action Employer.

Bard, a small, private, liberal arts college in the Hudson valley, 100 miles from New York City, seeks to hire into a tenure track line a mathematician primarily a strong commitment to undergraduate teaching coupled with the expectation of continued research. Phd. required although particularily attractive candidates who are about to receive their Phd. in mathematics will be considered.

We are looking for someone interested in shaping an innovative department at Bard. The opening is for spring or fall of 1985; candidates available for only the spring semester should also apply.

Respond to:

Peter Renz, Department of Mathematics
Bard College, Annandale-On-Hudson
New York 12504

EO/AAE.

SHORT COURSE

THE UNIVERSITY OF TENNESSEE SPACE INSTITUTE

Will Offer A Short Course On

NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

18 - 22nd March 1985

Main Speakers:

George Fix	Carnegie-Mellon University
Stanley Osher	University of California
Joseph Oliger	Stanford University
Roger Temam	Laboratorie D'Analyse Numerique, Paris

The objectives of the Course are to discuss and critically review the recent developments in the theory of numerical methods for elliptic, hyperbolic, parabolic and mixed partial differential equations. It is anticipated that this course will encourage the adoption of these latest theories by researchers involved with physical problems.

For Technical details contact:
S. I. Hariharan or T. H. Moulden 615-455-0631 (ext. 338 or 479)

For Registration contact:
Ms. S. Shankle, Short Course Manager, 615-455-0631, (ext. 278)

UTSI Tullahoma, TN 37388

UNIVERSITY OF UTAH

DEPARTMENT OF MATHEMATICS

invites applications for the following positions

1. Three or four non-renewable 3-year Instructorships. Persons of any age receiving Ph.D. degrees in 1984 or 1985 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary this year is $22,500 and cost of living increases are contingent on action by the State Legislature. Duties consist of teaching two courses through the academic year.
2. One visiting position of one year or less. Selection criteria are teaching ability and potential contribution to our research environment.
3. Two tenure track appointments are available. Selection will be based on research expertise and teaching ability.

Applications must include curriculum vita, bibliography and three references. (Instructorship applications must also include an abstract of thesis and a list of graduate courses completed or transcripts.) Applications will be accepted until all available positions are filled.

Please send your application to:

Committee of Staffing—Department of Mathematics
University of Utah—Salt Lake City, Utah 84112

The University of Utah is an equal opportunity — affirmative action employer.

ForMath™

a text-formatter for mathematical papers, books and theses

$$\lim_{n\to\infty} \sum_{i=1}^{n} \begin{bmatrix} \frac{1}{i(i+1)} & \frac{1}{2^i} \\ \frac{(-1)^i}{2^i} & \frac{1}{\pi^{2i}} \end{bmatrix} = \frac{1}{2} \begin{bmatrix} \int_0^1 \frac{\log(1-x)}{-\pi^2 x}\,dx & -1 \\ 1/3 & 1 \end{bmatrix}^{-1}$$

- matrices, big symbols sized and placed automatically
- concise command syntax; macros further reduce typing
- automatic numbering; bibliographic references, chapters, equations, cross-references
- table of contents, indexes
- automatic justification, word-splitting
- automatic numbering and placement of footnotes
- multiple fonts, sizes, special symbols
- output on CRT, dot-matrix printers, daisywheels, laser printers, photo-typesetters
- use on micros (CP/M,™ PC™-DOS, MS™-DOS) or mainframes (any IBM,™ VAX/VMS™)
- Write or call **SHANTHA SOFTWARE, INC.** 50 West 97 St., Room 11-N New York, NY 10025 212-222-SNIP

MACQUARIE UNIVERSITY
SYDNEY AUSTRALIA

SCHOOL OF MATHEMATICS
AND PHYSICS

LECTURERS IN MATHEMATICS

Equality of Employment Opportunity is University Policy

Applications are invited for appointment to two positions of LECTURER IN MATHEMATICS in the School of Mathematics and Physics, tenable from 1 February 1985. One position is a permanent appointment, and the other is for a fixed term of five years. Candidates should indicate if they are not interested in the fixed-term appointment.

Successful candidates will be active in research areas which will enrich and complement present strengths of the Mathematics discipline at Macquarie University. A strong commitment to teaching at all levels of University mathematics, and the ability to teach effectively, is essential as is the preparedness to contribute to the general management and advancement of the School's activities.

Further information about the position may be obtained from Professor A.J. van der Poorten.

Salary range: $A24,840 to $A32,634.

Further information about the University and advice regarding the method of application should be obtained from the Secretary-General, Association of Commonwealth Universities, 36 Gordon Square, London, WC1H OPF, England, or from the Registrar, Macquarie University, North Ryde, New South Wales, 2113, Australia.

Applications close 16 November 1984.

A.J.T. Ford
Registrar

September 1984

UNIVERSITY OF TORONTO
Department of Mathematics

The Department has an opening for a tenure stream position at the level of Assistant or Associate Professor, beginning July 1, 1985. The successful candidate shall be expected to make significant research contributions to an active area of pure or applied mathematics, and to carry out graduate and undergraduate instruction. Salary negotiable.

We also invite applications for a one-year term appointment beginning July 1, 1985 which we will offer in the event that a suitable candidate for the tenure-stream position is not found for this date.

Applications including a C.V. and the names of at least three referees should be sent by January 31, 1985 to:

Professor John M. Perz
Chairman
Physical Sciences Division
Scarborough Campus
University of Toronto
1265 Military Trail
Scarborough, Ontario
Canada M1C 1A4

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and landed immigrants. This position is subject to budgetary approval.

THE UNIVERSITY OF FLORIDA
DEPARTMENT OF MATHEMATICS

announces the opening of two new tenure-track assistant professorships beginning August, 1985. Those applying for these positions should have demonstrable research potential. In particular the search committee encourages applications from mathematicians with postdoctoral experience and from those whose research interests are compatible with the interests of current department members. Priority areas include algebra/combinatorics, analysis, differential equations, logic, and numerical analysis/approximation theory. The salaries will be highly competitive. Applicants should provide a résumé (including a list of publications) and should arrange for at least three letters of reference to be sent to:

David A. Drake
Chair, Search and Screen Committee
Department of Mathematics
University of Florida
Gainesville, Florida 32611

Applications must be received by January 21, 1985.

The University of Florida is *an equal opportunity employer.*

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER

Instructions for Applicant's Form on facing page

The form. Applicants' forms submitted for the Employment Register at the Joint Mathematics Meetings in Anaheim will be photographically reproduced in the December issue of *Employment Information in the Mathematical Sciences* to appear in December 1984. They will also be posted at the Employment Register.

The forms **must be** carefully typed using a fresh black ribbon. The best results are obtained with a carbon-coated polyethylene film ribbon, but satisfactory results may be obtained using a ribbon made of nylon or other woven fabric if suitable care is exercised. It is important that the keys be clean and make a sharp, clear impression. Do not erase—it causes smudges which reproduce when photographed. Use a correcting typewriter or correction tape or fluid if necessary. Submit the original typed version only. Copies will not reproduce properly and are not acceptable. **Hand lettered forms will be returned.**

Applicants' forms must be received by the Society by November 15, 1984 in order to appear in the special issue of *EIMS*, and must be accompanied by the Preregistration and Housing Form printed at the back of this issue. **See the Meeting Announcement in the October issue of the *Notices* for information. Forms received past the deadline will be returned.**

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

Ⓐ Specialties

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

Ⓑ Career Objectives

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

Ⓗ Ⓘ Duties

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

Location

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

Ⓛ U.S. Citizenship Status

C = U.S. Citizen	P = Permanent Resident
T = Temporarily in U.S.	N = Non-U.S. Citizen

(please see instructions on facing page)

APPLICANT: Name_____

Mailing address (include zip code) _____

Ⓐ Specialties_____

Ⓑ Career objectives and accomplishments

ACADEMIC: ☐ Research, ☐ Teaching

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

Near-term career goals_____

Significant achievements or projects, including role_____

Honors and offices_____

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

Selected titles of papers, reports, books, patents_____

Ⓒ Degree Year Institution

____ ____ _____ Ⓓ No. of abstracts, internal reports____

____ ____ _____ Ⓔ No. of papers accepted____

____ ____ _____ Ⓕ No. of books and patents____

EMPLOYMENT HISTORY:

	Present	Previous	Previous
Ⓖ Employer			
Position			
Ⓗ Duties			
Years	____ to ____	____ to ____	____ to ____

DESIRED POSITION:_____

Ⓘ Duties_____

Ⓙ Available mo.____ /yr.____ Location_____ Salary____

Ⓚ References (Name and Institution)

Ⓛ Citizenship _____

Ⓜ AVAILABLE FOR INTERVIEWS:

(Interviews for Session 4 scheduled on the basis of employer's request only.)

Session 1 ☐	Session 2 ☐	Session 3 ☐	Session 4 ☐
Fri. AM 9:30-11:45	Fri. PM 1:15-5:00	Sat. AM 9:30-11:45	Sat. PM 1:15-5:00

SUMMARY STRIP

Family Name, First Name, Mailing Address, Address (cont'd.), Address (cont'd.), State & Zip Code, Ⓐ Specialties, Ⓑ Career objectives, Ⓒ Highest Degree, Ⓒ Yr., Ⓒ Institution, Ⓓ, Ⓔ, Ⓕ, Ⓖ Most recent employer, Ⓗ Present duties, Ⓘ Desired duties, Ⓙ Available mo./yr., Ⓛ, Ⓜ Sessions

INSTRUCTIONS: Please read carefully before completing form below. Circled letters identify corresponding items in the FORM and the SUMMARY STRIP; abbreviations to be used are provided in the notes below. Please print or type in black ink. Block capitals are suggested. The FORM itself will be placed on display at the Register exactly as submitted. The SUMMARY STRIP will be used to prepare a computer printed list of summaries for distribution at the Register sessions. Employers are encouraged to provide more than one interviewer when they are able to do so, in order to increase the number of interviews which may be scheduled. Please take care to indicate on the Form the number of interviewers for whom simultaneous interviews may be scheduled. (If all interviewers will be interviewing for the same position, or for the same set of positions, only one form should be submitted and only one employer code number will be assigned; therefore, each interviewer would then receive a separate computer schedule and separate table number.) More than one employer code will be required if some interviewers will not interview for all positions. Thus, if there are two disjoint sets of positions, two forms are required and two employer codes will be assigned. **(Please refer to the section on the Employment Register following the Anaheim meeting announcement.)**

EMPLOYER FORM Institution_____ Dept._____

Name of Interviewer(s)_____

City, State, Zip_____

Ⓐ Title(s) of Position(s)_____ Ⓑ Number of Positions_____ Number of People Supervised_____

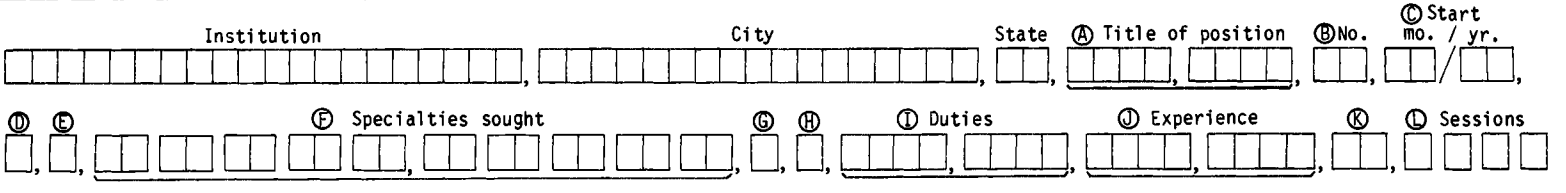
Ⓒ Starting Date _____/_____ mo. yr. Salary_____ Ⓓ Term of Appointment_____ yrs. Ⓔ Renewal ( ) Possible ( ) Impossible Tenure Track Position Yes ( ) No ( ) Unknown ( )

Teaching hrs./week_____ Ⓕ Specialties Sought_____

Ⓖ Degree Preferred_____ Ⓗ Degree Accepted_____ Ⓘ Duties_____ Ⓙ Experience_____ Ⓚ Citizenship Restriction_____

Ⓛ **Available for Interviews** **Session 1 ( ) Fri. AM, 9:30-11:45** **Session 2 ( ) Fri. PM, 1:15-5:00** **Session 3 ( ) Sat. AM, 9:30-11:45** **Session 4 ( )* Sat. PM, 1:15-5:00**

Ⓜ **Number of Interviewers:** _____ **Interviewers** _____ **Interviewers** _____ **Interviewers** _____ **Interviewers**



NOTES: Ⓐ Inst, Lect, Asst Prof, Asso Prof, Prof, Dean, Open, MTS (Member Technical Staff), OPAN (Operations Analyst), PREN (Project Engineer), RESC (Research Scientist); Ⓒ Date 01/83, e.g.; Ⓔ Possible=P, Impossible=I; Ⓕ Algebra=AL, Analysis=AN, Biomathematics=BI, Biostatistics=BS, Combinatorics=CB, Communication=CM, Control=CN, Computer Science=CS, Circuits=CT, Differential Equations=DE, Economics=EC, Mathematical Education=ED, Functional Analysis=FA, Financial Mathematics=FI, Fluid Mechanics=FL, Geometry=GE, History of Mathematics=HM, Logic=LO, Mathematical Biology=MB, Mechanics=ME, Modeling=MO, Mathematical Physics=MP, Management Science=MS, Numerical Analysis=NA, Number Theory=NT, Operations Research=OR, Probability=PR, Systems Analysis=SA, Statistics=ST, Topology=TO; Ⓖ Ⓗ Bachelor=B, Master=M, Doctor=D; Ⓘ Ⓙ Teaching=T, Undergraduates=U, Graduates=G, Research=R, Consulting=C, Administration=A, Supervision=S, Industry=IND, Government=GOV, Data Processing=DP, No experience required=N; Ⓚ U.S. Citizen=C, U.S. Citizen or permanent resident=CP, No restriction=NR; Ⓛ Periods available for interviews: List 1, 2, 3, and/or 4, see the FORM above.
* Interviews are scheduled in this session on the basis of employers request only.

PREREGISTRATION/HOUSING FORM, ANAHEIM, CALIFORNIA

AMS Short Course
January 7–8, 1985

January 9–13, 1985

MAA Minicourses
January 11–13, 1985

MUST BE RECEIVED IN PROVIDENCE NO LATER THAN NOVEMBER 15, 1984

Please complete this form and return it with your payment to

Mathematics Meetings Housing Bureau, P.O. Box 6887, Providence, RI 02940, Telephone 401-272-9500, extension 239

CHANGES/CANCELLATIONS: Before January 1, 1985, make all changes to or cancellations of hotel reservations with the Mathematics Meetings Housing Bureau in Providence; after that date, changes or cancellations should be made directly with the hotel. REFUNDS: 50% of preregistration fee(s) will be refunded in Providence on or before January 4, 1985. After this date, there will be no refunds.

	REGISTRATION FEES	
	Preregistration (by mail prior to 11/15)	At Meeting
JOINT MATHEMATICS MEETINGS		
Member of AMS, ASL, MAA, NCTM	$55	$ 72
Nonmember	$84	$109
*Student, Unemployed, or Emeritus	$14	$ 18
AMS SHORT COURSE		
Member/Nonmember	$25	$ 30
*Student or Unemployed	$ 5	$ 10
EMPLOYMENT REGISTER – Employer fee	$75	$100
– Applicant fee	$15	$ 20

MAA MINICOURSES (payable at meeting)

#1 – The teaching of applied mathematics
#2 – APL – A functional computer language
#3 – Teaching problem solving
#4 – Applications of discrete mathematics
#5 – Groups, graphs, and computing
#6 – PROLOG
#7 – Linear programming
#8 – Microcomputer software in mathematics
#9 – Teacher in-service programs
#10 – Constructing placement examinations

*All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned from their latest position. Persons who are emeritus members of either the AMS or MAA may register at the emeritus rate.

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

Joint Mathematics Meetings [ ]
AMS Short Course [ ]
MAA Minicourses: (Maximum of 2; please indicate alternate choices)

#1 [ ] #6 [ ]
#2 [ ] #7 [ ]
#3 [ ] #8 [ ]
#4 [ ] #9 [ ]
#5 [ ] #10 [ ]

NOTE: I am preregistering for the Joint Meetings only in order to attend the MAA Minicourse(s). [ ]

Employment Register

Applicant fee – $15 [ ] NOTE: Applicants who wish to be included in the special issue of EIMS must submit applicant forms with preregistration form and fees by November 15.

Employer fee – $75 [ ] Please be sure to complete and return herewith the appropriate Employment Register form.

1) Last name _____ First name _____ Middle initial _____

2) Employer _____ Unemployed [ ] Emeritus [ ]

3) Address for confirmation of room reservation:

Line 1 _____ Line 2 _____

City _____ State _____ Zip Code _____ Phone # _____

4) I am a student at _____ (5) Accompanied by spouse _____; number of children _____

5) Member of AMS [ ] ASL [ ] MAA [ ] NCTM [ ] NONMEMBER [ ] (Member discount applies only to members of AMS, ASL, MAA, and NCTM.) Member of other organizations: AWM [ ] NAM [ ]

6) Joint Meetings fee enclosed $ _____ (7) AMS Short Course fee enclosed $_____ (8) Employer fee enclosed $_____

9) Applicant fee enclosed $_____ (10) Disneyland ticket(s) _____ @ $9

11) TOTAL AMOUNT ENCLOSED FOR 6 THROUGH 10 $_____ NOTE: May be paid by check payable to AMS (Canadian checks must be marked "In U.S. Funds") or VISA or MasterCard credit cards.

Credit card type: _____; Card number: _____ Expiration date: _____

_____
(Signature)

12) HOTEL DEPOSIT ENCLOSED: Check payable to AMS (where applicable) $ _____ or credit card [ ]

(See reverse for appropriate card type) Credit card type _____; Card number: _____

Expiration date: _____ 4-digit bank code (for MasterCard only) _____ _____
(Signature)

[ ] PLEASE CHECK HERE IF YOU WILL NOT REQUIRE A ROOM.

PLEASE BY SURE TO COMPLETE THE SECTION ON NEXT PAGE IF YOU WILL REQUIRE HOTEL ACCOMMODATIONS.

For Office use only:				
Codes:	Options:	Dates:	Hotel:	Room Type:
Special remarks:			Amt. pd:	CC [ ] Check [ ]

PREREGISTRATION/HOUSING FORM, ANAHEIM, CALIFORNIA

HOUSING SECTION: JANUARY 1985

Please rank all hotels in order of preference by writing 1, 2, 3, etc., in spaces at left on form, and by circling the requested room type and rate. If the rate requested is no longer available, you will be assigned a room at another hotel at the next best available rate. If not all hotels are ranked, and all rooms have been filled at the ranked hotels, the assignment will be made at an unranked hotel with the next lowest rate. The rates listed below are subject to 8% tax.

1) Name (as it appears on credit card) _____ Phone number: _____

2) Will arrive (date) _____ at _____ a.m./p.m., and depart (date) _____ at _____ a.m./p.m.

NOTE: Please supply address for confirmation on reverse of form.

3) Please be sure to complete sections 3 and 11 on the reverse and to include payment of $50 deposit where applicable.

Order of choice	Numbers in parentheses indicate location on map in meeting announcements.		Single	Double	Twin double	Triple (2 beds)	Triple (2 beds w/cot)	Quad (2 beds)	Quad (2 beds w/cot)	Suites	Deposit Requirements
	Hilton at the Park	(5)	$60	$60	$60	$70	$80	$80	N/A	$155–$380	N/A
	Holiday Inn—Anaheim	(6)	$58	$64	$64	$70	$70	$76	N/A	N/A	A, B, C
	Inn of Tomorrow	(1)	$36	$40	$40	$44	$48	$48	$52	N/A	A, B, C, D
	Jolly Roger Inn	(4)	$41	$42	$42	$45	$47	$45	$47	N/A	A, B, C, D
	Magic Carpet	(3)	$28	$32	$32	$36	$38	$38	$40	N/A	A, B, C, D
	Magic Lamp	(2)	$28	$32	$32	$36	$38	$38	$40	N/A	A, B, C, D
	Marriott	(7)	$55	$60	$60	$66	$70	$68	$72	On request	A, B, C, D
	Quality Inn—Anaheim	(8)	$50	$58	$58	$64	$66	$64	$66	N/A	A, B, C, D
	Town and Country Inn	(9)	$38	$42	$42	$46	$47	$50	$55	$ 49–$100	A, B, C, D
	Travelodge International Inn	(10)	$40	$40	$40	$40	$44	$42	$46	$ 75–$ 95	A, B, C, D

A = Check; B = VISA; C = MasterCard; D = American Express

4) List other room occupants:

FULL NAME	ARRIVAL DATE	DEPARTURE DATE

Order Form

(Use your peel-off label from the *Notices*)

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