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

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

MEETING #	DATE	PLACE	ABSTRACT DEADLINE	ISSUE
831	January 21–24, 1987 (93rd Annual Meeting)*	San Antonio, Texas	EXPIRED	January
832	March 26–28, 1987	Honolulu, Hawaii	February 2	February
833	April 3–4, 1987	Kent, Ohio	February 4	February
834	April 25–26, 1987	Newark, New Jersey	February 6	February
835	June 18–20, 1987	Tacoma, Washington	April 17	June
836	August 5–8, 1987	Salt Lake City, Utah		
	January 6–9, 1988 (94th Annual Meeting)	Atlanta, Georgia		
	August 8–12, 1988 (AMS Centennial Celebration)	Providence, Rhode Island		
	January 11–14, 1989 (95th Annual Meeting)	Phoenix, Arizona		

* Preregistration/Housing deadline is November 15.

DEADLINES

Advertising	(*Jan.* 1987 *Issue*) *Nov.* 12, 1986	(*Feb.* 1987 *Issue*) *Feb.* 18, 1987	(*Apr.* 1987 *Issue*) *Mar.* 23, 1987
News/SMIC	(*Jan.* 1987 *Issue*) *Oct.* 27, 1986	(*Feb.* 1987 *Issue*) *Feb.* 2, 1987	(*Apr.* 1987 *Issue*) *Mar.* 5, 1987

Other Events Sponsored by the Society

January 20–22, 1987, AMS Short Course: The Moment Problem, San Antonio, Texas. Details: October issue.

February 18, 1987, Symposium on Some Mathematical Questions in Biology: Models in Population Biology, Chicago, Illinois. Details: October issue.

May 12–16, 1987, Symposium on the Mathematical Heritage of Hermann Weyl, location to be announced.

June 14–July 25, 1987, Joint Summer Research Conference in the Mathematical Sciences, University of Colorado, Boulder, Colorado. Details: October issue.

July 12–August 15, 1987, Joint Summer Research Conference in the Mathematical Sciences, Cornell University, Ithaca, New York. Details: October issue.

July 6–24, 1987, Summer Research Institute on Theta Functions, Bowdoin College, Brunswick, Maine.

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Notices
of the American Mathematical Society

Volume 33, Number 6, November 1986

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Notices: highlights

Oscar Zariski, past President of the AMS, died on July 4 and is remembered by David Mumford in an article that traces the interesting life and describes the mathematical achievements of this outstanding mathematician. Page 891.

Frank Quinn, in his special article "Local Algebraic Topology," illustrates how the local versions of global topological theorems can be used to probe the local structure of manifolds and more complicated spaces. Page 895.

Fields Medalists and Nevanlinna Prize Recipient have their mathematical works highlighted with lectures at ICM by distinguished mathematicians: Atiyah on the work of Donaldson, Mazur on the work of Faltings, Milnor on the work of Freedman, and Strassen on the work of Valiant. Page 900.

European Mathematical Council surveys mathematics periodicals in Europe to provide a cost comparison of the journals based on subscription price and the amount of material per page. This survey is a companion to the AMS study of American publications presented in the March issue of *Notices*. Page 905.

30th Annual AMS Survey presents statistics on faculty salaries for 1986-1987 and examines new Ph.D. production, as well as the starting salaries for these new doctorates. Page 910.

Kenneth Hoffman looks at the ups and downs of the National Science Foundation budget for FY 1987. Page 939.

John Polking, in an open letter to the mathematical community, stresses the need for mathematicians to serve as program directors at the funding agencies. Page 943.

Oscar Zariski

1899–1986

Oscar Zariski was born on April 24, 1899, in the town of Kobryn, which lies on the border of Poland and the U.S.S.R. It was Russian at the time of Zariski's birth, was Polish between the two world wars, and is now Russian again. He was the son of Bezalel and Chana Zaristky, and was given the name of Asher Zaristky, which he changed to Oscar Zariski when he came to Italy. Kobryn was a small town where his mother ran a general store, his father having died when he was two. In 1918, he went to the University of Kiev in the midst of the revolutionary struggle. He was seriously wounded in one leg when caught in a crowd that was fired at by troops, but recovered after two months in the hospital. As a student, he was attracted to the fields of algebra and number theory as well as to the revolutionary political ideas of the day. He supported himself partly by writing for a local Communist paper. This is most surprising for those of us who only knew him much later, but calls to mind the quip—A man has no heart if he is not a radical in his youth and no mind if he is not a conservative in his mature years.

Because of the limitations of the education available in the U.S.S.R. at the time, in 1921 Zariski went first to the University of Pisa and six months later to the University of Rome where the famous Italian school of algebraic geometry, Castelnuovo, Enriques, and Severi, was flourishing. He had no money and the fact that universities in Italy were free to foreign students was an important consideration. Zariski was especially attracted to Castelnuovo, who immediately recognized his talent. Castelnuovo took him on a three hour walk around Rome after which Zariski realized that he had been given an oral exam in every area of mathematics! Castelnuovo saw in Zariski a man who would not only push their subject further and deeper, but would find radically new ways to overcome its present limitations. Zariski was fond of quoting Castelnuovo as saying "Oscar, you are here with us, but are not one of us," referring to Zariski's doubts even then of how rigorous their proofs were. Zariski met his wife, Yole Cagli, while a student in Rome and they were married on September 11, 1924, in Kobryn.

He received his doctorate in the same year. His thesis ([1],[2]) classified all rational functions $y = P(x)/Q(x)$ of x such that 1) x can be solved for in terms of radicals starting with y, and 2) given any two solutions $x1$ and $x2$, all other solutions x are rational functions of $x1$ and $x2$. Already in his first work he strongly showed his ability to combine algebraic ideas (the Galois group), topological ideas (the fundamental group), and the "synthetic" ideas of classical geometry. The interplay of these different tools was to characterize his life's work.

He pursued these ideas with the support of a Rockefeller fellowship in Rome during the years 1925–1927. His son Raphael was born there on July 18, 1925. In 1927, he accepted a position at Johns Hopkins and in 1928 his family moved to the U.S.A. to join him. Here his daughter Vera was born on September 14, 1932.

A crucial paper in this phase of his career is his analysis [3] of an incomplete proof by Severi that the Jacobian of a generic curve of genus g has no nontrivial endomorphisms. Severi's paper reads as though the proof were complete. Zariski discovered the problem and found a very ingenious argument to remedy it, but neither were well received by Severi who published his own correction independently.

The effect of this discovery seems to have been to turn Zariski's interests to the study of the topology of algebraic varieties, especially of the fundamental group, where the rigor of the techniques was beyond question and the tools were clean and new. He travelled frequently to Princeton to discuss his ideas with Lefschetz. In this phase of his career, roughly from 1927 to 1935, he studied the fundamental group of a variety through the fundamental group of projective n-space minus a divisor. This work is characterized by the spirit of exploration and discovery and, in spite of much recent interest, it remains a largely uncharted area. One result will give the flavor of the new things he turned up: according to another incomplete paper of Severi, it was widely believed that all plane curves of fixed degree with a fixed number of nodes (ordinary double points) belonged to a single algebraic family. What Zariski found was that curves with a fixed degree and a fixed number of *cusps* (the next most complicated type of double point) could belong to several families. He exhibited curves $C1$ and $C2$ of degree 6 with 6 cusps such that the fundamental groups of their complements were not isomorphic!

In 1935, however, Zariski completed his monumental review of the central results of the Italian

school, his Ergebnisse monograph *Algebraic Surfaces* [4]. His goal had been to disseminate more widely the ideas and results of their research, but the result for him was "the loss of the geometric paradise in which I so happily had been living"[1]. He saw only too clearly that the lack of rigor he had touched on was not a few isolated sores but a widespread disease. His goal now became the problem of restoring the main body of algebraic geometry to proper health. Algebra had been his early love and algebra was blooming, full of beautiful new ideas in the hands of Noether and Krull, and various applications to algebraic geometry had already been proposed by van der Waerden. Zariski threw himself into this new discipline. He spent the year 1935–1936 at the Institute for Advanced Study in Princeton, and met regularly with Noether, then at Bryn Mawr, learning the new field through first hand contact with the master.

The fifteen years or so that followed, 1938–1951, if you take the years between his paper [5] recasting the theory of plane curve singularities in terms of valuation theory and his monumental treatise [6] on his so-called "holomorphic functions" (sections of sheaves formed from completions of rings in I-adic topologies), saw the most incredible outpouring of original and creative ideas in which tool after tool was taken from the kit of algebra and applied to elucidate basic geometric ideas. Many mathematicians in their forties reap the benefits of their earlier more original work; but Zariski undoubtedly was at his most daring exactly in this decade. He corresponded extensively in this period with Andre Weil, who was also interested in rebuilding algebraic geometry and extending it to characteristic p with a view to its number-theoretic applications. Although they only rarely agreed, they found each other very stimulating, Weil saying later that Zariski was the only algebraic geometer whose work he trusted. They managed to get together in 1945 while both were visiting the University of Sao Paulo in Brazil.

At the same time, these were years of terrible personal tragedy. During the war, all his relatives in Poland were killed by the Nazis. Only his immediate family and those of two of his siblings who had moved to Israel escaped the holocaust. He told the story of how he and Yole were halfway across the U.S., driving back to the East Coast, the day Poland was invaded. They listened each hour to the news broadcasts on their car radio, their only link to the nightmare half a world away. There was nothing they could do.

In this period of his work, Zariski solved many problems with his algebraic ideas. Three themes in his work are particularly beautiful and deep and I want to describe them in some detail.

[1] Preface by Zariski to his Collected Works, MIT Press.

The first theme is the study of birational maps which lead him to the famous result universally known as "Zariski's Main Theorem". This was the final result in a foundational analysis of birational maps between varieties, "maps" which are one to one and onto outside of a finite set of subvarieties of the range and domain, but which "blow up" or "blow down" special points. Zariski showed that if there are points P and Q in the range and domain which are isolated corresponding points, i.e. the set of points corresponding to P contains Q but no curve through Q, and the set of points corresponding to Q contains P but no curve through P, and if, further, P and Q satisfy an algebraic restriction—they are **normal** points—then in fact Q is the only point corresponding to P and vice versa (slightly stronger: the map is **biregular** between P and Q). Zariski's proof of this was astonishingly subtle, yet short.

The second theme from this period is the resolution of singularities of algebraic varieties, which culminated in his proof that all algebraic varieties of dimension at most 3 (in characteristic zero) have "nonsingular models," i.e., are birational to nonsingular projective varieties. In dimension 3, this was a problem that had totally eluded the easy-going Italian approach. Even in dimension 2, although some classical proofs were essentially correct, many of the published treatments definitely were not. Zariski attacked this problem with a whole battery of techniques, pursuing it relentlessly over 6 papers and 200 pages. Perhaps the most striking new tool was the application of the theory of general valuations in function fields to give a birationally invariant way to describe the set of all places which must be desingularized. The result proved to the mathematical world the power of the new ideas. For many years, this work was also considered by everyone in the field to be technically the most difficult proof in all algebraic geometry. Only when the result was proven for surfaces in characteristic p by Abhyankar and later for varieties of arbitrary dimension in characteristic 0 by Hironaka[2] was this benchmark surpassed!

The third theme is his theory of abstract "holomorphic functions." The idea was to use the notion of formal completion of rings with respect to powers of an ideal as a substitute for the idea of convergent power series, and to put elements of the resulting complete rings to some of the same uses as classical holomorphic functions. The most striking application was to a stronger version of the "Main Theorem," known as the connectedness theorem. The connectedness theorem states that if a birational map from X to

[2] S.S. Abhyankar, *Local uniformization on algebraic surfaces of characteristic* $p \neq 0$, Annals of Math., **63** (1956); H. Hironaka, *Resolution of singularities of an algebraic variety of characteristic* 0, Annals of Math., **79** (1964).

Y is single-valued and if a point Q of Y is normal, then the inverse image of Q on X is connected (we are assuming X and Y are complete, e.g. projective). This result was later one of the inspirations for Grothendieck's immense work in rebuilding with yet newer tools the foundations of algebraic geometry[3].

This phenomenal string of papers caught the attention of the mathematical world. Zariski received the Cole Prize from the American Mathematical Society in 1944. In 1945, he moved to a Research Professorship at the University of Illinois. Early in the forties, his work had caught the attention of G.D. Birkhoff who decided he must come to Harvard[4] and, indeed, in 1947 he received and accepted an offer to come to Harvard University, where he remained for the rest of his life. He was a very strong influence on the mathematical environment at Harvard and he enjoyed the opportunity of luring the best people he could to Harvard and bringing out the best in each of his students. While he was chairman, the Dean, McGeorge Bundy, used to refer to him as that "Italian pirate," so shrewd was he in getting his way, inside or outside the usual channels. Whenever Harvard's baroque appointment rules, known as the Graustein Plan (after the earlier mathematician who invented it), jibed with his plans, he used them; but whenever they did not, he feigned ignorance of all that nonsense and insisted the case be considered on its own merits. Over the next thirty years, he made Harvard into the world center of algebraic geometry. His seminar welcomed Weil, Hodge, Nagata, Kodaira, Serre, Grothendieck, and many others. The stimulating evenings at his home and the warm welcome extended by Oscar and Yole were not easily forgotten.

His work of reconstruction of algebraic geometry had started with the writing of the monograph *Algebraic Surfaces*, and now that Zariski felt he had reliable and powerful general tools, it was natural for him to see if he could put all the main results of the theory of surfaces in order. He initiated the modern work on the duality theorems for cohomology (called by him the "lemma of Enriques-Severi" [7], before the topic was taken up by Serre and Grothendieck), the questions of the existence of minimal nonsingular models in each birational equivalence class of varieties [8], and on the classification of varieties following Enriques [9] (now known as the classification by Kodaira dimension). In each of these areas he spread before his students the vision of many possible areas to explore, many exciting prospects.

Although he himself had developed a fully worked out theory of the foundations of algebraic geometry, he welcomed the prospect of yet newer definitions and techniques being introduced because they would make the subject itself stronger. He embraced the new language of sheaf theory and cohomology, working through the basic ideas methodically as was his custom in the Summer Institute in Colorado in 1953 [10], although he never adopted this language as his own. When Grothendieck appeared in the field, he immediately invited him to Harvard. Grothendieck, for his part, welcomed the prospect of working with Zariski. Because Grothendieck's political beliefs did not allow him to swear the oaths of loyalty required in those unfortunate days, he even asked Zariski to investigate the feasibility of continuing his mathematical research from a Cambridge jail cell, i.e., how many books and visitors would be allowed!

The final phase of Zariski's mathematical career was a return to the problems of singularities. Zariski had absolutely no use for the concept of retirement and he dedicated his sixties and seventies and as much of his eighties as he could to a broad-based attack on the problem of "equisingularity". The goal was to find a natural decomposition of an arbitrary variety X into pieces Y_i, each one made up of a subvariety of X from which a finite set of lower dimensional subvarieties have been removed, such that *along* each subvariety Y_i, the big variety X had essentially the same type of singularity at each point. Zariski made major strides towards the achievement of this goal, but the problem has turned out to be quite difficult and is still unsolved.

Zariski's last years were disturbed by his fight with his hearing problem. Zariski was always very lively both in mathematical and in social interactions with his friends and colleagues, picking up every nuance. He was struck with tinnitus, which produced a steady ringing in his ears, a greater sensitivity to noise, and a gradual loss of hearing. This forced him into himself, into his research and kept him close to home. Only the boundless love of his family sustained him in his last years. He died at home on July 4, 1986.

Many honors flowed to Zariski in well-deserved appreciation of the truly extraordinary contribution he had made to the field of algebraic geometry. He received honorary degrees from Holy Cross in 1959, Brandeis in 1965, Purdue in 1974, and from Harvard in 1981. He received the National Medal of Science in 1965, and the Wolf Prize, awarded by the government of Israel, in 1982. His friends, his students, and his colleagues

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[3] Grothendieck's style was the opposite of Zariski's. Whereas Zariski's proofs always had a punch-line, a subtle twist in the middle, Grothendieck would not rest until every step looked trivial. In the case of holomorphic functions, Grothendieck liked to claim that the result was so deep for Zariski because he was just proving it for the 0th cohomology group. The easy way, he said, was to prove it first for the top cohomology group, then use descending induction!

[4] The story, which I have from reliable sources, is that Birkhoff approached Zariski and said in his magisterial way: "Oscar, you will probably be at Harvard within the next five years."

will remember not only the beautiful theorems he found, but the forcefulness and the warmth of the man they knew and loved.

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[2] *Sopra una classe di equazioni algebriche contenenti linearmente un parametro e risolubili per radicali*, Rend. Circolo Mat. Palermo, vol. 50 (1926) pp. 196–218.

[3] *On a theorem of Severi*, Amer. J. Math., vol. 50 (1928) pp. 87–92.

[4] *Algebraic Surfaces*, Ergebnisse der Mathematik, vol. 3, no. 5., Springer–Verlag, Berlin, 1935, 198 pp.; second supplemented edition, with appendices by S.S. Abhyankar, J. Lipman, and D. Mumford, Ergebnisse der Mathematik, vol. 61, Springer–Verlag, Berlin–Heidelberg–New York, 1971, 270 pp.

[5] *Polynominal ideals defined by infinitely near base points*, Amer. J. Math., vol. 60 (1938) pp. 151–204.

[6] *Theory and applications of holomorphic functions on algebraic varieties over arbitrary ground fields*, Mem. Amer. Math. Soc., no. 5 (1951) pp. 1–90.

[7] *Complete linear systems on normal varieties and a generalization of a lemma of Enriques–Severi*, Ann. of Math., vol. 55 (1952) pp. 552–592.

[8] *Introduction to the problem of minimal models in the theory of algebraic surfaces*, Publ. Math. Soc. Japan, no. 4 (1958) pp. 1–89.

[9] *On Castelnuovo's criterion of rationality* $p_a = P_2 = 0$ *of an algebraic surface*, Illinois J. Math., vol. 2 (1958) pp. 303–315.

[10] *Algebraic sheaf theory* (Scientific report on the second Summer Institute), Bull. Amer. Math. Soc., vol. 62 (1956) pp. 117–141.

Local Algebraic Topology

*Frank Quinn**

The title may at first seem to be a contradiction: most texts on algebraic topology state quite definitely that it is a *global* theory. The spaces studied are assumed to be locally "nice," nice being whatever is required to keep the theory from being cluttered with local static. Indeed the most extensive developments of algebraic topology are in the context of manifolds, which are thought of as being locally almost featureless.

Manifolds are locally homeomorphic to Euclidean spaces, so the suggestion is that Euclidean spaces are "locally featureless." This is certainly false, as analysts well know. More accurately one could say that relatively little of the rich local structure shows up in the global picture given by algebraic topology. The purpose of this article is to illustrate a recent trend; the use of local versions of global topological theorems to probe the local structure of manifolds and more complicated spaces.

There is a long tradition in mathematics of application of global theories to local questions. A familiar example in complex analysis is an application of the Cauchy integral formula. This formula describes the integral around a loop of a complex-differentiable function, in terms of behavior of the function inside the loop. We think of this as a global theorem, since the loop can be quite large. However, the fact that a once differentiable complex function is infinitely differentiable is usually proved by applying this theorem to small loops, and letting the diameters go to zero.

An analogous step occurs in the topological work of P. A. Smith on periodic maps, early in this century. Smith showed (among other things) that if $f: S^n \to S^n$ satisfies $f^p = \mathrm{Id}$, with p prime, then the set of fixed points has the same $\mathbf{Z}/p$ homology as some sphere S^r. This is certainly a global theorem. Smith then applied this locally; suppose f is a map of a manifold to itself with $f^p = \mathrm{Id}$, and suppose x is a fixed point. Consider a very small sphere about x which is taken to itself by f. Then the global theorem applies to the restriction of f to this sphere, and implies that the intersection of the fixed point set with the sphere has the $\mathbf{Z}/p$ homology of a sphere

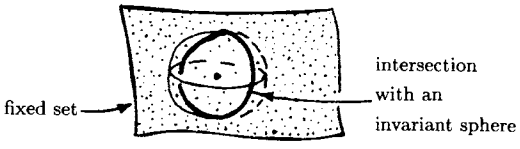


FIGURE 1

(Figure 1). By letting the diameter go to zero one can derive the striking fact that the fixed point set is a $\mathbf{Z}/p$ *homology manifold* (more about these later). This property is a key part of the structure of a periodic map.

By local algebraic topology we mean local versions and applications of global theorems, as in this example.

The sixties and early seventies were a time of considerable activism, in algebraic topology as well as politics. Previously the emphasis had been on calculation of invariants of more-or-less familiar spaces. The work of Smale, Kervaire, Milnor, Browder, Novikov, Kirby, and others ushered in an "activist" era of constructions of new spaces, or new structures on spaces. The Smith theorem above is an example of the older "passive" theory. In the remainder of the article we describe some recent local applications of "activist" topology. More precisely, we describe "controlled" versions of standard theorems, and then local applications of these. The term "controlled" was introduced by Chapman [**2**], and refers to the use of a map to a "control space".

The most famous of the activist theories is Surgery. In this, one begins with a space X with the global algebraic properties of a manifold (Poincaré duality) and tries to construct a manifold M and a homotopy equivalence $M \to X$. The local analog is this: Suppose X has the *local* algebraic properties of a manifold (i.e., X is a homology manifold, like the fixed sets above.) When is there a map $M \to X$ which is a *local* homotopy equivalence? By this we mean that for each open set $U \subset X$ the restriction $f^{-1}(U) \to U$ is a homotopy equivalence. Local homotopy equivalences are sometimes called *cell-like* maps, or *resolutions* when M is a manifold. This last is by analogy with the resolution of singularities in algebraic geometry: the manifold M resolves the singularities in the homology manifold X (Figure 2).

*Partially supported by the National Science Foundation.

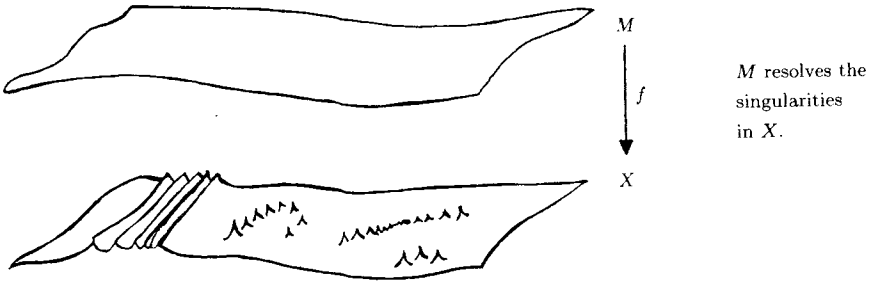


FIGURE 2

A principal application of controlled surgery is a characterization of manifolds, so we discuss the result in that context. A manifold is defined to be a space locally homeomorphic with Euclidean space. The problem was to find properties, particularly ones which do not suppose the existence of homeomorphisms, which characterize these spaces.

The first and simplest properties are that manifolds are finite dimensional (embed in some Euclidean space) and locally contractible (given a point and a neighborhood, there is a smaller neighborhood which contracts in the larger).

On the next level of sophistication are the Alexander-Lefschetz duality relationships between subsets and their complements. The best-known example is the Jordan curve theorem, which asserts that a simple closed curve divides the plane into exactly two components. For single points this can be expressed by saying the complement has the same relative homology ($\mathbf{Z}$ coefficients) as the complement of a point in Euclidean space;

$$H_i(X, X - \text{pt}) = H_i(\mathbf{R}^n, \mathbf{R}^n - \text{pt}), \quad \text{all } i.$$

This condition for points is now used as the definition of "homology manifold." It turns out to imply duality for arbitrary subsets, so homology manifolds have the same homological duality relationships between subsets and complements as do manifolds. Duality for points implying duality for arbitrary subsets is a little like once differentiability implying infinite differentiability for complex functions. We must be a bit jaded, that this fact no longer seems amazing.

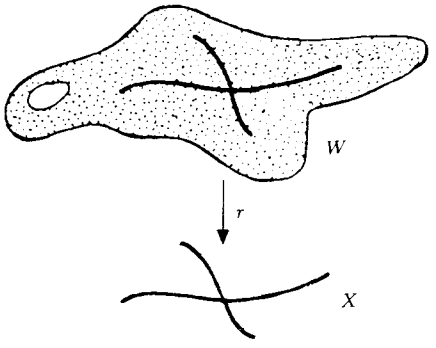
The next property is more subtle, and appears as an obstruction to the construction of a resolution using controlled surgery. One of the obstructions to ordinary surgery is the *index*: the signature of the bilinear form on the middle homology of a manifold of dimension congruent to 0 mod 4. In a manifold of dimension n, "subobjects" of codimension n are points, and so trivially have index 1. In a general homology n-manifold "subobjects of codimension n" (as well as we can make sense of this) may not be points, and particularly may have index different from 1. This is called the *local index* of the homology manifold, and the result is that a finite-dimensional locally contractible homology manifold of dimension ≥ 4 has a resolution if and only if it has local index 1 [**9**]. In fact it is currently unknown if there are homology manifolds of local index $\neq 1$ (and therefore not resolvable), but it seems likely.

The final property has to do with intersection of subsets. In a manifold of dimension n, maps of objects of dimensions j and k can be approximated by maps whose images intersect in a subset of dimension $j + k - n$. As a very special case we see that two maps of a 2-disk into a manifold of dimension at least 5 can be approximated by maps with disjoint images. A theorem of R. D. Edwards [**3**], conjectured by J. Cannon [**1**], states that a homology manifold with a resolution is a manifold of dimension ≥ 5 if and only if it satisfies this disjoint 2-disk property. Again, as with duality, we see that a very special case of intersections implies the general result. This theorem still evokes amazement, however.

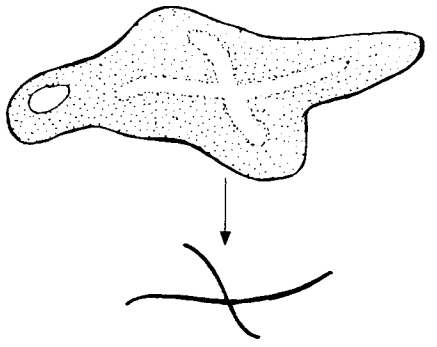
Putting the pieces together we get the characterization: a space X is a manifold of dimension ≥ 5 if and only if it is a locally contractible finite-dimensional homology manifold of local index 1, and satisfies the disjoint 2-disk property.

The next global result we consider is the End Theorem. In this, one begins with a noncompact manifold W and tries to add boundary to it to obtain a compact manifold. This is the opposite of deleting the boundary. Criteria for this were discovered by Browder, Livesay, Levine, and Siebenmann. The appropriate controlled version is: Suppose a map $W \to X$ is given, with X compact. Is it possible to add boundary to W to get a compact manifold M, *and extend the map* to a map $M \to X$?

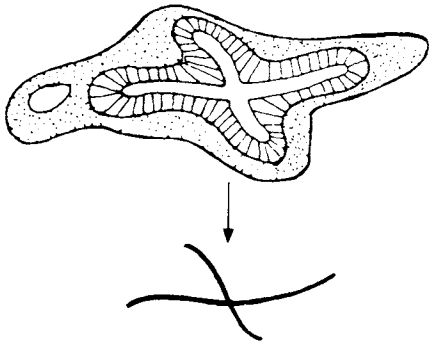
The application of the controlled end theorem to local topology arises as follows; suppose X is embedded in a manifold M, and suppose a compact neighborhood V retracts to X. Denote the retraction by $r: V \to X$, and consider V with X deleted. $V - X$ is no longer compact; there is a hole where X was. We claim: *X has a mapping cylinder neighborhood if and only if boundary can be added to $V - X$, and the map $r: V - X \to X$ extended to this new boundary.* A mapping cylinder neighborhood is just what it sounds like: a neighborhood homeomorphic



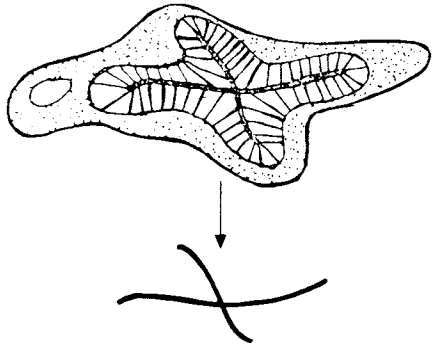
(1) The retraction of W to X.



(2) Delete X to obtain a noncompact manifold.



(3) Add boundary and a collar to $W - X$.



(4) Identify to obtain a mapping cylinder neighborhood.

FIGURE 3

with the mapping cylinder of some map $N \to X$. These neighborhoods are the topological analogs of regular neighborhoods in polyhedra, and tubular neighborhoods in smooth manifolds. The equivalence is easily seen: if boundary N can be added then it has a collar homeomorphic to $N \times I$. The image of this collar in M is a mapping cylinder (Figure 3). Some hypotheses are necessary, since, for example, Alexander's horned sphere gives an embedding of S^2 in S^3 which does not have a mapping cylinder neighborhood. We say X is 1-LC embedded in M if small loops in the complement of X can be extended to maps of small 2-disks in the complement of X. This is not a necessary condition for mapping cylinders, but is very often satisfied. The final result is: if the dimension of M is at least 5 and X is 1-LC embedded with a neighborhood which retracts, then it has a mapping cylinder neighborhood.

Not only is this extremely useful in providing topological analogs of regular neighborhoods, but it contains the solution to a famous old problem of Borsuk: the finiteness of compact ANRs (absolute neighborhood retracts). The finiteness question is: if X is a (finite-dimensional) compact ANR, is it homotopy equivalent to a finite complex? Any such X can be embedded in some Euclidean space, and crossing this with $\mathbf{R}$ gives an embedding which satisfies the mapping cylinder criteria above. A mapping cylinder neighborhood is certainly homotopy equivalent to X, and since it is a compact manifold (in fact smooth) it is a finite complex. J. West first solved this problem, with a more involved argument (which however also applies to infinite-dimensional ANRs).

Another activist global result which has a controlled version is the h-cobordism theorem. In this, one has a manifold W with two boundary pieces M_0 and M_1, and asks when there is a product structure $M_i \times I \approx W$. In the controlled version a map $W \to X$ is given, and we seek product structures so that the images in X of arcs $\{m\} \times I$ have small diameters. Applied locally this theorem gives a uniqueness result for mapping cylinder neighborhoods, and solutions to two more famous old problems: the Hauptvermutung and the topological invariance of Whitehead torsion.

The "topological invariance of Whitehead torsion" is essentially a uniqueness version of the finiteness question. Does a homeomorphism of finite complexes have trivial Whitehead torsion? A more general result comes out of the uniqueness

of the mapping cylinder neighborhoods; a homeomorphism of finite-dimensional ANRs extends to a diffeomorphism of smooth mapping cylinders, and hence has trivial torsion. This means that ANRs as well as finite complexes have "finite homotopy types" which are well defined up to homeomorphism. T. A. Chapman first solved this problem for finite complexes, and R. D. Edwards extended the result to ANRs, using very different methods.

The modern statement of the "Hauptvermutung" asserts that a homeomorphism of PL manifolds is isotopic to a PL homeomorphism. This was formulated early in the century by Dehn and Heegaard, and its resolution by Kirby and Siebenmann [**7**] in dimensions ≥ 5 was one of the principal achievements of the 70s. (It is not quite true, but is close). There is a different and more direct proof using the controlled h-cobordism theorem, which also includes the 4-dimensional case [**8**, part III].

The key ingredient in this proof is a destabilization theorem; if $f: M \to N$ is a homeomorphism of smooth or PL manifolds such that $f \times 1: M \times \mathbf{R} \to N \times \mathbf{R}$ is isotopic to a smooth or PL isomorphism, and M has dimension ≥ 5, then f itself is isotopic to a smooth or PL isomorphism. To prove this let N_f denote the mapping cylinder of f, then the isotopy hypothesis directly implies that there is a smooth or PL structure on N_f extending the given structure on M and N. (Note that the interior of the mapping cylinder is $M \times \mathbf{R}$.) Consider N_f as a smooth or PL controlled h-cobordism over $X = N$, with control map the projection. Applying the h-cobordism theorem gives a smooth or PL product structure, and in particular a smooth or PL isomorphism $g: M \to N$ of the ends. The control in the theorem implies that we can find such a g arbitrarily close to f. A theorem of Chernovski (see [**4**]) then implies g is isotopic to f, as required.

So far we have discussed local applications of the controlled theory to manifolds, and have suggested the power of the theory by observing that along with new results some of the major topological achievements of a decade ago follow as corollaries. But the theory finds its fullest application in spaces with singularities. Note, for example, that in the discussion of mapping cylinder neighborhoods of $X \subset M$ we used only that $M - X$ is a manifold, not that M itself is. Arguing by induction, the theory can be extended to certain spaces X with subsets $X^n \supset \cdots \supset X^1 \supset X^0$ so that each difference $X^i - X^{i-1}$ is a manifold. The exact conditions needed are that X is a "weakly stratified set," and are worked out in detail in [**11**]. The theory is applied there to obtain (among other things) the most general isotopy extension theorem known, which in turn leads to the solution of an old problem about topological "intrinsic strata," and a very general invariance theorem for intersection homology.

There are many examples of these weakly stratified sets, including quotients of many topological actions of groups on manifolds, polyhedra, algebraic varieties, and singularities of generic smooth maps. The local analysis of these spaces therefore has very general potential application.

A new feature is encountered in singular spaces: obstructions. The classical end and h-cobordism theorems in full generality require the vanishing of invariants in the algebraic K-theory of fundamental groups. The controlled analogs have obstructions in complicated homology groups with K-theory coefficients [**8**, part II]. These obstructions are not visible in the applications to the local structure of manifolds described above, because the fundamental groups which arise have vanishing relevant K groups. In more general circumstances the obstructions may be nontrivial, so that, for example, mapping cylinder neighborhoods may not exist. Examples are given in [**8**, part II] of invariant sets in group actions on manifolds which do not have equivariant mapping cylinder neighborhoods for this reason.

Some of the more remarkable applications of the theory use the local topological analysis "backwards": local information is used to obtain conclusions about the obstruction groups. If a group π acts on a space X, then there is a connection between the local structure of X/π and the K- and L-theory groups of π. If X is a Riemannian manifold with nonnegative curvature and π acts by isometries then the connection seems to be quite close. This line of investigation was initiated by Farrell and Hsiang for K-theory, roughly in the case X is flat and π is torsion free [**5**]. K-theory in the flat case with torsion [**10**] and negatively curved torsion free [**6**], and L-theory in the flat case with torsion [**12**] have also been analyzed. When this analysis of the obstruction groups is complete, the local topological analysis will lead to a much deeper understanding of the topological properties of even these very classical geometric quotients X/π.

The pattern emerging is that the high-powered global topological results of previous decades have controlled analogs. These controlled theories are being used like high-energy particles to probe the local structure of manifolds and singular spaces. The story revealed so far is rich and fascinating, and undoubtably many more surprises await us.

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This article is the fifteenth in the series of Special Articles published in *Notices*. The author, Frank Quinn, received his Ph.D. from Princeton University in 1970 with W. Browder. He has held positions at the Courant Institute, the Institute for Advanced Study, Yale, and Rutgers, and is currently University Distinguished Professor of Mathematics at Virginia Polytechnic Institute and State University (Virginia Tech).

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 *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.

Addresses on Works of Fields Medalists and Nevanlinna Prize Recipient

The following are summaries of the lectures on the work of the 1986 Fields Medal and Nevanlinna Prize recipients. These talks were presented following the Opening Ceremonies at the International Congress of Mathematicians in Berkeley. Michael Atiyah spoke on the work of Simon Donaldson, Barry Mazur spoke on the work of Gerd Faltings, John Milnor spoke on the work of Michael Freedman, and Volker Strassen spoke on the work of Leslie Valiant. It should be noted that in the October 1986 issue of Notices, the names of Mazur and Strassen were interchanged in the list of who presented these addresses. The complete manuscripts of these talks are expected to appear in the Proceedings of the Congress. These summaries are being published in Notices with the permission of ICM-86.

Fields Medals

The Work of Simon Donaldson

Michael Atiyah
Oxford University

In 1982, when he was a second year graduate student, Simon Donaldson proved a result which stunned the mathematical world. Together with the important work of Michael Freedman, Donaldson's result implied that there exist "exotic" 4-spaces–4-dimensional manifolds which are topologically but not differentially equivalent to the standard Euclidean 4-space $\mathbf{R}^4$. This result is especially surprising because $n = 4$ is the only value for which such exotic n-spaces exist. These spaces, unlike $\mathbf{R}^4$, contain compact sets that cannot even be contained inside any differentially embedded 3-sphere.

To a closed, oriented 4-manifold one can associate a topological invariant, an integer matrix of determinant ± 1 defined by the intersection properties of the 2-cycles, and depending on the choice of basis. Freedman showed that all such matrices can occur for topological manifolds, while Donaldson showed that only those equivalent to the unit matrix can occur for differentiable manifolds. This shows an inherent difference between the topological and differentiable cases.

Donaldson's results are derived from the Yang-Mills equations of theoretical physics, which are the nonlinear generalization of Maxwell's equations for electromagnetism. In the Euclidean case, the solutions to the Yang-Mills equations giving the absolute minimum (for given boundary conditions at infinity) are of special interest and are called instantons. Mathematicians have worked with instantons before, but it was Donaldson who boldly used instantons (or, more precisely, the nonlinear space of instanton parameters) as a new geometrical tool. This approach revealed completely new phenomena and showed that the Yang-Mills equations are beautifully suited to studying this new field.

When Donaldson proved his first results it was unclear that instantons could be used more generally. Since then, Donaldson has developed and exploited instantons with great insight and skill. He has proved further constraints on the topology of differentiable 4-manifolds, and has produced new invariants. He proved an existence theorem which implied that on an algebraic surface, instanton parameter spaces have a purely algebraic description coinciding with stable vector bundles. Donaldson used this result to calculate algebraically his new invariants, and to exhibit two algebraic surfaces which are homeomorphic but not diffeomorphic.

Donaldson linked the problem of explicitly finding all instantons in Euclidean 4-space to algebraic vector bundles on the complex projective plane (viewed as a compactification of $\mathbf{R}^4 = \mathbf{C}^2$). Applying similar ideas, he proved the remarkably simple result that the parameter space of monopoles of magnetic charge k can be identified with the space of rational functions of a complex variable of degree k.

Donaldson's methods are very subtle and difficult in their use of nonlinear partial differential equations, and required a thorough understanding

of the complex and delicate theory of the Yang-Mills equations. The mastery of such a wide range of ideas and techniques by such a young mathematician indicates that mathematics has lost neither its unity, nor its vitality.

The Work of Gerd Faltings

Barry Mazur
Harvard University

One of the recent great moments in Mathematics was when Gerd Faltings revealed the circle of ideas which led him to a proof of the conjecture of Mordell. The conjecture, marvelous in the simplicity of its statement, had stood as a goad and an elusive temptation for over half a century: it is even older than the Fields Medal! In modern language it takes the following form:

K is any number field and X is any curve of genus > 1 defined over K, then X has only a finite number of K-rational points.

To get a feeling for our level of ignorance in the face of such questions, consider that, before Faltings, there was not a single curve X (of genus > 1) for which we knew this statement to be true for all number fields K over which X is defined!

Already in the 20s, Weil and Siegel made serious attempts to attack the problem. Siegel, influenced by Weil's thesis, used methods of diophantine approximation, to prove that the number of *integral* solutions to a polynomial equation $f(X < Y) = 0$ (i.e., solutions in the ring of integers of a number field K) is finite, provided that f defines a curve over K of genus > 0, or a curve of genus 0 with at least three points at infinity.

In his thesis, Weil generalized Mordell's theorem on the finite generation of the group of rational points on an elliptic curve, to abelian varieties of any dimension. Weil then hoped to use this finite generation result for the rational points on the jacobian of a curve to go on to show that when a curve of genus > 1 is imbedded in its jacobian, only a finite number of the rational points of the jacobian can lie on the curve. Not finding a way to do this, he decided to call his proof of finite generation (the "theorem of Mordell-Weil") a thesis, despite Hadamard's advice not to be satisfied with half a result!

After this work of Weil and Seigel there was little progress for 30 years. It was in the 60s and early 70s that several new developments occurred in algebraic geometry and number theory which were to influence Faltings (work of Grothendieck, Serre, Mumford, Lang, Néron, Tate, Manin, Shafarevich, Parsin, Arakelov, Zarhin, Raynaud, and others).

These developments enter, and come together, in an essential way in the work of Faltings who proved the conjecture of Mordell, by first establishing the truth of a number of other outstanding conjectures-fundamental to arithmetic, and to arithmetic algebraic geometry.

Gerd Faltings's approach to the conjecture of Mordell, as well as his other mathematical contributions, immediately impress one as the work of a marvelously original mind from which we may expect similarly wonderful things in the future.

The Work of Michael Freedman

John Milnor
Institute for Advanced Study

Michael Freedman has not only proved the celebrated Poincaré hypothesis for 4-dimensional topological manifolds, but has also given us classification theorems for important classes of topological 4-manifolds. These theorems are simple to state and use, and are in marked contrast to the extreme complications that are now known to occur in the study of differentiable and piecewise linear 4-manifolds.

The n-dimensional Poincaré hypothesis is the conjecture that every topological n-manifold which has the same homology and the same fundamental group as the n-sphere is actually homeomorphic to the n-sphere. The cases $n = 1, 2$ and $n \geq 5$ had been proved, but the 3- and 4-dimensional cases were found to be much more difficult.

Freedman's 1982 proof of the 4-dimensional Poincaré hypothesis was an extraordinary tour de force. He characterized, up to homeomorphism, all compact, simply connected topological 4-manifolds by two simple invariants, thereby providing a complete classification. This work unearthed many previously unknown examples of such manifolds, and many previously unknown homeomorphisms between known manifolds.

Freedman was able to extend his methods to noncompact manifolds. For example, he showed that $S^3 \times \mathbf{R}$ can be given an exotic differentiable structure containing a smoothly embedded Poincaré homology sphere, which prevents a smooth embedding in Euclidean 4-space. He also addressed the case of nonsimply connected 4-manifolds, by showing that, for example, a "flat" 2-sphere in 4-space is unknotted if and only if its complement has free cyclic fundamental group, and that a flat 1-sphere in S^3 has trivial Alexander polynomial if and only if it bounds a flat 2-disk in the unit 4-disk whose complement has free cyclic fundamental group.

In the difficult proofs of these results, Freedman used a variation of the methods used in low dimensions by Moebius and Poincaré and in high dimensions by Smale and Wallace. The basic idea is to start with a 4-dimensional disk and build up the 4-manifold by successively adding handles. To get around the essential difficulties that arise in four dimensions, Freedman's major technical tool is a theorem stating that every Casson handle is actually homeomorphic to the standard open handle, (closed 2-disk) $\times$ (open 2-disk). The proof involves a delicately controlled infinite repetition argument in the spirit of the Bing school of topology, and is nondifferentiable in a crucial way.

Nevanlinna Prize

The Work of Leslie Valiant

Volker Strassen
University of Zürich

Valiant has contributed in a decisive way to the growth of almost every branch of theoretical computer science. In order to convey some impression of the scope of his work and the impetuous pace of its creation, this address first discusses three early papers, published within a single year, which contain spectacular advances in three widely different areas. Then it turns to Valiant's most important and mature work, centering around his theory of counting problems.

Context-free grammars are being used extensively for describing the structure of programming languages. The central algorithmic problem is to recognize sentences of the language defined by such a grammar. For a number of years, recognition algorithms which run in a time proportional to n^3 on sentences of length n had been known, but despite great efforts no significant improvement had been obtained until 1975 when Valiant showed that the problem can be solved in less than cubic time by reducing it to integer matrix multiplication. He has never returned to this subject, but ingenious algorithmic reductions from combinatorial to algebraic problems have become one of the main themes of his work.

Let m be a positive integer. An m-superconcentrator is a directed graph with m input and m output nodes, such that for every $r \leq m$ any r input nodes may be connected to any r output nodes by r disjoint directed paths. By the size of an m-superconcentrator one means its number of edges. Superconcentrators first appeared in algebraic complexity theory: any straightline algorithm for computing the discrete Fourier transform of order m yields an m-superconcentrator of a size proportional to the length of the algorithm. This observation led to the intriguing idea of proving the optimality of the fast Fourier transform by purely graph theoretical means. Building on previous work of Pinsker, Valiant dashed such hopes by showing that there exist m-superconcentrators of size only linear in m. This is just one example of Valiant's systematic and penetrating study of efficient imbedding and routing properties of graphs, leading in recent years to a theory of the general purpose parallel computer (the so-called supercomputer).

Turing machines are the principal theoretical model on which notions of computability and computational complexity are being based. Given a function: $t : \mathbf{N} \to \mathbf{N}$, let TIME($t$) be the class of all decision problems (coded as sets of binary strings) which can be decided by a multitape Turing machine using $0(t(n))$ steps on inputs of length n. Define SPACE(t) similarly in terms of the number of tape squares visited. TIME(t) $\subset$ SPACE(t), since in one step a Turing machine can reach at most a constant number of new tape squares. Hopcroft, Paul, and Valiant caused a scientific sensation by showing that the above inclusion is strict. In fact they proved

$$\text{TIME}(t) \subset \text{SPACE}(t/\log t),$$

which implies TIME(t) $\subsetneq$ SPACE(t) by a classical diagonalization argument. The class $P := \bigcup_k \text{TIME}(n^k)$ of problems decidable in *polynomial time* has gained a central position in complexity theory, since it appears to be best suited for distinguishing between what can be and what cannot be computed in practice. For brevity, problems in P are called easy, those not in P hard. Now consider a map $f : \mathbf{N} \to 2^{\mathbf{N}}$ such that

$$(1) \qquad \{(x, y) : y \in f(x)\} \text{ is easy,}$$

$$(2) \qquad y \in f(x) \Rightarrow |y| \leq |x|^k$$

for a suitable constant k. ($|x|$ denotes the binary length of x). The set of all numbers x such that $f(x)$ is nonempty is called a *search problem.* The set of composite numbers is an example: $f(x)$ may be taken to consist of all proper divisors of x. The class NP of all search problems contains P, but also includes numerous decision problems occurring in mathematics and its applications that apparently are not easy. Cook in 1971 introduced the fundamental notion of NP-completeness. Roughly speaking, NP-complete problems have maximal degree of difficulty among all search problems. *Cook's hypothesis* $N \neq NP$ therefore implies that NP-complete problems are hard. Cook, Karp and others have succeeded in

classifying most of the naturally occurring search problems as either easy or NP-complete.

In 1979, Valiant drew attention to what he called *counting problems*. These are the numerical functions $x \mapsto \#f(x)$ associated with maps f satisfying (1) and (2). Clearly, a counting problem is at least as difficult as the corresponding search problem. Hence complete counting problems are hard under Cook's hypothesis. Most exciting is Valiant's discovery of various complete counting problems that correspond to easy search problems, thereby considerably enlarging the theory of NP-completeness. Examples are: counting subtrees of a directed graph, evaluating the probability of failure of an unreliable connecting network, counting perfect matchings of a bipartite graph. The proofs of completeness of these problems intricately combine ideas belonging to mathematical logic, graph theory, and algebra.

The number of perfect matchings of a bipartite graph is equal to the value of the permanent function at the zero-one matrix representing the graph over the ring of integers. Replacing $\mathbf{Z}$ by $\mathbf{Z}/m\mathbf{Z}$, Valiant showed that the permanent becomes easy when m is a fixed power of two, while the existence of a fast algorithm for the permanent modulo m for some m that is not a power of two implies that any polynomially bounded number theoretical function, whose graph is easy to decide, is itself easy to compute. It can be deduced that if the permanent modulo 3 (say) is easy, then so is prime factorization of integers. The permanent is a polynomial function of the entries in the matrix. Thus Valiant was naturally led into algebraic complexity theory. Here the basic model is that of a straightline algorithm, i.e., a finite sequence of arithmetical instructions, to be executed over a suitable algebraic structure. For a number of years it had seemed that this subject would remain unaffected by the notion of NP-completeness. Motivated by his work on the permanent, however, Valiant developed a convincing analogue of the theory of search and counting problems entirely in the algebraic framework.

Theoretical computer science is in the stage of formulating its central problems and devising the proof techniques for their solution. Valiant has been eminently involved in this process, not only by answering a number of recalitrant open questions, but above all by developing important new concepts, which have led him to discover deep and beautiful connections between problems that had seemed to be totally unrelated.

MATHEMATICAL REVIEWS

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The *Mathematical Reviews* Editorial Committee invites applications and recommendations for two-year appointments as Associate Editor of **MR**, to commence as soon as possible, but no later than the summer of 1987. 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.

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Those 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, 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.

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European Mathematical Council
Survey of European Mathematical Periodicals

The second survey of American research journals, prepared by the AMS, was published in the March 1986 issue of Notices. The following is a companion survey, conducted by the European Mathematical Council, of European mathematical periodicals, which was originally published in The London Mathematical Society Newsletter (No. 132 Special Issue, Sept. 1986).

Methods. The list of journals surveyed contains only those which are: 1. published in Europe, and 2. reviewed in their entirety by *Mathematical Reviews*.

The boundaries of Europe were defined more or less arbitrarily, taking into account the purposes of this survey. In particular, journals published in the U.S.S.R. have not been surveyed, partly because a large part of the U.S.S.R. lies outside Europe, partly because the U.S.S.R. does not participate in European Mathematical Council affairs, and partly because economic comparisons with the West are of little value. In addition, in order to restrict the scope of the survey to a manageable size, some attempt was made to exclude journals sponsored by a university or similar institution and limited, e.g., to reports of seminars held at that institution. (For example, *Atti Sem. Mat. Fis. Univ. Modena, Sem. Anal. Convexe, Publ. Centre Rech. Math. Pures*).

Counting methods. Twenty pages were arbitrarily selected from each journal, as follows:

The number of pages published in 1984 was determined by taking the number on the last numbered page in each volume (or issue, if numbered separately), and summing these numbers for all volumes or issues published in 1984. Author indexes, tables of contents, and other such front and end matter were excluded from the page counts. The blanks that occasionally occur between consecutive articles were not excluded.

Once it had been determined, the number of pages was divided by 20, and the result was rounded to the nearest multiple of 10. (This rounding was done in order to make the task of photocopying the samples easier and quicker). This rounded number was used as the index for selecting pages from the journal for counting purposes.

I.e., letting p denote the number of pages in 1984, we found $q = p/20$. Then we rounded q to the nearest 10, and called this rounded number q'. Pages numbered $q', 2q', 3q', \ldots, 20q'$ were selected for the counting procedures. (If pages were not numbered consecutively and continuously throughout 1984, pages were selected as if they had been so numbered.)

If any of the pages selected was deemed unsuitable, the nearest suitable page was used instead. Pages were deemed unsuitable if they were shorter than a full page, or if they contained figures, diagrams or tables, or if they were set in type different in size from the type used for the main body of text of the journal—for example, references, footnotes, or, in some cases, book reviews. Pages with a one-line footnote were not deemed unsuitable.

Once twenty suitable pages had been found, the number of lines per page was counted and the average was computed. Display lines were each counted as one line, except for fractions where the combined length of the numerator and denominator exceeded the width of the text format; such fractions were counted as two lines.

The average number of characters per line was determined by counting the number of characters in the first and last full lines of text on the first six pages of the sample taken from each journal. Spaces between words counted as one character each; spaces within mathematical expressions were not counted. Embellishments above symbols were not counted; but each character in a superscript or subscript was counted.

Note that display lines were not used in finding the average number of characters per line. Usually they do not contain as many characters as a line of text; in a cost study, however, this factor is offset by the greater cost of typesetting for displayed mathematics as opposed to text, and by the superiority of symbols over words for expressing information compactly.

Note further that because display lines were not counted, and because some text lines are less than full length by reason of ending or beginning a paragraph, or introducing a display, the average number of characters per line (and hence, the average characters per page) is somewhat overstated by our methods. We use the figures for comparison only, however, not as absolutes.

It goes without saying that, owing to variations in the exchange rate, the prices should be regarded as approximate only; it should also be remembered that, in some cases, there are considerable variations in volume from year to year. Some journals have not published any issues during 1984 and, for this reason, were omitted. In other cases, it was impossible to ascertain the price. For all these reasons, great caution must be exercised in drawing conclusions from these figures.

We are grateful to the American Mathematical Society for much valuable help in gathering data.

Survey of European Mathematical Periodicals

Journal	Publisher	1984 list price, $US	Pages in 1984	Char/ page	Cents/ 1000 char
Acta Appl. Math.	Reidel, Dordrecht	76	400	3025	6.3
Acta Arith.	Polish Academy of Sciences	126	413	2268	13.5
Acta Math.	Inst. Mittag-Leffler, Djursholm	90	605	2274	6.5
Acta Math. Hungar.	Akad. Kiado, Budapest	40	778	2617	2.0
Acta Sci. Math.	Joszef Attila Univ., Szeged	52	470	2422	4.6
Adv. Appl. Prob.	Appl. Probability Trust, Sheffield	102	931	2364	4.6
Anal. Math.	Akad. Kiado, Budapest	90	335	2344	11.5
Analysis	R. Oldenbourg Verlag, Munchen	85	361	1389	17.0
Ann. Acad. Sci. Fenn. Ser. A I Math.	Acad. Sci. Fennica, Helsinki	60	192	2632	11.9
Ann. Global Anal. Geom.	Elsevier B.V. (North-Holland)	62	384	1453	11.1
Ann. Inst. Fourier	Univ. Grenoble	117	1042	1702	6.6
Ann. Math. Pura Appl.	Zanichelli, Bologna	80	1182	2411	2.8
Ann. Polon. Math.	Panstwowe Wydawnictwo Naukowe, Warsaw	45	359	2269	5.5
Ann. Pure Appl. Logic	Elsevier B.V. (North-Holland)	184	669	2631	10.5
Ann. Sci. Ecole Norm Sup.	Bordas, Paris	116	662	2632	6.7
Arch. Math. (Basel)	Birkhauser Verlag	125	1152	3031	3.6
Arch. Math. Logik Grundlag.	Kohlhammer, Stuttgart	82	191	2601	16.5
Arch. Rat. Mech. Anal.	Springer Verlag	442	785	2759	20.4
Ark. Mat.	Inst. Mittag-Leffler, Djursholm	40	210	2597	7.3
Beitrage Alg. Geom.	Wiss. Beitrage Martin Luther Universtat, Halle	11	411	1607	1.7
Bull. London Math. Soc.	London Math. Soc.	80	656	3002	4.1
Bull. Math. Soc. Sci. Math. R.S. (Roumanie) (NS)	Soc. Sti. Mat. RS Romania, Bucharest	22	276	2572	3.1
Bull. Polish Acad. Sci. Math.	PWN, Warsaw	87	743	2461	4.8
Bull. Sci. Math. (2)	Gauthier-Villars	96	446	1883	11.4
Bull. Soc. Math. France*	Bordas, Paris	98	480	2198	9.3
C.R. Acad. Sci. Paris Ser. I Math.	Bordas, Paris	244	1575	2877	5.4
Casopis pro Pest. Mat.	Matematicky ustav Ceskoslovenke akademie ved	87	448	2592	7.5
Collect. Math.	University of Barcelona	18	111	1857	8.7

* price includes Mem. Soc. Math. France

Journal	Publisher	1984 list price, $US	Pages in 1984	Char/ page	Cents/ 1000 char
Colloq. Math.	Panstwowe Wydawnictwo Naukowe, Warsaw	81	425	2377	8.0
Combinatorica	Kultura, Budapest	86	395	3026	7.2
Comm. Math. Helvet.	Birkhauser Verlag	90	676	2207	6.0
Comm. Math. Univ. Carol.	Univ. Karlova, Prague	42	764	1576	3.5
Compositio Math.	Kluwer, Dordrecht	318	1168	1959	13.9
Czechoslovak Math. J.	Academia, Prague	245	668	2589	14.2
Demonstratio Math.	Politech. Warszaw. Warsaw	3	1109	1470	.2
Diagrammes	Univ. Paris VII	11	179	2154	2.9
Discrete Math.	Elsevier B.V. (North-Holland)	384	1625	2518	9.4
Ergodic Theory and Dynamical Systems	Cambridge U.P.	180	643	2878	9.7
European J. Combinatorics	Academic Press	89	395	3329	6.8
Expositiones Math.	Bibl. Institut AG, Mannheim	85	378	2984	7.5
Fund. Inform.	Panstwowe Wydawnictwo Naukowe, Warsaw	58	501	1829	6.3
Fund. Math.	PWN Warsaw	216	1291	2762	6.1
Geom. Dedicata	Reidel, Dordrecht	168	814	2439	8.5
Glas. Mat. Ser. III	Soc. Math. Phys. SR Croatia, Zagreb	14	407	1881	1.9
Glasgow Math. J.	Scottish Acad. Press Edinburgh	45	262	2497	6.9
IMA J. Numer. Anal.	Academic Press	173	506	2780	12.3
Indag. Math.	North-Holland	90	478	2598	7.2
IHES Publ. Math.	Presses Univ. France, Paris	66	369	2848	6.3
Integral Equation Operator Th.	Birkhauser Verlag	110	905	1714	7.1
Internat. J. Computing Math.	Gordon and Breach, London	252	701	2013	17.9
Internat. J. Game Th.	Physica Verlag, Vienna	76	256	2085	14.2
Invent. Math.	Springer Verlag	775	2218	2675	13.1
J. Appl. Prob.	Appl. Probability Trust, Sheffield	82	934	2251	3.9
J. Geom.	Birkhauser Verlag	102	401	1760	14.5
J. London Math. Soc.	London Math. Soc.	252	1152	2590	8.4
J. Math. Economics	Elsevier B.V. (North-Holland)	93	305	2403	12.7
J. Math. Pures Appl.	Bordas, Paris	76	483	2378	6.6
J. Operator Th.	Nat. Inst. Sci. Tech Creation Bucharest	60	402	2334	6.4
J. Pure Appl. Algebra	Elsevier B.V. (North-Holland)	338	1313	2820	9.1

Survey of European Mathematical Periodicals

Journal	Publisher	1984 list price, $US	Pages in 1984	Char/ page	Cents/ 1000 char
J. Reine Angew Math.	de Gruyter, Berlin	78	1962	2814	1.4
J. Statist. Plann. Inference	North-Holland, Amsterdam	193	792	2465	9.9
Lett. Math. Phys.	Reidel, Dordrecht	90	540	3203	5.2
Manuscripta Math.	Springer Verlag	233	1020	1515	15.1
Mat. Vesnik	Mat. Inst., Belgrade	6	400	2124	.7
Math. Ann.	Springer-Verlag	727	1699	2697	15.9
Math. Comput. Simulation	Elsevier B.V. (North-Holland)	115	566	3718	5.5
Math. Methods Appl. Sci.	Teubner, Stuttgart	140	549	2501	10.2
Math. Nachr.	Akademie-Verlag, Berlin	43	1706	2803	.9
Math. Proc. Cambridge Phil. Soc.	Cambridge U.P.	220	1068	3285	6.3
Math. Programming	North-Holland, Amsterdam	206	1086	2778	6.8
Math. Scand.	Aarhus Univ., Aarhus	64	635	2233	4.5
Math. Slovaca	Slovak Academy of Sciences	10	430	2452	.9
Math. Soc. Sci.	Elsevier B.V., Dordrecht	161	609	3058	8.6
Math. Zeitschr.	Springer Verlag	549	1856	2755	10.7
Mathematica (Cluj)	Acad. Rep. RSR, Cluj-Napoca	42	180	2226	10.5
Mathematika	University College, London	19	339	2511	2.2
Mem. Soc. Math. France*	Gauthier-Villars	98	904	2130	5.1
Monatsh. Math.	Springer, Vienna	182	696	2062	12.7
Nieuw Arch. Wisk. (4)	Math. Centrum, Amsterdam	29	451	2322	2.8
Nonlinear Analysis	Pergamon Press	225	1506	2581	5.8
Numer. Math.	Springer Verlag	210	1417	2478	6.0
Optimization	Akademie-Verlag, Berlin	52	636	2847	2.9
Order	Reidel	84	218	3197	12.1
Proc. Edinburgh Math. Soc.	Scottish Academic Press, Edinburgh	75	350	2407	8.9
Proc. London Math. Soc.	London Math. Soc.	272	1152	3046	7.8
Proc. Royal Irish Acad.	Royal Irish Acad., Dublin	22	173	2698	4.7
Proc. Royal Soc. Edinburgh A	Royal Society of Edinburgh	60	1220	2630	1.9
Publ. Math. Debrecen	Kossuth Lajos Tudoman, Debrecen	25	297	2804	3.0
Quart. J. Math. Oxford (2)	Oxford U.P.	80	512	2533	6.2
Rend Circ. Math. Palermo	Circ. Math. Palermo	47	469	1964	5.1
Rend Math.	Univ. Studi Roma	50	624	1968	4.1
Resultate Math.	Brikhauser-Verlag	55	250	2365	9.3
Rev. Roumaine Math. Pures Appl.	Acad. RS Romania, Bucharest	88	919	2521	3.8
Serdica	Bulgarian Acad. Sci., Sofia	11	448	3027	.8
Simon Stevin	Rijksuniversiteit, Gent	16	333	1634	2.8

* price includes Bull. Soc. Math. France

Journal	Publisher	1984 list price, $US	Pages in 1984	Char/ page	Cents/ 1000 char
Statistics	Akademie-Verlag, Berlin	60	566	2360	4.5
Stochastic Proc. Appl.	Elsevier B.V. (North-Holland)	254	1070	2267	10.5
Studia Logica	Ossolineum, Wroclaw	58	484	2612	4.6
Studia Math. PWN, Warsaw	PWN, Warsaw	162	1250	2339	5.5
Theoret. Comp. Sci.	Elsevier B.V. (North-Holland)	485	2452	2910	6.8
Topology	Pergamon Press	140	480	3270	8.9
Topology Appl.	Elsevier B.V. (North-Holland)	161	628	2735	9.4
Z. Anal. Anwendungen	Deutscher Verlag Wissensch., Berlin	110	576	2660	7.2
Z. Math. Logik Grundlag. Math.	Deutscher Verlag Wissensch., Berlin	62	573	3240	3.3
Z. Warsch. Verw. Gebiete	Springer Verlag	595	1920	1685	18.4

First Report

The following pages contain a first report on the 1986 AMS Survey. Included in this report are salary and other data on faculty members in four-year colleges and universities, a report on the 1986 survey of new doctorates, a report on salaries of new doctorates, and a list of names and thesis titles for members of the 1985-1986 Ph.D. class.

The Annual AMS Survey is conducted in two parts. Questionnaires were distributed in May to 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 1985 and June 1986, 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, and new this year, retirement trends and extramural support. These data will be reported in the February 1987 issue of *Notices*.

This Survey is the thirtieth 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 Stefan A. Burr, Edward A. Connors, Philip C. Curtis, Jr., Gerald J. Janusz, Donald C. Rung (chairman), and Audrey A. Terras. The questionnaires were devised by CEEP's Data Subcommittee consisting of Lida K. Barrett, Edward A. Connors (chairman), Lincoln K. Durst, James Hurley, Charlotte Lin, James W. Maxwell, Donald E. McClure, and Donald C. Rung.

Faculty Salaries, Tenure, Women

The questionnaires 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 1986 questionnaire requested information for both the years 1985-1986 and 1986-1987. The sample in this survey is thus the same for both years and is different from the sample used in the Twenty-Ninth AMS Survey in 1985. 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 minimum 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 635 departments in the mathematical sciences, 48 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 Va is applied mathematics/applied science; **Group Vb** is operations research and management science.

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 *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

	1985–1986				1986–1987			
	Faculty		Women		Faculty		Women	
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure
WITHOUT DOCTORATE								
Instructor/Lecturer	914	47	510	22	807	45	427	20
Assistant Professor	552	299	166	78	548	277	167	74
Associate Professor	373	347	49	44	358	320	51	41
Professor	111	106	15	9	105	96	13	10
Total	1950	799	740	153	1818	738	658	145
WITH DOCTORATE								
Instructor/Lecturer	264	35	48	3	262	35	56	5
Assistant Professor	1845	205	316	35	1869	206	330	31
Associate Professor	2497	2145	236	196	2510	2113	239	203
Professor	4070	3997	200	189	4093	4004	206	195
Total	8676	6382	800	423	8734	6358	831	434

TABLE 2: Percent of Doctorate Faculty with Tenure

	Fall 1985	Fall 1986
Groups I, II, III	76.8%	76.6%
Groups IV, V	71.4%	71.8%
Group VI	88.5%	86.6%
Masters and Bachelors	68.4%	66.8%

TABLE 3: Response Rates

U.S. Departments

Group	I	II	III	IV	V	M	B
% Response	77	67	67	62	46	47	34

Canadian Departments

Group	VI
% Response	61

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 70%.

	SIZE OF FACULTY								SALARIES (*in hundreds of dollars*)					
	1985–1986				1986–1987				1985–1986			1986–1987		
	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	16	3	10	2	17	3	10	2						
Assistant Professor	2	2	1	1	2	2	1	1						
Associate Professor	2	2	0	0	2	2	0	0						
Professor	1	1	0	0	1	1	0	0						
	21	8	11	3	22	8	11	3						
WITH DOCTORATE														
Instructor/Lecturer	99	0	9	0	99	0	13	0	201(223-256)	(230-258)	(238-268)270	207(238-270)	(241-271)	(241-280)285
Assistant Professor	200	4	19	2	200	4	21	0	217(250-272)	(256-297)	(285-323)366	229(262-294)	(280-320)	(311-354)391
Associate Professor	237	225	16	15	246	234	16	16	249(293-333)	(334-359)	(354-436)540	268(298-351)	(355-399)	(393-464)568
Professor	887	887	28	28	902	902	29	29	262(337-419)	(450-514)	(638-780)896	303(347-431)	(448-543)	(701-850)910
	1423	1116	72	45	1447	1140	79	45						
DOCTORATE GRANTING DEPARTMENTS, Group II					(29 of 43 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	47	4	33	2	45	3	31	2	141(165-226)	(169-231)	(168-247)259	172(174-208)	(175-232)	(175-260)270
Assistant Professor	7	7	1	1	7	7	1	1	--	--	--	--	--	--
Associate Professor	11	10	4	3	11	10	4	3	--	--	--	--	--	--
Professor	4	4	0	0	3	3	0	0	--	--	--	--	--	--
	69	25	38	6	66	23	36	6						
WITH DOCTORATE														
Instructor/Lecturer	34	0	8	0	37	0	10	0	150(165-210)	(181-219)	(183-223)260	180(180-236)	(193-237)	(203-248)270
Assistant Professor	209	13	32	2	203	24	29	2	198(230-255)	(258-292)	(273-336)427	266(251-290)	(270-318)	(290-356)448
Associate Professor	310	290	18	17	319	290	18	16	241(272-310)	(303-352)	(354-402)492	257(281-330)	(313-382)	(364-433)527
Professor	541	538	17	17	549	545	20	20	288(320-379)	(399-471)	(577-712)792	319(333-404)	(424-519)	(583-758)848
	1094	841	75	36	1108	859	77	38						
DOCTORATE GRANTING DEPARTMENTS, Group III					(49 of 73 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	93	3	61	3	83	1	54	1	120(150-210)	(160-211)	(174-232)318	120(160-222)	(170-226)	(182-249)340
Assistant Professor	40	27	16	9	41	28	17	10	170(222-284)	(231-284)	(242-291)427	177(228-284)	(246-292)	(256-295)427
Associate Professor	20	18	1	1	20	18	1	1	270(277-364)	(284-368)	(294-383)408	240(282-378)	(288-379)	(309-409)441
Professor	11	11	6	0	9	9	0	0	--	--	--	--	--	--
	164	59	84	13	153	56	72	12						
WITH DOCTORATE														
Instructor/Lecturer	57	25	9	1	53	25	9	2	180(195-251)	(193-258)	(230-285)625	120(180-283)	(193-299)	(200-306)660
Assistant Professor	286	41	41	5	323	44	49	5	170(232-265)	(252-282)	(260-320)385	177(240-277)	(267-300)	(292-341)420
Associate Professor	394	350	24	23	383	342	26	24	185(267-306)	(305-351)	(334-409)533	187(271-330)	(310-372)	(349-439)568
Professor	587	578	16	16	593	584	17	17	290(324-390)	(394-453)	(503-616)850	305(340-421)	(409-483)	(532-662)898
	1324	994	90	45	1352	995	101	48						

DOCTORATE GRANTING DEPARTMENTS, Group IV					(43 of 69 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	9	1	4	0	8	1	4	0						
Assistant Professor	5	2	0	0	3	2	0	0						
Associate Professor	1	1	0	0	1	1	0	0						
Professor	5	3	0	0	5	3	0	0						
	20	7	4	0	17	7	4	0						
WITH DOCTORATE														
Instructor/Lecturer	7	1	5	1	5	1	3	1	—	—	—	—	—	—
Assistant Professor	152	5	26	0	142	3	29	0	205(249-280)	(276-308)	(280-329)390	220(256-300)	(282-319)	(293-352)422
Associate Professor	135	113	13	9	147	127	14	12	241(290-341)	(323-382)	(341-401)481	272(312-368)	(347-393)	(355-441)510
Professor	322	308	14	12	325	310	13	11	301(365-444)	(453-566)	(538-717)892	324(390-480)	(473-609)	(569-804)948
	616	427	58	22	619	441	59	24						
DOCTORATE GRANTING DEPARTMENTS, Group V					(13 of 28 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	0	0	0	0	0	0	0	0						
Assistant Professor	0	0	0	0	0	0	0	0						
Associate Professor	1	1	0	0	0	0	0	0						
Professor	2	2	0	0	2	2	0	0						
	3	3	0	0	2	2	0	0						
WITH DOCTORATE														
Instructor/Lecturer	6	0	1	0	6	0	1	0	—	—	—	—	—	—
Assistant Professor	34	8	3	0	32	8	2	0	260(265-321)	(293-357)	(314-397)422	272(286-383)	(304-405)	(323-455)473
Associate Professor	30	26	2	1	21	18	1	0	296(343-441)	(366-443)	(372-478)545	302(366-468)	(381-495)	(385-558)617
Professor	101	101	3	3	86	82	3	3	230(356-492)	(500-551)	(633-743)800	339(405-520)	(515-597)	(700-850)880
	171	135	9	4	145	108	7	3						
DOCTORATE GRANTING DEPARTMENTS, Group VI (Canadian Departments)					(17 of 28 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	11	1	6	1	9	1	6	1						
Assistant Professor	19	13	5	5	20	14	5	5						
Associate Professor	13	13	2	2	13	13	2	2						
Professor	7	7	0	0	7	7	0	0						
	50	34	13	8	49	35	13	8						
WITH DOCTORATE														
Instructor/Lecturer	2	0	1	0	2	0	2	0	—	—	—	—	—	—
Assistant Professor	61	13	9	4	67	13	10	3	218(220-273)	(255-304)	(279-345)452	220(233-278)	(272-290)	(286-360)470
Associate Professor	183	176	10	9	180	169	11	10	274(304-385)	(351-430)	(397-520)624	280(309-374)	(374-432)	(398-516)649
Professor	252	252	6	6	253	253	6	6	352(365-451)	(443-532)	(503-706)820	333(366-439)	(450-515)	(497-703)782
	498	441	26	19	502	435	29	19						

	SIZE OF FACULTY								SALARIES (*in hundreds of dollars*)					
	1985–1986				1986–1987				1985–1986			1986–1987		
	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					(128 of 272 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	377	28	226	12	326	28	187	11	123(170-200)	(178-217)	(194-242)495	130(175-209)	(186-234)	(199-252)530
Assistant Professor	194	135	52	26	178	118	47	22	139(225-290)	(241-303)	(255-316)391	147(236-298)	(254-313)	(266-332)412
Associate Professor	142	138	18	18	136	127	17	15	161(278-334)	(295-351)	(313-365)499	170(290-348)	(312-368)	(318-386)499
Professor	49	48	5	5	42	39	6	5	194(309-395)	(318-395)	(329-431)526	208(347-435)	(344-439)	(356-449)487
	762	349	301	61	682	312	257	53						
WITH DOCTORATE														
Instructor/Lecturer	46	5	11	1	48	6	15	2	153(203-290)	(209-300)	(221-306)335	162(182-318)	(213-294)	(221-322)353
Assistant Professor	493	74	80	12	503	70	91	13	161(230-265)	(245-281)	(261-320)450	169(237-275)	(255-295)	(275-334)480
Associate Professor	673	565	86	75	652	538	84	71	187(267-308)	(293-347)	(318-390)460	196(282-321)	(308-357)	(340-407)484
Professor	857	841	59	58	862	837	63	62	222(324-380)	(365-426)	(394-487)700	233(340-400)	(373-447)	(424-519)750
	2069	1485	236	146	2065	1451	253	148						
BACHELOR DEGREE GRANTING DEPARTMENTS					(326 of 950 reporting)									
WITHOUT DOCTORATE														
Instructor/Lecturer	361	7	170	2	319	8	135	3	113(171-205)	(176-208)	(184-220)288	144(185-220)	(185-228)	(198-237)355
Assistant Professor	285	113	91	36	297	106	96	35	141(201-250)	(209-260)	(220-287)374	152(209-261)	(218-270)	(230-291)394
Associate Professor	183	164	24	20	175	149	27	20	185(248-322)	(244-316)	(255-336)445	170(259-335)	(255-340)	(265-341)427
Professor	32	30	4	4	36	32	7	5	237(272-374)	(293-384)	(293-384)457	240(272-383)	(317-404)	(307-408)479
	861	314	289	62	827	295	265	63						
WITH DOCTORATE														
Instructor/Lecturer	13	4	4	0	12	3	3	0	175(188-221)	(202-250)	(211-271)279	200(200-237)	(200-270)	(217-290)293
Assistant Professor	410	47	106	10	399	40	99	8	177(218-249)	(230-262)	(238-291)430	170(236-261)	(247-280)	(250-302)465
Associate Professor	535	400	67	47	562	395	69	54	199(254-304)	(262-321)	(283-354)482	199(270-315)	(277-335)	(299-361)525
Professor	523	492	57	49	523	491	55	47	195(294-385)	(308-398)	(329-437)601	201(314-399)	(323-414)	(344-451)720
	1481	943	234	106	1496	929	226	109						

Salary Survey for New Recipients of Doctorates

The figures for 1986 in this article were compiled from questionnaires sent to individuals who received a doctorate in the mathematical sciences during the 1985-1986 academic year from universities in the United States and Canada.

Questionnaires requesting information on salaries and professional experience were distributed to 676 recipients of degrees using addresses provided by the departments which granted the degrees. Of these, 9 were returned by the postal service as undeliverable and could not be forwarded. There were 303 individuals who returned forms between late June and early September. The tables below are based on the responses from 270 of these individuals (227 men and 43 women). Data from 33 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 1986 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 1986 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. The salary information in the graphs is in hundreds of dollars.

The connected line segments equate value of the dollar from one year to the next, using the 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 1986 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. (For a more detailed analysis of academic salaries, see Donald Rung's article, "A Fifteen Year Retrospective on Academic Salaries of U.S. Doctorate Holding Faculty," in the November 1985 issue of *Notices*, pp. 772-773.) "Between 1984 and 1985, in academe and in business, median starting salaries gained only slightly with respect to inflation, whereas for twelve-month research positions, they gained substantially." However, starting salaries in government lost ground to inflation from 1984 to 1985.

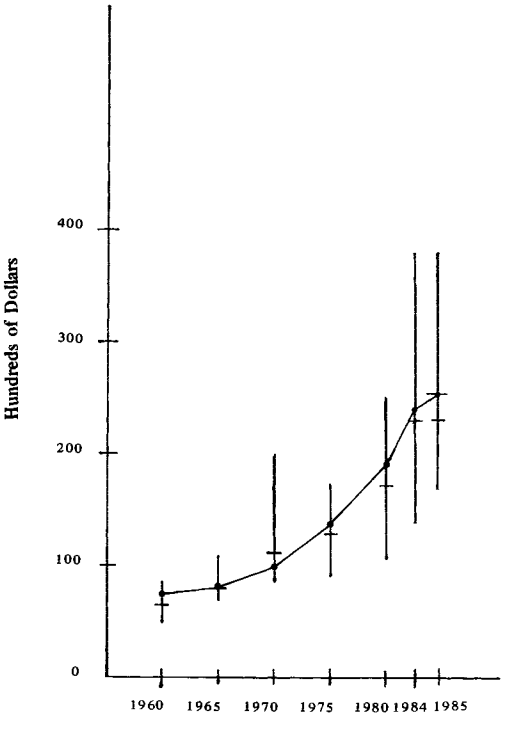
Nine-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	1965 Salary Median in Current $
TEACHING OR TEACHING AND RESEARCH (128 + 28)						
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	241
1985	170	23	250	270	380	249
1986	170	250	269	290	400	—
1983M	95	204	220	240	350	
1983F	80	198	210	227	330	
1984M	140	215	232	255	380	
1984F	161	215	228	251	325	
1985M	186	232	250	270	380	
1985F	170	215	242	270	366	
1986M	170	250	269	290	400	
1986F	230	250	268	294	270	
One Year Experience (108 + 21)						
1986M	170	250	270	291	400	
1986F	230	250	270	290	370	

Nine-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
RESEARCH (5 + 1)				
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	244
1985	205	235	250	252
1986	215	245	280	—
1983M	100	200	230	
1983F	205	205	205	
1984M	205	205	205	
1984F	—	—	—	
1985M	205	226	250	
1985F	—	—	—	
1986M	215	250	280	
1986F	240	240	240	
One Year Experience (5 + 1)				
1986M	215	250	280	
1986F	240	240	240	

Nine-Month Teaching



Graph omitted because sample size too small

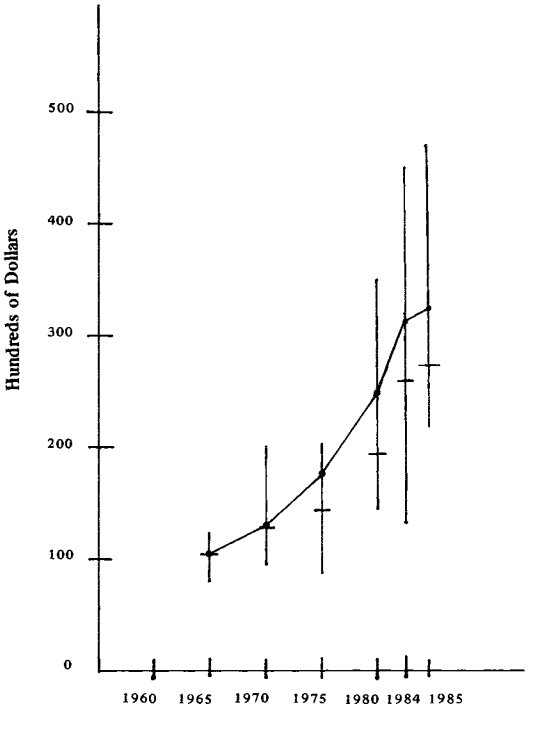
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
TEACHING OR TEACHING AND RESEARCH (30 + 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	313
1985	220	273	470	323
1986	220	320	480	—
1983M	160	255	320	
1983F	240	265	270	
1984M	134	260	450	
1984F	240	275	330	
1985M	230	240	470	
1985F	220	280	420	
1986M	220	320	480	
1986F	240	285	360	
One Year Experience (23 + 4)				
1986M	220	305	444	
1986F	240	285	360	

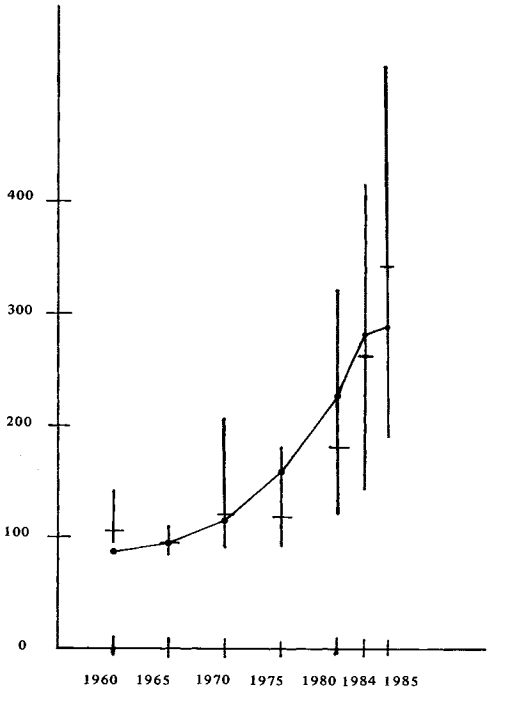
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
RESEARCH (22 + 2)				
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	280
1985	190	342	520	286
1986	160	300	510	—
1983M	195	262	450	
1983F	155	260	364	
1984M	170	283	415	
1984F	145	200	253	
1985M	190	360	520	
1985F	279	300	323	
1986M	160	300	510	
1986F	240	270	300	
One Year Experience (21 + 2)				
1986M	160	300	480	
1986F	240	—	300	

Twelve-Month Teaching



Twelve-Month Research



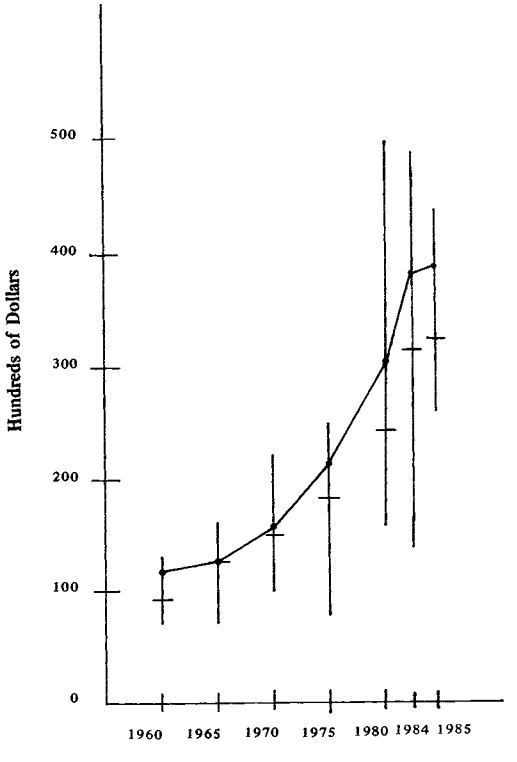
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
		GOVERNMENT (10 + 0)		
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	379
1985	263	325	440	392
1986	270	400	610	—
1983M	160	313	422	
1983F	293	320	350	
1984M	288	326	490	
1984F	140	202	263	
1985M	263	325	440	
1985F	—	—	—	
1986M	270	400	610	
1986F	—	—	—	
One Year Experience (3 + 0)				
1986M	270	325	330	
1986F	—	—	—	

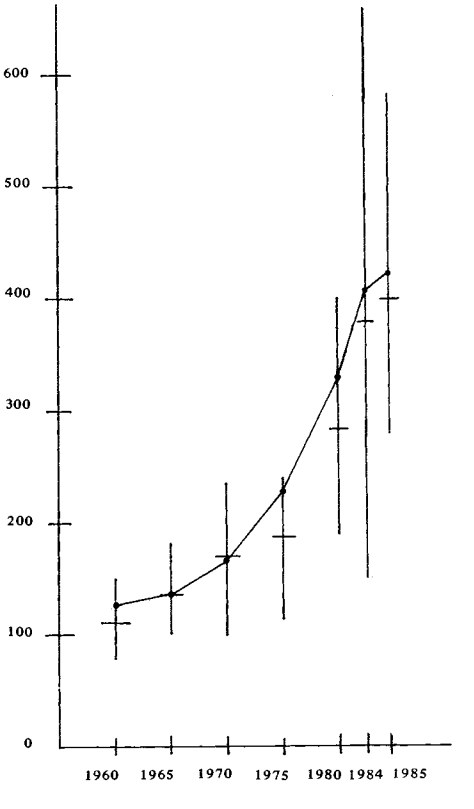
Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current $
		BUSINESS AND INDUSTRY (32 + 8)		
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	409
1985	260	400	493	423
1986	324	425	750	—
1983M	300	370	580	
1983F	276	375	413	
1984M	180	383	660	
1984F	200	342	416	
1985M	260	400	493	
1985F	295	370	430	
1986M	324	453	750	
1986F	350	375	440	
One Year Experience (21 + 7)				
1986M	324	420	500	
1986F	350	360	440	

Twelve-Month Government



Twelve-Month Business and Industry



Report on the 1986 Survey of New Doctorates

Edward A. Connors

This report presents a statistical profile of new doctorates in mathematical sciences awarded by universities in the United States and Canada during the period July 1, 1985, through June 30, 1986. It includes the employment status of recipients of 1985-1986 doctorates in mathematical sciences (as of August 20, 1986) and an analysis of the data by sex, minority group, and citizenship. In addition, trends in the number of doctoral degrees are reported for each of the Groups I through V (see the first page of this Report of the 1986 Annual AMS Survey for a description of the classification system and *Notices*, June 1983, for a listing of the departments in Groups I and II. Table 0 provides information on the response rates for this part of the Survey.

TABLE 0: Response Rates

Group I	37 of 39
Group II	39 of 43 including 2 with 0 degrees
Group III	65 of 73 including 18 with 0 degrees
Group IV	55 of 69 including 8 with 0 degrees
Group Va	10 of 21 including 2 with 0 degrees
Group Vb	16 of 38 including 3 with 0 degrees
Group VI	24 of 29 including 8 with 0 degrees

We continue the practice adopted in the 1983 Report and do not report doctorates granted by computer science departments (formerly included with the totals for Group V departments). The reporting rate of computer science doctorates was considered too small to merit inclusion. In the 1982 Survey, for example, 105 doctorates in computer science were reported whereas the actual number of degrees granted was more than twice that number. For 1982 the National Science Foundation reported 220 doctorates awarded in computer science (under the heading Mathematical Sciences) and 72 doctorates in Computer Engineering (*Science and Engineering Doctorates: 1960-82*, NSF 83-328, pages 19 and 17 respectively). In contrast, virtually all of the mathematical sciences doctorates are reported. Thus, any year to year comparisons that bridge the 1982 and 1983 Surveys should accommodate this modification. This year we initiate a presentation in Table 1C of the number of doctorates in the mathematical sciences awarded by departments and/or programs in Groups I, II, III, IV, Va, and VI for the years 1982-1983 to 1985-1986. All but the entry for 1985-1986 are the spring counts.

TABLE 1A: New Doctorates, Fall Counts

80-81	81-82	82-83	83-84	84-85	85-86
812	755	792	789	769	801

TABLE 1B: New Doctorates, Fall and Spring Counts

	80-81	81-82	82-83	83-84	84-85	85-86
Fall	904*	860*	792	789	769	801
Spring	927*	914*	840	827	807	**

TABLE 1C: New Doctorates Awarded by Groups I–Va, VI

82-83	83-84	84-85	85-86
767	735	755	717***

* Includes computer science.
** To appear in *Notices*, February 1987.
*** This is a fall count. The other entries in Table 1C are spring counts.

Table 1C will be updated to include a spring count for 1985-1986 in the February *Notices*.

The number of new doctorates reported for 1985-1986 is 801 (fall 1986 count) compared to 769 for 1984-1985 (fall 1985 count). The comparable statistics for 1983-1984 and 1982-1983 are 789 and 792, respectively. None of these tallies include doctorates awarded by computer science departments. These numbers are obtained from the Annual Survey Reports in the November *Notices* and appear as part of Table 1A. In Table 1C we record for the first time a count of new doctorates in the mathematical sciences in the U.S. and Canada for the years 1982-1983 through 1985-1986, exclusive of Group Vb. The response rate for Group Vb is the lowest of all groups, and the responders include departments in engineering and management science.

As is customary, a second, updated report is planned for the February 1987 issue of *Notices*. Table 1B contrasts the number of new doctorates reported in the November Reports with the more complete totals reported in the following spring Reports for the years 1980-1981 to 1984-1985. The last column is the number reported in this Survey. Note that the table entries prior to 1982-1983 include the computer science departments and, thus, this table is comparable to Table 1b from last year's Report (*Notices*, November 1985, page 768).

The data for 1985-1986 shows an increase of 4% in doctorates awarded compared to 1984-1985 and an increase of 3% over the four-year average from the years 1981-1982 through 1984-1985. These percentages are computed from the fall counts of the cited years. However, if we exclude the doctorates reported by the respondents in Group Vb, these increases are no longer present. The second part of this report, to appear in February, will include a similar computation based on spring counts.

Of the 756 doctorates reported from U.S. universities (there were 45 doctorates from Canadian

TABLE 2: Employment Status of 1985-1986 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	19	20	22	1	1	4	2		15		4	88
Group II	5	6	7		2	1			10		3	34
Group III	4	9	6	3		7	1	1	10	1	2	44
Group IV					4	28					3	35
Group V		1			1	4	1	4	5		1	17
Masters	10	8	9	3		10	2	2	14		2	60
Bachelors	11	15	7	6	3	5	2	2	7		2	60
Two-year College	1	1						1		1		4
Other Academic Departments		2		1	1	19	2	15	12		12	64
Research Institutes	4	2				3		1	1		1	12
Government	1		1			9		3	6		5	25
Business and Industry	4	7		1	1	32	5	15	18		19	102
Canada, Academic	3	5	2	1		4		1	5		1	22
Canada, Nonacademic	1								2			3
Foreign, Academic	17	19	6	2	4	18		3	14		6	89
Foreign, Nonacademic	2	5	2	2	5	10		7	7		6	46
Not seeking employment	1	1	1			5			1			9
Not yet employed	6	1	8	1	1	6		1	14		4	42
Unknown	10	5	4	2	3	6	1	6	7		1	45
Total	99	107	75	23	26	171	16	62	148	2	72	801

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

July 1, 1985–June 30, 1986

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	13		129	1	143	3		31		34	177
Black	2		6		8	3				3	11
American Indian, Eskimo, Aleut								1		1	1
Mexican American, Chicano, Puerto Rican	4		3	1	8	2				2	10
None of those above	271	5	163		439	70		22		92	531
Unknown	14		8		22	4				4	26
Total Number	304	5	309	2	620	82		54		136	756

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			10		10						10
Black											
American Indian, Eskimo, Aleut											
Mexican American, Chicano, Puerto Rican											
None of those above		13	12		25	1	2			3	28
Unknown		4		2	6				1	1	7
Total Number		17	22	2	41	1	2		1	4	45

universities), the citizenship is reported as known for 754 recipients, with U.S. citizens accounting for 51% (386). The percentage of U.S. citizens receiving doctorates in the mathematical sciences from U.S. universities has declined consistently and dramatically from 73% in 1979-1980 to 51% in 1985-1986. If we delete Group Vb from consideration, the number of U.S. citizens receiving doctorates in the mathematical sciences from U.S. universities in 1985-1986 is clearly below 400.

Women comprise 21% of the U.S. citizens receiving doctorates in the mathematical sciences from U.S. universities in 1985-1986. Since 1972-1973 this percentage has more than doubled. It had held fairly constant at or above 20% for the last three years. Table 6 presents this data for the period 1972-1973 to 1985-1986.

The employment matrix, Table 2, is similar to last year's, with a few exceptions. There are 35 new doctorates employed by Group IV departments compared to 18 in 1984-1985. There is a decline in the number of new doctorates reporting statistics as a specialty (171, down from 189) and likewise for probability (26, down from 39). However, there is an increase in the number of new doctorates reporting applied mathematics as a specialty (148, up from 115) and likewise for operations research (62, up from 41). Most of the latter increase seems to be a reflection of the increase in doctorates reported by Group Vb in comparison to last year.

Employment Status of New Doctorates, 1985-1986. Table 2 shows the employment status, by type of employer and field of degree, of the 801 recipients of doctoral degrees conferred by the mathematical sciences departments in the U.S. and Canada between July 1, 1985 and June 30, 1986. The names of these 801 individuals are listed with their thesis titles in a later section of this Report.

In rows 1 through 5, the numbers represent those who have accepted appointments in U.S. doctorate-granting mathematical sciences departments (Groups I–V). In the next two rows, the figures represent those accepting appointments in U.S. mathematical sciences departments granting masters and bachelors as the highest degree. The information was obtained from the departments granting the degrees and from the recipients themselves.

Among the 1985-1986 new doctorates employed in the U.S. (545), 62% (338) took academic positions in university or four-year college mathematical sciences departments, and 23% (127) took employment in government, business, or industry. Each of these is one percentage point higher than reported in November of 1984 and 1985.

Table 2 shows as "not yet employed" about 6% of the 1985-1986 new doctorates, excluding those whose employment status is unknown. The data in Table 2 were obtained in many instances early in the summer of 1986 and do not reflect subsequent hiring; an update of Table 2 is planned for the February 1987 *Notices*. A similar update last year revealed that all but 6 new 1984-1985 doctorates found positions by fall 1985 (see *Notices*, November 1985, page 769, and March 1986, page 293). Nine persons included in Table 2 reported taking part-time employment.

Table 2 shows that recipients in the two employment categories *foreign academic* and *foreign nonacademic* comprise a total of 135 or 17% of the 801 new doctorates—corresponding numbers for last year were 140 and 18%, respectively.

Sex, Minority Group, and Citizenship of New Doctorates, 1985-1986. Table 3 presents a breakdown according to sex, minority group, and citizenship of these 801 new doctorates. The information reported in this table was obtained from departments granting the degrees and in some cases from the recipients themselves.

Analyses of the 1985-1986 employment forms of the new doctorates indicate that of the 166 new doctorates employed by Group I, II, or III departments, 16% are women, an increase of 3 percentage points from the 13% reported last year, and an increase of 6 percentage points over the 10% reported in the three prior years.

Of the 120 new doctorates employed by Groups M and B institutions, 21% are women (compared to 26% last year); of the 127 new doctorates employed by government, business, or industry, 14% are women (compared to 15% last year).

Trends in the Number of New Doctorates. Table 4 gives the number of doctorates granted during 1983-1984, 1984-1985, and 1985-1986 by those departments in Groups I–VI *which reported in all three years* (as of August 20, 1986). This is the same criterion used in last year's Report. The number of such departments out of the total is given in parentheses. (Computer science departments are not included.) The entries for the 1983-1984 and 1984-1985 columns should *not* be expected to agree with the corresponding columns in last year's Report, due to the criterion for inclusion. For example, a department that did not respond to this year's Survey is not included this year although it may have been included in the tally for last year.

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

	83-84	84-85	85-86
Group I (37 of 39 depts.)	220	269	256
Group II (37 of 43 depts.)	117	74	112
Group III (47 of 73 depts.)	83	61	71
Subtotal	420	404	439
Group IV (44 of 69 depts.)	139	150	137
Group Va (9 of 17 depts.)	25	32	21
Group Vb (13 of 38 depts.)	71	49	55
Group VI (25 of 28 depts.)	47	39	43
Total	702	674	695

Citizenship and Sex of U.S. Doctorates, 1972–1986. Again this year, information is presented on the annual number of doctorates granted by U.S. universities to U.S. citizens (Table 5). This number is divided into male and female doctorates (Table 6). These data are presented for the period 1972–1986 using the Annual AMS Survey Reports on new doctorates published each year in the October or November *Notices*. Thus Tables 5 and 6 are extensions of tables in last year's Report. In Table 5 the first column (headed Adjusted Total of Doctorates given by U.S. Universities) gives the number of doctorates granted between July 1 and June 30 of the indicated years *whose citizenship is known.* Column 2 gives the number who were U.S. citizens and Column 3 the percentage that 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, 1983-1984, 1984-1985, and 1985-1986 include doctorates granted by computer science departments.

TABLE 5: U.S. Citizen Doctorates

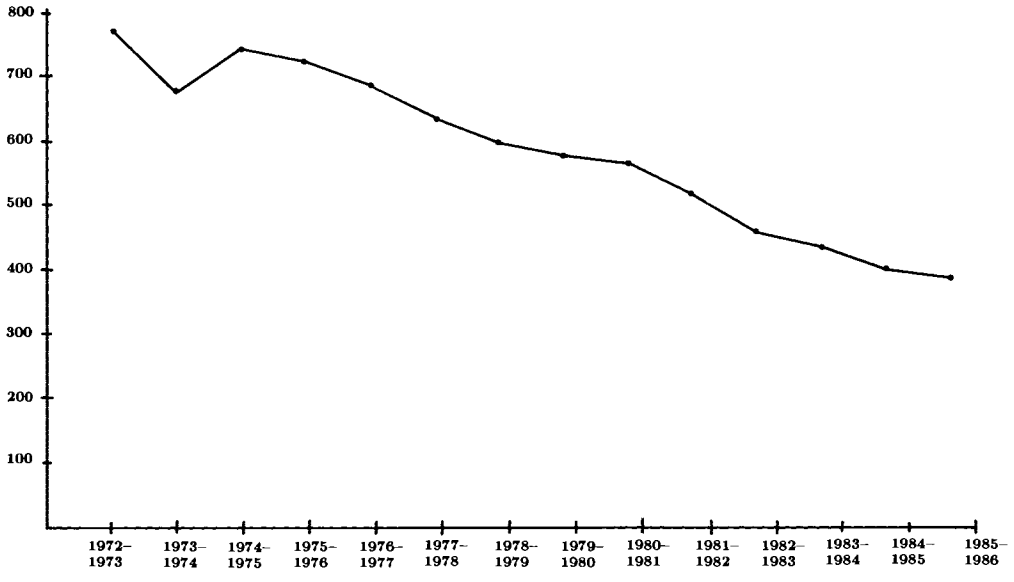
	Adjusted Total of Doctorates given by U.S. universities	Total of Doctorates who are U.S. citizens	%
1972-1973	986	774	78%
1973-1974	938	677	72%
1974-1975	999	741	74%
1975-1976	965	722	75%
1976-1977	901	689	76%
1977-1978	868	634	73%
1978-1979	806	596	74%
1979-1980	791	578	73%
1980-1981	839	567	68%
1981-1982	798	519	65%
1982-1983	744	455	61%
1983-1984	738	433	59%
1984-1985	726	396	55%
1985-1986	755	386	51%

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

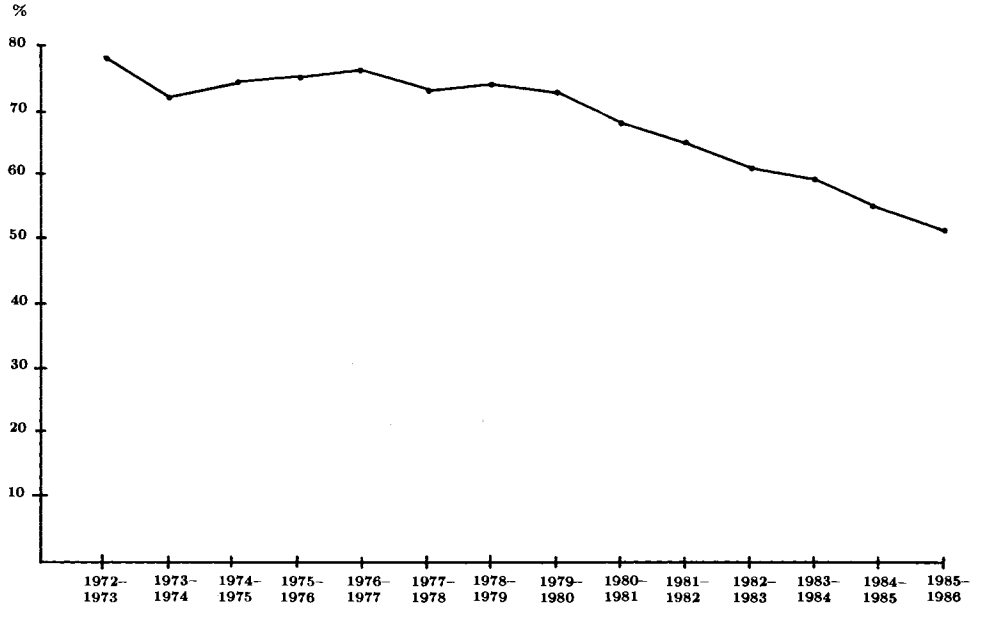
	Doctorates who are U.S. Citizens	Male	Female	% Female
1972-1973	774	696	78	10%
1973-1974	677	618	59	9%
1974-1975	741	658	83	11%
1975-1976	722	636	86	12%
1976-1977	689	602	87	13%
1977-1978	634	545	89	14%
1978-1979	596	503	93	16%
1979-1980	578	491	87	15%
1980-1981	567	465	102	18%
1981-1982	519	431	88	17%
1982-1983	455	366	89	20%
1983-1984	433	346	87	20%
1984-1985	396	315	81	20%
1985-1986	386	304	82	21%

We reiterate our concern at the persistent plummeting in both the absolute number and the relative percentage of U.S. citizens among the new Ph.D.'s in the mathematical sciences. There are several important and timely questions and issues that need to be raised and addressed on this and similar trends in the mathematical and scientific disciplines. For example, how will a moderate to severe shortage of well-trained Ph.D.'s in the mathematical sciences impact on American business, industry, and government? Will American institutions—educational and otherwise—enter the 21st century with a disproportionate part of their population of mathematical scientists at, near, or past retirement age and find an inadequate number of qualified replacements?

Recently, the Conference Board of the Mathematical Sciences (CBMS), a consortium of mathematics organizations including the AMS, appointed a "Committee on American Graduate Mathematics Enrollments," chaired by Professor Barry Simon of the California Institute of Technology, to address these concerns. (See *Notices*, August 1986, page 626, for the complete charge to the committee.) The Committee has solicited comments from the members of the mathematical community. They may be addressed to: Professor Barry Simon, CBMS Committee on American Graduate Mathematics Enrollment, Mathematics Department, 253-37, California Institute of Technology, Pasadena, CA 91125. To be most useful to the Committee, your comments should arrive before December 1, 1986.



Graph for Table 5: U.S. Citizen Doctorates
Total of Doctorates who are U.S. Citizens



Graph for Table 5: U.S. Citizen Doctorates
Total of Doctorates by Percent

Doctoral Degrees Conferred 1985 – 1986

THE ANNUAL AMS list of doctoral degrees in the mathematical sciences and related subjects reports 801 degrees conferred between July 1, 1985, and June 30, 1986 by 212 departments in 142 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

Lumley, Judy Kitt, *On the construction of resolvable Mendelson triple systems having prescribed intersections.*

Mera-Valverde, Reuben Nelson, *Entire functions of order larger than one.*

University of Alabama, Tuscaloosa
(3;0,2,0,0,0,0,1)

MANAGEMENT SCIENCES AND STATISTICS

Chang, Hang-Ling, *Comparisons of hypothesis testing procedures for the two-group growth curve problem in incomplete-data small-sample situations.*

Fahmy, Ahmed Fikry Abdel Wahab, *An expert system for the design of flexible manufacturing systems using simulation analysis.*

Hardin, James Michael, *Contributions to the calculus for factorial arrangements.*

ARKANSAS

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

MATHEMATICAL SCIENCES

Piston, Calvin E., *An order relation for positive operators on Banach lattices.*

CALIFORNIA

California Institute of Technology
(4;2,0,0,0,0,0,2)

MATHEMATICS

Baldi, Pierre, I. *On a generalized family of colorings.* II. *Some contributions to the theory of neural networks.* III. *Embeddings of ultrametric spaces.*

Ho, Chi-Fai, *On polynomial invariants for knots and links.*

Ramsamujh, Taje Indralall, *Some topics in descriptive set theory and analysis.*

Rushanan, Joseph John, *Topics in integral matrices and abelian group codes.*

Claremont Graduate School
(1;0,0,0,0,1,0,0)

MATHEMATICS

El Doma, Mohamed Osman, *Analysis of nonlinear integro-differential equations arising in age-dependent epidemic models.*

Stanford University
(30;7,5,0,11,5,0,2)

ENGINEERING-ECONOMIC SYSTEMS

Claudio, Corazon, *Design and evaluation of warning systems: Application to nuclear power plants.*

Ezawa, Kazuo J., *Efficient evaluation of influence diagrams.*

Hamm, Gregory, *Simple models of the interactions among energy, the economy, and carbon dioxide.*

Kenley, C. Robert, *Influence diagram models with continuous variables.*

Kline, David, *Storage decisions in incomplete markets.*

Parnell, Gregory Samuel, *Large bilateral reductions in superpower nuclear weapons.*

Perez, Miguel Angel, *Interfirm coordination with application to the electrical industry.*

Phillips, Robert Lewis, *Solving generalized equilibrium models.*

Schwartz, Richard Glen, *The adoption and diffusion of medical innovation.*

Tatman, Joseph A., *Decision processes in influence diagrams: Formulation and analysis.*

Viswanathan, Nagarathnam, *Service reliability differentiated pricing with special reference to electric utilities.*

MATHEMATICS

Arno, Steven, *Class #4.*

Boyse, William, *Wave propagation and inversion in a slightly inhomogeneous medium.*

Chi, Quo-Shin, *Curvature properties of rank one symmetric spaces.*

Frankel, Sidney, *Convex domains with compact quotients are symmetric spaces in complex dimension two.*

Koonce, Alexander Eben, *Relations among characteristic classes for complex cobordism.*

Liang, Fei-tsen, *On nonparametric surfaces of constant mean curvature.*

Palmer, Bennett, *Surfaces of constant mean curvature in space forms.*

Wolf, Michael, *The Teichmüller theory of harmonic maps.*

OPERATIONS RESEARCH

Beltramo, Mark Anthony, *Interfuel substitution and natural gas trade in North America.*

Haas, Peter Jay, *Recurrence and regeneration in non-Markovian simulations.*

Hoyle, Stephen Carey, *A single-phase method for quadratic programming.*

Krueger, Frederick Robert, *d-Arrangements and random polyhedra.*

Peterson, William Paul, *Diffusion approximations for networks of queues with multiple customer types.*

Titus, Birney Donnell, *Modified confidence intervals for the mean of an autoregressive process.*

Wan, Yieh-Hwang, *An implicit enumeration algorithm with binary-valued constraints.*

STATISTICS

DeVeaux, Richard Donald, *Parameter estimation for a mixture of linear regression.*

Hu, Inchi, *Repeated significance tests for exponential families.*

Matthews, Peter Claver, *Covering problems for random walks on spheres and finite groups.*

Segal, Mark Robert, *Regression trees based on rank statistics.*

University of California, Berkeley
(24;3,10,0,7,0,0,4)

BIOSTATISTICS

Kenley, Susan Scearce, *An examination of the relationship between prevalence, incidence and duration of illnesses in various stochastic models.*

Quesenberry, Charles Price, Jr., *Regression analysis under stratified sampling.*

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Chang, Kiduck, *Combination of opinions: The expert problem and the group consensus problem.*

Feo, Thomas Aurelio, I. *A Lagrangian relaxation method for testing the infeasibility of certain VLSI routing problems.* II. *Efficient reduction of planar networks for solving certain combinatorial problems.*

Greenberg, Betsy Sue, *Queueing systems with returning customers and the order of tandem queues.*

Gupta, Anil Kumar, *Analysis of electricity consumption in U. S. manufacturing: An engineering approach.*

Jun, Duk Bin, *ARMA forecasts with random level changes.*

Milidiu, Ruy Luiz, *The computation of compound distributions with two-sided severities.*

Mizrach, Michael, *Dynamic models of detailed and aggregate production networks.*

Righter, Rhonda Lee, *Analysis of sequential stochastic assignment problems.*

Sigman, Karl, *Applications of Harris ergodic Markov chains to the regenerative nature of queueing systems.*

STATISTICS

Alemayehu, Demissie, *Bootstrapping multivariate models and robust statistics.*

Belisle, Claude J. P., *Limit distributions of windings of planar random walks.*

Flannery, Barry Richard, *Quasi-stationary distributions of Markov chains.*

Haycock, Keith, *Bootstrapping prediction error estimates in dynamic linear models.*

Ihaka, George Ross, *Ruaumoko.*

Iyer, Srinivan Narayan, *Domination theory, network reliability and the factoring algorithm.*

Kim, Seong-Ju, *Statistical properties of distances for robust estimation of location and the multivariate Behrens-Fisher problem.*

Koyak, Robert Anthony, *Optimal transformations for multivariate linear reduction analysis.*

Navidi, William Cyrus, *Edgeworth expansions for bootstrapping regression models.*

Rizzardi, Frances Irene, *Some asymptotic properties of Robbins-Monro type estimators with applications to estimating medians from quantal response.*

Romano, Joseph Paul, *On bootstrapping the joint distribution of the location and size of the mode.*

Truong, Young Kinh-Nhue, *Asymptotic properties of nonparametric prediction.*

Wang, Mie-Cheng, *Regression analysis with selection biased dependent variable.*

University of California, Davis
(4;4,0,0,0,0,0,0)

MATHEMATICS

Filliman, Michael Paul, *Isoperimetric problems for zonotopes.*

Rooney, Elaine Kasimatis, *Applications of algebra to packings, coverings and tilings.*

Shannon, Gary Preston, *A truth predicate for Peano arithmetic.*

Spake, Reuben Michael, *On the power semigroup of the infinite cyclic group.*

University of California, Irvine
(2;0,1,0,0,1,0,0)

MATHEMATICS

Hromadka, Theodore V., II, *The complex variable boundary element method for engineers and scientists.*

Panganiban, Rosana Limjoco, *Limit distributions of test statistics in the analysis of categorical data.*

University of California, Los Angeles
(17;6,9,0,0,2,0,0)

BIOSTATISTICS

Bock, James R., *Estimation of the parameters in the logistic regression model for retrospective studies.*

Hardwick, Janis, *The modified bandit: An approach to ethical allocation in clinical trials for choosing the better of two binomial populations.*

Lee, Martha Bi-Fong, *Conditional independence under order restrictions.*

Liu, Yin Sang, *Optimum design in exponential survival model with right censoring.*

Welch, Michael Emmons, *Classification methods for linear dynamic models.*

MATHEMATICS

Eggan, Peter Cornelius, *Ramanujan congruences for power products of Dedekind eta-functions.*

Horng, Sheau-Ru Crystal, *Sublinear convergence in EM algorithm.*

Marechal, Nicholas James, *Inverse problems for lossy hyperbolic equations.*

Matsubara, Yo, *Filters related to supercompact cardinals.*

McCardle, Kevin Francis, *Information acquisition and the adoption of new technology.*

Moore, Charles Nelson, *Some applications of Cauchy integrals on curves.*

Sako, Brian Hiroyuki, *A model for the crack-and-punch problem in elasticity.*

Sweezy, Caroline Perkins, *L-harmonic functions and the exponential square class.*

Tan, Lin, *Invariant theory for unipotent subgroups of reductive groups.*

Tang, Dei-In, *Minimax and Bayes designs for model robust regression parameter estimation and prediction.*

Thomas, Pascal Joseph, *Properties of interpolating sequences in the unit ball.*

Yu, Qiqing, *Admissibility of the best invariant estimator of a distribution function.*

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

MATHEMATICS

Griffing, Gary R., *Cofree Lie and other nonassociative coalgebras.*

STATISTICS

Jackson, Dennis Harold, *A simplified multivariate approach to the analyses of generalized repeated measures models.*

University of California, San Diego
(8;4,2,0,0,2,0,0)

MATHEMATICS

Abello-Monedero, James, *A study of an independent system arising in group choice via the weak Bruhat order.*

Dean, Carolyn Anne, *Annihilators and embeddability of Noetherian rings.*

Gordon, Daniel Martin, *Perfect multiple error-correcting arithmetic codes.*

Grenier, Douglas, *Fundamental domains for $P_n/GL_n(\mathbf{Z})$ and applications in number theory.*

Hart, Susan O'Malley, *Depth-first classification of obstructions to planarity.*

Hobbs, Stephen Lee, *Statistical properties of a nonparametric regression function on S^2.*

Messer, Karen Sue, *Boundary effects of smoothing splines.*

Stopple, Jeffrey, *A functional equation for some Selberg zeta functions.*

University of California, Santa Barbara
(4;1,0,2,0,1,0,0)

MATHEMATICS

Du, Ding-Zhu, *Generalized complexity cores and levelability of intractable sets.*

HassanAli, Mohamad, *On the structure and commutativity of certain classes of rings.*

Pan, Luquan, *Applications of rewriting techniques.*

Sadigh-Esfandiari, Ramin, *Theory and application of a maximum principle to a class of distributed parameter control problem.*

University of California, Santa Cruz
(3;0,0,0,0,1,0,2)

MATHEMATICS

Cabaniss, Sharon Lee, *Bi-embeddings of the complete graph.*

Cotter, Christopher Scott, *The 1:1 resonance and the Hnon-Heiles family of hamiltonians.*

Schaffer, Karl, *The splitting number of other topological parameters of graphs.*

COLORADO

Colorado State University
(3;0,3,0,0,0,0,0)

STATISTICS

Ballerini, Rocco, *Records in the presence of a linear trend.*

Calvin, James A., *Confidence intervals for fixed factors in mixed models.*

Lu, Tai-Fang R., *Confidence intervals on sums, differences and ratios of variance components.*

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

MATHEMATICS

Heiss, Herbert, *Large deviation principles of Markov processes in noncompact cases.*

Kessel, Catherine, *Compactness and expressive power of some generalized quantifiers.*

Lewin, Renato, *Interpretations into varieties of algebraic logic.*

Quillen, John, *An application of the Melnikov method of the planar three-body problem.*

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

MATHEMATICS AND COMPUTER SCIENCE

Myers, J. Paul, Jr., *Software testing: A new methodology and a theory of complexity.*

University of Northern Colorado
(3;0,1,0,0,0,0,2)

MATHEMATICS AND APPLIED STATISTICS

Belstock, Alan, *The effects of specific heteroscedastic trends on the testing of hypotheses in regression analysis.*

Raney, Michael Eugene, *Common factors affecting stock price volatility.*

Zandi, Aziz, *Relationship of creativity with selected personal and academic variables in college students.*

CONNECTICUT

University of Connecticut
(2;1,1,0,0,0,0,0)

MATHEMATICS

Hefferon, James Stephen, *The structure of upper bounds for the arithmetical degrees.*

STATISTICS

Leighty, Robert McConnell, *Interaction terms for categorical variables.*

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

MATHEMATICS

Baloglou, George, *Compact covering numbers.*

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

MATHEMATICS

Lee, In-Sok, *Liftings of irreducible characters of* ${}^3D_4(q)$.

Shamash, Josephine, *Blocks and Brauer trees for groups of type* $C_2(q)$.

STATISTICS

Fox, John V., *Probability models on the sphere for genetic fate mapping.*

Jones, Albyn C., *A stochastic analysis of the propagation of error in floating point calculations.*

Kogure, Atsuyuki, *Optimal cells for a histogram.*

Nolan, Deborah A., *U-Processes.*

DELAWARE

University of Delaware
(5;2,2,0,0,1,0,0)

MATHEMATICAL SCIENCES

Joglekar, Gitanjali, *A method of grouping observations for a near neighborhood lack of fit test in regression.*

Landau-Treisner, Laurellen, *Weakly close-to-convex meromorphic functions.*

Ochs, Robert Lamar, Jr., *The limited aperture problem of inverse acoustic scattering.*

Porter, John Frederick, *On the coupling of boundary integral and finite element methods for treating a class of singular perturbation problems.*

Shen, Yujin, *Pair comparison in eigenvalue approach.*

DISTRICT OF COLUMBIA

Catholic University of America
(1;0,0,0,0,1,0,0)

MATHEMATICS

Ahangar, Reza, *Existence of optimal controls for generalized dynamical systems.*

George Washington University
(12;1,4,0,7,0,0,0)

MATHEMATICS

Maleki, Amir Afrasiab, *Semigroups of quasicompact operators: Convergence and mean ergodic properties.*

OPERATIONS RESEARCH

Batcher, Robert Thomas, *Application of semi-Markov processes to the derivation of Lanchester coefficients.*

El-Dessouky, Samir Abdalla, *Stepwise regression using least absolute value criterion.*

Kioussis, Leonidas Christos, *Transient and steady-state analysis of Markovian multi-echelon repairable item inventory systems.*

McGrath, Michael Francis, *A subjective Bayesian approach to queuing theory.*

Nasser, Ahmed Awad, *Algorithmic problems in factorable programming with application to solution of model in systems dynamics.*

Soyer, Refik, *Random coefficient autoregressive processes and their ramifications: Applications to reliability growth assessment.*

Talbott, Carlos Maurice, Jr., *Graphical techniques for maintenance planning.*

STATISTICS / COMPUTER AND INFORMATION SYSTEMS

Blodgett, Robert Jay, *Combination tests on dependent data arising from equal employment litigation.*

Fan, Milton Chung-lien, *Estimation of parameters for the logistic regression model with partially incomplete observations.*

Nolan, Thomas W., *Simultaneous tests for time series data from designed experiments.*

Wright, Elizabeth C., *Conditional tests for third-order interaction in* $2 \times 2 \times R \times C$ *tables.*

FLORIDA

Florida State University
(7;2,4,0,0,1,0,0)

MATHEMATICS AND COMPUTER SCIENCE

Byrd, James Stanley, *Operators satisfying p-estimates.*

Jackson, Jay Alan, *On the shock cell structure and noise of imperfectly expanded supersonic jets.*

Zoeller, Martha Bettina, *Freeness of Hopf algebras over grouplike subalgebras.*

STATISTICS

Freitag, Steven A., *Estimating jointly system and component reliabilities using a mutual censorship approach.*

Mimmack, Gillian Mary, *Piecewise geometric estimation of a survival function and some results in total positivity orderings.*

Sconing, James Arthur, *Information in censored models.*

Young, Barbara Nelson, *The comparison of sensitivities of experiments.*

University of Florida
(3;1,2,0,0,0,0,0)

MATHEMATICS

Sousa, Michael, *Set-valued integrals.*

STATISTICS

Nickerson, David McLeod, *Sequential shrinkage estimation.*

Samara, Basil, *Tests for correlation and partial correlation based on Kendall's tau.*

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

MATHEMATICS AND COMPUTER SCIENCE

Alvarez, Carlos, *Application of topological degree to the periodic competing species problem.*

Hosseini, Naser, *The geometric realization functor and preservation of finite limits.*

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

MATHEMATICS

Mabry, Richard, *Control of space with preassigned responses.*

GEORGIA

Georgia Institute of Technology
(3;1,0,0,2,0,0,0)

MANAGEMENT

Bouakiz, Mokrane, *Risk sensitivity in stochastic optimization with applications.*

Chung, Kun-Jen, *Some topics in risk-sensitive stochastic dynamic models.*

MATHEMATICS

Hardin, Douglas Patten, *Hyperbolic iterated function systems and applications.*

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

STATISTICS

Srinivasan, Rajagopalan, *Some inference procedures for time series models.*

Vanichbuncha, Kanlaya, *Multiple comparisons with the best population.*

HAWAII

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

MATHEMATICS

Kohs, Werner Paul Georg, *Derivatives of meromorphic functions and solutions to second order differential equations with rational coefficients.*

IDAHO

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

MATHEMATICS

Gillman, Richard Allan, *Homomorphisms of graphs.*

ILLINOIS

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

MATHEMATICS

Reichmann, Péter Iván, *Consistency condition for reduced integration on the Stokes operator.*

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

MATHEMATICS

Burnham, James Norman, *The effects of extra study materials and notetaking instruction on intermediate algebra at the college level.*

Northwestern University
(8;2,1,0,0,2,0,3)

ENGINEERING SCIENCE AND APPLIED MATHEMATICS

Knessl, Charles, *Asymptotic analysis of state-dependent queueing systems.*

Lasseigne, David Glenn, *Ignition of a combustible solid with reactant consumption.*

MANAGERIAL ECONOMICS AND DECISION SCIENCES

Gresik, Thomas, *The effects of general valuation structures and dependent signal distributions on the efficiency of optimal trading mechanisms.*

Salchenberger, Linda, *Differential games in renewable resource problems.*

Sung, Keuk-Je, *Product differentiation and entry deterrence.*

MATHEMATICS

Cejtin, Henry, *Some cohomology of* $\mathrm{GL}_n(F_q)$ *with coefficients and a category for generic cohomology.*

Jost, Steve, *Nonparametric additive regression.*

Stojanovic, Srdjan, *Free boundary problems.*

Southern Illinois University, Carbondale
(3;2,0,0,0,1,0,0)

MATHEMATICS

Islam, Muhammed, *Periodic solutions of Volterra integral equations.*

Krishnamani, Vatsala, *Finitely generated Witt rings of local type and n-linked Witt rings.*

Nyagura, Levi M., *Analogues of the Levy-Khinchin representation of a hypergroup.*

University of Chicago
(4;3,1,0,0,0,0,0,0)

MATHEMATICS

Chen, Lung-Kee, *On singular integrals.*

Hickey, Timothy John, *On the Fourier-Jacobi coefficients of certain Eisenstein series on a unitary group.*

Lemp, Steffen, *Topics in recursively enumerable sets and degrees.*

STATISTICS

Heitjan, Daniel F., *A model for age reporting.*

University of Illinois, Chicago
(3;3,0,0,0,0,0,0)

MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Lin, Lieh-San, *Performance modeling of database systems.*

Samhan, Marouf, *First order definability in universal algebras.*

Vaughn, John, *Forking and modularity in stable theories.*

University of Illinois, Urbana-Champaign
(7;7,0,0,0,0,0,0)

MATHEMATICS

Goswami, Alok Kumar, *The prediction process of step-processes and applications.*

Hvidsten, Michael David, *Volume and energy stability for immersions.*

Kandilakis, Dimitrios, *On the theory of set-valued functions with application in approximation, optimization and control theory.*

Perez-Sequi, Maria Luisa, *Simplicial complexes and a partial classification of almost completely decomposable torsion free abelian groups.*

Siskakis, Aristomenis George, *Semigroups of composition operators and the Césaro operator on* $H^P(ID)$.

Yamaguchi, Jinsei, *Aspects of large cardinals.*

Zhang, Wen-Bin, *Asymptotic distribution of Beurling's generalized prime numbers and integers.*

INDIANA

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

MATHEMATICS

Decker, Robert James, *Propagation of singularities for two-parameter stochastic processes with stationary independent increments.*

Paulik, George Francis, *Boundary regularity of solutions of certain elliptic systems.*

Titi, Edriss Saleh, *A uniform spectral estimate for the linearized Navier-Stokes operators and their Galerkin approximations.*

Wang, Chien-Tu, *On the Hausdorff dimension of two special sets for the Brownian sheet.*

Purdue University
(22;7,4,0,2,4,0,5)

INDUSTRIAL ENGINEERING

Ben-Arieh, David, *Knowledge-based control system for automated production and assembly.*

Chen, Peter, *A model formalism for the design of simulation model representation.*

Chen, Ye-Sho, *Statistical models of text generation: A system theory approach.*

Donmez, Alkan M., *A general methodology for machine tool accuracy enhancement: Theory, application and implementation.*

Lin, Chin-Wen, *An energy-effective production scheduling strategy for hierarchical control of steel manufacture.*

Lin, Yhu-Tin, *Geometric adaptive control for accuracy and stability in machining a cylindrical workpiece.*

Ong, Kim Lai-King, *Approximating nonstationary multivariate queuing models.*

Riesser, William Fitzhugh, *Electrotribology in metal cutting.*

Tirupatikumara, Soundar R., *Artificial intelligence techniques in facilities layout planning: Development of an expert system.*

MATHEMATICS

Ajanapon, Pimon, *A derivation of the classical limit of quantum mechanics and quantum electrodynamics.*

Himonas, Alexandros T., *On analytic microhypoellipticity of linear partial differential operators of principal type.*

Kulkarni, Devadatta M., *Semigroup of ordinary multiple point, analysis of straightening formula and counting monomials.*

Lin, Huaxin, *The structure of quasi-multipliers of* C^**-algebras.*

Parker, Ellen Maycock, *The Brauer group of graded continuous trace* C^**-algebras.*

Pheidas, Athanasios C., *The Diophantine problem for addition and divisibility in polynomial rings.*

Sun, Hsiao-lan, *Approximation theory in local rings.*

Yong, Jiongmin, *On differential games of evasion and pursuit.*

STATISTICS

Crank, Keith N., *Methods of approximating Markov jump processes.*

Moser, Barry Kurt, *Missing data in linear models with constant interclass correlation and random block designs with binary data.*

Ramalingam, T., *Statistical properties of file-merging methodology.*

Sohn, Joong K., *Multiple decision procedures for Tukey's generalized lambda distributions.*

Sundar, P., *Ergodic solutions of stochastic differential equations and related topics.*

University of Notre Dame
(3;3,0,0,0,0,0,0,0)

MATHEMATICS

Betley, Stanislaw, *Homological stability for* $O_{n,n}$ *over a local ring.*

Kennedy, George Thomas, III, *Foundations of super-simple surgery theory.*

Zukowski, Tomasz, *Connections between hermitian K-theory and symmetric L-theory.*

IOWA

Iowa State University
(13;0,11,0,0,2,0,0)

MATHEMATICS

Smith, Richard Allan, *Theoretical and numerical studies of some ill-posed problems in partial differential equations.*

Vijitha-Kumara, Kanaka Hewage, *Variable stepsize variable order multistep methods for still ordinary differential equations.*

STATISTICS

Anderson, Kevin Karl, *Limit theorems for renewal processes in the infinite mean case.*

Callanan, Terrance Patrick, *Restricted maximum likelihood estimation of variance components: Computational aspects.*

Crowder, Lee Ann, *Goal programming: Computational solutions for large-scaled models.*

Crowder, Stephen Vernon, *Kalman filtering and statistical process control.*

Gan, Fah Fatt, *Goodness-of-fit statistics for location-scale distributions.*

Jeske, Daniel Robert, *Prediction intervals for the realization of a random variable under a general mixed linear model.*

Kim, Byung Hwee, *The admissibility of some generalized and stepwise Bayes estimators.*

McNulty, Mark Steven, *Information usage in the formation of price expectations: Theory and econometric tests.*

Rogers, Michael Philip, *Selection using a dichotomized auxiliary variate.*

Saad-Eldin, Mohamed Saad-Eldin, *The split-plot design with covariance.*

Tveite, Michael David, *Statistical aspects of L_1 regression.*

University of Iowa
(5;2,2,0,0,1,0,0)

APPLIED MATHEMATICAL SCIENCES

Kolpin, Van Warren, *Extensions and applications of effectivity function theory.*

MATHEMATICS

Neves, Vitor, *Topologies on spaces of smooth functions.*

Wolcott, Keith, *The knotting of theta-curves and other graphs in S^3.*

STATISTICS AND ACTUARIAL SCIENCE

Amini, Saeid Baradaran, *A comparative study of selected covariance-adjusted survivorship data tests for treatment effects.*

Wollan, Peter Carl, *Estimation and hypothesis testing under inequality constraints.*

KANSAS

Kansas State University
(8;4,3,0,0,1,0,0)

MATHEMATICS

Castellini, Gabriele, *Closure operators, epimorphisms and Hausdorff objects.*

Grubb, Daniel Joseph, *Sets of uniqueness on compact zero-dimensional metric spaces.*

Kilmer, Shelby James, *Mutual absolute continuity and singularity of Riesz product measures.*

Koslowski, Jürgen, *Dedekind cuts and Frink ideals for categories.*

Miller, Timothy Lynn, *Low frequency behavior of solutions to Helmholtz equation in the exterior in $\mathbf{R}^2$.*

STATISTICS

Bugaighis, Mohamed, *Small sample properties of estimates of Weibull regression parameters.*

Fermin, Jose Simon, *Noninteractive mathematical models for quantal responses to mixtures of compounds.*

Juico, Yolanda Tongol, *Use of nonconjugate prior distributions in compound failure models.*

KENTUCKY

University of Kentucky
(4;1,3,0,0,0,0,0)

MATHEMATICS

Waggoner, Daniel Floyd, *Loop spaces and the classical unitary groups.*

STATISTICS

Clemmens, Ann Elizabeth, *Some nonparametric contributions to linear models: Random effects models.*

Shelty, Ishwar Devaru, *Contributions to the theory of nonparametric ANOVA.*

Wang, Chyan-Ji, *Numerically stable computational methods for dealing with ill-conditioned stepwise-type linear regression problems.*

LOUISIANA

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

MATHEMATICS

Lynch, Mark James, *Spaces of order arcs in hyperspaces of subcontinua.*

Tulane University
(3;1,0,0,0,2,0,0)

MATHEMATICS

Melvin, Robin Guy, *Random choice methods for turbulent combustion model.*

Renegar, Cynthia Diane, *Inertial h-cobordisms.*

Rieder, Gisele Ruiz, *Mathematical contributions to Thomas-Fermi theory.*

MARYLAND

Johns Hopkins University
(6;3,1,0,2,0,0,0)

MATHEMATICAL SCIENCES

Choudhury, Dipa S., *The role of complex orthogonal matrices in matrix factorization.*

Lee, Huey-Miin, *Gain/variability tradeoffs in Markov decision processes.*

Robinson, Alan M., *The isolation game and its generalization.*

Zucker, David M., *Survival data regression analysis with time-dependent covariate effects.*

MATHEMATICS

Ortacgil, Ercument, *On growth of entire holomorphic mappings.*

Robinson, Margaret Maher, *On the complex powers associated with the twisted cases of the determinant and the Pfaffian.*

University of Maryland, College Park
(14;1,2,0,1,10,0,0)

MATHEMATICS

Chan, Ngai Hang, *Asymptotic inference of nonstationary autoregressive processes.*

D'Annunzio, Camille Marie, *Numerical analyses of a singular perturbation problem with multiple solutions.*

Fisher, David, *Matrix computations on parallel processors in one, two and three dimensions.*

Jensen, Soren, *Dimensional reduction for nonlinear B. V. P.'s.*

Kostelich, Eric J., *Lorenz cross sections and basin and boundary structure of the double rotor map.*

Larsen, Soren, *Numerical analysis of elliptic partial differential equations with stochastic input data.*

Negrón-Marrero, Pablo Victor, *Large buckling of circular plates with singularities due to anisotrophy.*

Shih, Ke-Gang, *Global bifurcation problems of axisymmetric buckling of complete spherical shells.*

Shih, Shagi-Di, *Asymptotic analysis of a singular perturbation problem.*

Tedeschini-Lalli, Laura, *How often do simple dynamical systems have infinitely many coexisting sinks?*

Tsao, Thomas, *Design and analysis of parallel adaptive algorithm for composite decision processes.*

Vohra, Rakesh, *Packing, covering and cyclic staffing.*

Weiss, Howard N., *The geometry of measured geodesic laminations and the earthquake flow on Teichmüller space.*

Winnicki, Jan, *A unified estimation theory for the branching process with immigration.*

MASSACHUSETTS

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

MATHEMATICS

Delmarco, Stephen, *The mathematical foundation of the scalar-vector potential approach to analyzing viscous incompressible flow.*

Tangerman, Folkert Meindert, *Meromorphic continuation of Ruelle zeta functions.*

Brandeis University
(4;4,0,0,0,0,0,0)

MATHEMATICS

Mata-Lorenzo, Luis, *The Stein factorization for stable maps and π-stable arcs of maps from 3-manifolds into the plane.*

Sanchez, Rafael, *Structure theorem for grade 3 and type 3 perfect ideals.*

Srinivasan, Hema, *Multiplicative structures on some canonical resolutions.*

Stein, David, *Milnor's $\bar{\mu}$ invariants, Massey products, and a geometric formulation.*

Harvard University
(20;6,1,3,0,4,0,6)

APPLIED SCIENCES

Bloch, Anthony, *Completely integrable Hamiltonian systems and total least squares estimation.*

Freytag, Johann-Christoph, *Translating relational querics into iterative programs.*

Klausner, Aviel, *Multirelations in relational databases.*

Mack, Iris, *Block implicit one-step methods for solving smooth and discontinuous systems of differential/algebraic equations.*

Macrakis, Stavros M., *A programming language to support transformational refinement.*

Ponte Castaneda, Pedro, *Asymptotic stress and deformation fields in steady crack growth with linear strain-hardening.*

Strogatz, Steven Henry, *The mathematical structure of the human sleep-wake cycle.*

BIOSTATISTICS

DeGruttola, Victor Gerard, *Multivariate models for longitudinal data: Diagnostics and resistant methods.*

Hirji, Karim Fatehali, *Exact logistic regression.*

Kalish, Leslie A., *Efficient design of clinical trials and observational epidemiologic studies.*

Lange, Nicholas Theodore, *Influence analysis for proportional hazards and longitudinal random-effects models.*

Lefkopoulou, Myrto, *The Cox regression model with discrete failure time data: A counting processes approach.*

MATHEMATICS

Call, Gregory, *Local heights on families of abelian varieties.*

Gomez-Mont Avalos, Carlos, *On local Torelli for extremal varieties.*

Puckette, Miller Smith, *Shannon entropy and the central limit theorem.*

Sanchez-Valenzuela, Oscar, *On supergeometric structures.*

Teitelbaum, Jeremy, *p-adic periods as moduli for Schottky curves of genus 2.*

Wu, Xian, *On the nondegeneracy of an infinitesimal invariant associated to normal functions.*

Yukie, Akihiro, *Applications of equivariant Morse stratifications.*

STATISTICS

Godfrey, Katherine, *Analysis of distributional shape using g- and h-distributions.*

Massachusetts Institute of Technology
(19;11,2,3,0,0,0,3)

MATHEMATICS

Amiran, Edoh Y., *Caustics and evolutes for convex planar domains.*

Baez, John C., *Conformally invariant quantum fields.*

Barrington, David A., *Bounded width branching programs.*

Bien, Frédéric V., *Spherical $\mathcal{D}$-modules and representations of real reductive Lie groups.*

Butler, Lynne M., *Combinatorial properties of partially ordered sets associated with partitions and finite abelian groups.*

Collins, Karen L., *Distance matrices of trees.*

Hastad, Johan T., *Computational limitations for small depth circuits.*

Holt, Robert Jeffrey, *Computation of gamma tail probabilities.*

Lane, Thomas Paul, *A model for serial dependence in logistic regression.*

Lawton, Gregory M., *On cells in affine Weyl groups.*

Manuel, Guy, *Determining the number of subpopulations.*

Mathai, Varghese, *Heat kernels, Thom classes and the index theorem for imbeddings.*

Mazzeo, Rafe R., *Hodge cohomology of negatively curved manifolds.*

Rhodes, John A., *Modular forms on p-adic planes.*

Salamanca Riba, Susana A., *On unitary representations with regular infinitesimal character.*

Sengupta, Jyotirmoy, *Projection of orbits and K-multiplicities of a series of irreducible unitary representations.*

Shor, Peter W., *Random planar matching and bin packing.*

Smith, Daphne L., *Vapnik-Červonenkis classes and the supremum distribution of a Gaussian process.*

Sundaram, Sheila, *On the combinatorics of representations of* $\mathrm{Sp}(2n, C)$.

Northeastern University
(3;0,0,0,0,0,0,3)

MATHEMATICS

Kelleher, Laura, *Domination in graphs and its application to social network theory.*

Ryan, Charles T., *New codes associated to Schubert cycles.*

Wu, Shu-Shi Yang, *Classes of n^*-edge-connected and k-critical graphs.*

University of Massachusetts, Amherst
(5;1,1,0,0,3,0,0)

MATHEMATICS AND STATISTICS

Baginski, Frank E., *An analysis of a system of nonlinear partial differential equations modeling the nonaxis symmetric buckling of an elastic spherical shell.*

Chen, Yi-Ying, *Symmetric and nonsymmetric vortices for the Ginzburg-Landau equations.*

Jungster, Jerry Jonah, *The vertical heat equation.*

Link, William August, *Contributions to reliability theory and survival analysis.*

Picoult, Darri Cee, *Stationary random measures in euclidean spaces.*

MICHIGAN

Michigan State University
(6;2,1,0,0,3,0,0)

MATHEMATICS

Blaine, Larry, *Volterra-Lotka systems with small perturbations.*

Chan, Whei Ching, *A study of subharmonic solutions of second order equations.*

Gadbois, Steven, *Mixed norm generalizations of weighted Bergman spaces in the unit ballof* $\mathbf{C}^N$.

Gee, Henry, *A model for the correction of the geometric distortion of multispectral scanner data.*

Vernon, Michael H., *Some isoperimetric hypersurfaces in a complex hyperbolic space and their counterparts in anti-Desitter space time.*

STATISTICS AND PROBABILITY

Karunamuni, Rohana Jith, *Empirical Bayes with sequential components.*

University of Michigan, Ann Arbor
(19;13,0,1,1,0,0,4)

INDUSTRIAL AND OPERATIONS ENGINEERING

Evans, Susan Mary Ruesch, *Ergonomics in manual workplace design: Current practices and an alternative approach.*

Lehto, Mark, *A structured methodology for expert system development with application to safety ergonomics.*

Vander Veen, David, *Parallel replacement under nonstationary deterministic demand.*

Wiker, Steven, *Effects of relative hand location upon movement, time and fatigue.*

Zabinsky, Zelda, *Computational complexity of adaptive algorithms in Monte Carlo optimization.*

MATHEMATICS

Bachman, Tovey, *Closed ideals in an algebra of analytic functions on an annulus.*

Gottron, Stephen, *Skorokhod stopping times of minimal initial expectation.*

Hsu, Felix Chang Wang, *Fibering 5-manifolds over a circle.*

Leary, Christopher C., *Extensions of ideals on large cardinals.*

Marsalli, Michael, *On dual algebras and their preduals.*

Martin, Gaven, *The geometry of quasiconformal mappings.*

Mayans, Robert, *Ideals of real numbers in descriptive set theory.*

Nolder, Craig Allen, *A Privalov and a Hardy-Littlewood theorem for harmonic functions and quasi-regular mappings.*

Solinas, Jerome A., *A theorem of metric diophantine approximation, and estimate for sums involving binary digits.*

Thompson, Mary Lawrence, *Topics in the ideal theory of commutative Noetherian rings.*

Topiwala, Pankaj, *A twistor approach to the Einstein metric on $K3$.*

Unal, Aysenur, *Derivative type support points of the class S.*

Williamson, Calvin, *A phase cell cluster expansion for Phi 3/4.*

Wyneken, Matthew Fair, *Norm behavior of orthogonal polynomials.*

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

MATHEMATICS

Ishiguro, Kenshi, *Classifying spaces of compact Lie groups.*

Western Michigan University
(1;0,0,0,0,0,0,0,1)

MATHEMATICS

Zou, Hung Bin, *On common subgraphs.*

MINNESOTA

University of Minnesota, Minneapolis
(17;4,7,0,0,3,0,3)

BIOMETRY

Haight, Stewart, *The identification and support of medical decision-making weakness.*

Ogrinc, Francis Gerard, *The general linear model with logistic errors.*

Smith, Judith A., *Sample size requirements for studies of the etiologic fraction.*

MATHEMATICS

Carpentier, Michel, *p-adic analysis and exponential sums.*

Carvalho, Irene, *Variational methods for plastic crystals.*

Dokken, Douglas Paul, *Harmonic functions of locally compact groups.*

Hansen-Hulse, Jennie, *Asymptotic properties of random discrete graphs as the graph size grows.*

Johnson, James, *Some properties of a three-parameter family of diffeomorphisms of the plane, near a transcritical Hopf bifurcation.*

Lin, Fang-Hua, *Regularity for a class of parametric obstacle problems.*

Roussos, Jean, *Mean-curvature-preserving isometrics of surfaces in ordinary space.*

STATISTICS

Chapman, Phillip L., *Evaluation of a pivotal quantity for use with the bootstrap.*

Conaway, Mark R., *The repeated measurement of categorical data.*

Eick, Stephen G., *Sequential experimentation with delayed responses.*

Hodges, James Steven, *Methods for assessing the accuracy of some standard approximations.*

Lee, Yong Goo, *Independence relationships for multivariate distributions.*

McCulloch, Robert Edward, *Model influence in Bayesian statistics.*

Pederson, Shane P., *Misclassification in logistic regression.*

MISSISSIPPI

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

MATHEMATICS

Cole, Donald R., *Some existence results for steady state wave propagation in inhomogeneous anisotropic dispersive media.*

MISSOURI

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

MATHEMATICS AND COMPUTER SCIENCE

Summers, Wayne, *Implementation guide and user's manual for a subset of PL/I on an Apple computer.*

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

STATISTICS

Khan, Bashir, *Classification of a set distributions.*

University of Missouri, Rolla
(1;0,1,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Penas, Linda Marie, *Comparing a set of k statistical populations with respect to a control.*

Washington University
(11;7,0,0,1,3,0,0)

MATHEMATICS

Baigorri, Angel Rodolfo, *A new approach to inverse local times.*

Feldman, Marcus, *The atomic decomposition of weighted Bergman spaces on the Heisenberg group.*

Girela, Daniel, *Growth properties for certain classes of analytic functions.*

Steger, Tim Joshua, *Anisotropic harmonic analysis for homogeneous trees.*

Tabacco Vignati, Anita Maria, *Interpolation of quasi-Banach spaces.*

Vignati, Marco, *Interpolation: Geometry and spectra.*

SYSTEMS SCIENCE AND MATHEMATICS

Cheng, Daizhan, *On linearization and decoupling problems of nonlinear systems.*

Liu, Jiangbo, *Computer aided restoration of the large electric power system.*

Tunali, Emrullah Turhan, *Identifiability of nonlinear systems.*

Yen, Jing-Jou, *Two problems related to automatic generation control.*

Zeng, Xiao-ming, *Sampled output feedback stabilization of infinite dimensional systems.*

NEBRASKA

University of Nebraska
(2;0,1,0,0,1,0,0)

MATHEMATICS AND STATISTICS

Beezley, Randall Scott, *Electromagnetic direct and inverse problems for absorbing media.*

From, Steven Glen, *Optimal linear combinations of consistent, asymptotically normal estimators.*

NEW HAMPSHIRE

Dartmouth College
(3;2,0,1,0,0,0,0)

MATHEMATICS AND COMPUTER SCIENCE

Levine, David Bruce, *The pairwise intersection problem for monotone polygons.*

Richey, Matthew Potter, *The Z_n-Baxter model.*

Rosenkrantz, Roger Daniel, *Random drifts.*

University of New Hampshire
(2;1,0,0,0,0,1,0)

MATHEMATICS

Geuther, Karen Jean, *The role of error analysis, diagnostic grading procedures, and student reflection in first-semester calculus learning.*

Roy, Charles L., *Operator ranges of shifts and C^*-algebras.*

NEW JERSEY

Princeton University
(16;14,2,0,0,0,0,0)

MATHEMATICS

Adem, Alejandro, *Finite transformation groups and their homology representations.*

Cao, Huai-Dong, *Deformation of Kähler-matrices to Kähler-Einstein metrics on compact Kähler manifolds.*

Chang, Sheldon, *Two-dimensional area minimizing integral currents are classical minimal surfaces.*

Chen, So-chin, *Microlocal analysis on free nilpotent Lie groups.*

Chow, Bennett, *Deforming convex hypersurfaces by the heat equation.*

Diaz, Katharine, *The Szegő kernel as a singular integral kernel on a weakly pseudoconvex domain.*

Hales, Thomas Callister, *The subregular germ of orbital integrals.*

Heller, Peter, *Analyticity and regularity for nonhomogeneous operators on the Heisenberg group.*

Hodgson, Craig, *Degeneration and regeneration of geometric structures.*

Lafferty, John D., *The density manifold and configuration space quantization.*

Machedon, Matei, *Estimates for the parametrix of the Kohn laplacian on $(0,1)$ forms for certain weakly pseudoconvex domains.*

Neff, Andrew, *Maximal function estimates for meromorphic Nevanlinna functions.*

Perry, Kevin, *Estimates for some integrals on the space of minimal surfaces in $\mathbf{R}^3$.*

Rivin, Igor, *On geometry of convex polyhedra in hyperbolic 3-space.*

STATISTICS

Easton, George Sawyer, *Finite-sample and asymptotic approaches to compromise estimation including compromise maximum-likelihood estimators.*

Hurvich, Clifford Marc, *A unified approach to spectrum estimations: Objective estimate choice and generalized spectral windows.*

Rutgers University, New Brunswick
(9;9,0,0,0,0,0,0,0)

MATHEMATICS

Borsari, Lucilia Daruiz, *Bordism of semi-free circle actions on spin manifolds.*

Cordaro, Paulo Domingos, *On the range of the Lewy complex.*

Figueiredo, Leila, *Calculus of principally twisted vertex operators.*

Mandia, Marly, *Structure of the level one standard modules for the affine Lie algebras $F_4^{(1)}$ and $G_2^{(1)}$.*

Moloney, James, *First order theory of residue domains of rings of continuous functions.*

Orr, Kent, *New link invariants and applications.*

Thompson, Abigail, *Property P for some classes of knots.*

Tsai, Yuh-Dong, *Cyclic group actions on homotopy complex projective spaces.*

Villarreal, Rafael H., *Koszul homology of Cohen-Macaulay ideals.*

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

MATHEMATICS

Doty, Lynne L., *A study of vertex equivalence classes in graphs.*

NEW MEXICO

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

MATHEMATICAL SCIENCES

Dare, Adrienne Marie, *On the feasibility of using satellite doppler data for predicting an atmospheric index of refraction profile.*

Rojo, Hector J., *Basis functions in curved finite elements.*

University of New Mexico
(4;2,0,0,0,2,0,0)

MATHEMATICS AND STATISTICS

Ben Lemlih, Abdelali, *An extension of the method of averaging to partial differential equations.*

Dubrulle, Augustin A., *On matrix bidiagonalization and its application to the compression of large digital images.*

Echavarria, Hectir, *Mean capture time calculations with applications to cell biology.*

Johnson, Karen Anne, *Largest induced subgraphs of the n-cube with excluded $2K$-cycles.*

NEW YORK

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

MATHEMATICS AND COMPUTER SCIENCE

Bohannon, Barbara J., *A system of conservation laws exhibiting a parabolic degeneracy on two intersecting lines.*

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

MATHEMATICS AND COMPUTER SCIENCE

El-Tohami, Mohammed, *Mathematical problems of designing state and input observers for singular linear control systems.*

Saridakis, Yiannis G., *Parallelism, applicability and optimality of modern iterative methods.*

Columbia University
(12;9,0,0,0,0,0,0,3)

STATISTICS

Gomez, Guadalupe, *Estimation of the time-to-tumor distribution in serial/sacrifice experiments.*

Jeng, Huajin, *Contributions to spectral analysis with applications to electromyographic data.*

Olshansky, Moshe, *Topics on stopping times.*

Zhou, Mai, *Some nonparametric two sample tests with randomly censored data.*

MATHEMATICS

Datskovsky, Joseph, *Minimal geodesics on the sphere with three holes and word traces.*

Kueh, Ka-Lam, *Explicit formulas in analytic number theory.*

McEwan, Lee J., *Degenerations of rational surfaces to Inoue-Hirzebruch surfaces.*

Mizner, Robert, *On the geometry of CR structures of co-dimension 2.*

Smith, Kevin, *Two-generator groups of three-dimensional hyperbolic isometries.*

Wada, Masaaki, *Conjugacy invariants and normal forms of isometries of hyperbolic space.*

Ye, Yangbo, *Kuznietsov trace formula and base change.*

Zimmer, Robert, *Categories as a basis for algebraic automaton theory.*

Cornell University
(17;1,3,0,8,5,0,0)

APPLIED MATHEMATICS

Eteng, Ernest, *Density-stratified stagnation-point flow.*

French, Donald A., *The finite element method for a degenerate elliptic equation.*

Hockett, Kevin George, *Bifurcations of rational and irrational cantor sets and periodic orbits in maps of the circle.*

MATHEMATICS

Bennett, Allan D., *Continuous dependence on modeling in the Cauchy problem for second-order nonlinear partial differential equations.*

Persens, Jan, *On stabilizing ill-posed problems for partial differential equations under perturbations of the geometry of the domain.*

OPERATIONS RESEARCH

Aboudi, Ronny, *A constrained matching problem: A polyhedral approach.*

Bhaskaran, Bhanu G., *Almost sure ordering of some continuous time stochastic processes with applications.*

Cho, Dall Hoon, *Arranging points in R^d: A question of balance.*

Dietrich, Brenda Lynn, *A unifying interpretation of several combinatorial dualities.*

Ip, Chi Ming, *The distorted stationary point problem.*

Lee, Jonathan, *Subspaces with well-scaled frames.*

Lynch, David, *The guided decomposition algorithm for linear programming.*

Tipnis, Shailesh K., *Integer rounding and combinatorial max-min theorems.*

STATISTICS

Cecce, Margaret Ann, *A conditional approach to two-stage selection procedures.*

Legall, George, *A conservative test for normality.*

Phelan, Michael J., *Nonparametric inference from poisson-type counting.*

Zanelli, Marta, *Empirical Bayes methods in mixed linear models.*

New York University, Courant Institute
(19;10,0,0,0,9,0,0)

MATHEMATICS

Börgers, Christoph, *A Lagrangian fractional step method for the incompressible Navier-Stokes equations.*

Chan, Raymond Honfu, *Iterative methods for overflow queuing models.*

Chierchia, Luigi, *Quasi-periodic Schrödinger operators in one dimension, absolutely continuous spectra, Bloch waves, and integrable Hamiltonian systems.*

DeLillo, Thomas Knox, *A comparison of some numerical conformal mapping methods.*

Duke, William, *Some problems in multidimensional analytic number theory.*

Fein, Michael Bertrand, *Continuity of the distribution function of the sum of an additive and a multiplicative arithmetic function—an Erdös conjecture.*

Koralyov, Mikhail, *Long-time existence of the solutions of nonlinear wave equations.*

Lee, Tzong-Yow, *Large deviation theory for empirical density of noninteracting infinite particle systems.*

LeMesurier, Brenton John, *The focusing singularity of the nonlinear Schrödinger equation.*

McKenney, Alan, *The drift-kinetic model in the long-thin approximation.*

Menezes, Maria Lucia, *Infinite genus curves with hyperelliptic ends.*

Michalek, Raymond, *Multiplicity results for differential equations with symmetry.*

Ross, David Stewart, *Computation of the transonic flow about a swept wing in the presence of an engine nacelle.*

Rubinstein, Jacob, *Homogenization in domains with many free boundaries.*

Tarantello, Gabriella, *Some results on the minimal period problem for nonlinear vibrating strings and Hamiltonian systems; and on the number of solutions for semilinear elliptic equations.*

Van de Velde, Eric, *Algorithms for computational fluid dynamics on parallel processors.*

Vinacua, Alvaro, *Nonlinear elliptic equations written in terms of functions of the eigenvalues of the complex Hessian.*

Wolansky, Gershon, *Dissipative perturbations of completely integrable Hamiltonian systems with applications to celestial mechanics and geophysical fluid dynamics.*

Zhou, Zhengfang, *The existence of periodic solutions of nonlinear wave equations on S^n.*

Rensselaer Polytechnic Institute
(4;0,0,0,1,3,0,0)

MATHEMATICAL SCIENCES

Adjerid, Slimane, *Adaptive finite element methods for time dependent partial differential equations.*

Arney, David C., *An adaptive mesh algorithm for solving systems of time dependent partial differential equations.*

Jackson, Thomas L., *Effects of thermal expansion on the evolution and stability of combustion waves.*

Pedroso, Moacir, *Hybrid ellipsoid-sequential quadratic programming algorithms.*

SUNY at Buffalo
(6;2,0,0,0,4,0,0)

MATHEMATICS

Chi, Henjin, *On a numerical solution to a class of nonlinear delay-differential equations of mixed type.*

Hsu, Ray, *Topics on weakly almost periodic functions.*

Liu, De-fu, *Local energy decay for hyperbolic systems in exterior domains.*

Lu, Chunqing, *Multiple steady states and their stability in a biochemical system.*

Wang, Ching-an, *Multiple steady state solutions of buoyancy induced flows of a vertical ice wall melting in porous media saturated with pure and saline water.*

Yeh, Yeong-nan, *On the combinatorial species of Joyal.*

SUNY at Stony Brook
(13;5,2,0,2,4,0,0)

APPLIED MATHEMATICS AND STATISTICS

Al-Towaiq, Mohammed, *On a two-term based on incomplete factorization of large sparse systems.*

Driscoll, Michael A., *Numerical methods for the solution of integral equations of mathematical physics.*

Dynin, Svetlana, *Nonparametric probability density estimation.*

Garcia, Maria, *On numerical solutions of non-linear equations by homotopy methods.*

Gonzalez, Jaime, *On the role of signatures and strong spanning trees.*

Kim, Chul, *Continuum structure functions: Modules, bounds, axiomatization and reliability importance.*

Li, Wen-Jui, *Degree two inequalities, biperfect graphs and some extensions of antiblocking theory.*

Liu, Mu-Shieung, *An iterative method for the inverse problem of two dimensional diffusion equation.*

Thode, Henry, *Power of absolute moment tests against symmetric nonnormal alternatives.*

MATHEMATICS

Abdulali, Salman, *Absolute Hodge cycles in Kuga fiber varieties.*

Hensley, Harvey Scott, *Equivariant Reidemeister torsion.*

Kerbaugh, Gary Lynn, *Surfaces of constant mean curvature one in hyperbolic space.*

Kupeli, Demir Nuri, *On null hypersurfaces and spacelike surfaces in spacetimes.*

Syracuse University
(5;4,0,0,0,1,0,0)

MATHEMATICS

Guzman, Fernando, *Cointegrations and cohomology for comodules.*

Isaza, Pedro, *Functions of generalized-bounded variation and Fourier series.*

Lbekkouri, Aboubakr, *On cohomological dimension of modules and algebras.*

Lebbar, Rachid, *Convergence and superconvergence of numerical solutions of weakly singular integral and differential equations.*

Servatius, Herman J., *Graph groups* 1985.

University of Rochester
(6;3,3,0,0,0,0,0)

MATHEMATICS

Choi, Yun Sung, *Spaces of holomorphic functions.*

Hong, Sungpyo, *On the time-like geodesic flows on Lorentz manifolds of positive curvature.*

Ross, Shepley L., II, *Hecke operators for $\Gamma_0(N)$, their traces, and applications.*

STATISTICS

Hungerford-Harder, Melinda, *Effects of censoring on robustness.*

Kuranchie, Pasmor, *Estimators for the parameters of a linear regression model with random intercepts and heteroscedastic variances.*

Ramaswamy, Ravi, *Aspects of quasi-stationarity, exponentiality and relaxation time in birth-death processes.*

NORTH CAROLINA

Duke University
(6;3,1,0,0,2,0,0)

MATHEMATICS

Fehribach, Joseph David, *Perturbation methods for solid diffusion in an infinite two phase Stefan problem: Liquid-phase epitaxy in $GaAlAs$.*

Fernandez-Carmena, Fernando, *Bilinear forms over algebraic varieties.*

Layton, Harold Erick, *A mathematical model of the urine concentrating mechanism.*

Massey, David Bradley, *Families of hypersurfaces with one-dimensional singular sets.*

Noguchi, Mitsunori, *Abelian-Higgs theory on Riemann surfaces.*

Rayens, William Steven, *A model for classifying linear mixtures.*

North Carolina State University, Raleigh
(11;5,3,0,1,1,0,1)

MATHEMATICS

Clark, Kenneth Dean, *The numerical solution of linear time varying singular systems of differential equations by difference methods.*

Guglielmi, Josephine Patterson, *Compactifications with singular remainders.*

Hollis, Selwyn Lamar, *Globally bounded solutions of reaction-diffusion systems.*

Knowles, Paul Henry, *Symbolic integration in terms of error-functions and logarithmic integrals.*

Lopez-Permouth, Sergio Roberto, *Rings of quotients.*

Mendelson, Howard Bart, *Reductive operators on a separable Hilbert space and the invariant subspace conjecture.*

OPERATIONS RESEARCH

Snyder, Patricia M., *Incorporating nonproduct form stations into otherwise product form closed queueing networks.*

STATISTICS

Clem, Ted Roy, *On the statistical-mechanical representation of a quasistatic process.*

Dodds, Kenneth Grant, *Resampling methods in genetics and the effects of family structure in genetic data.*

Petersen, Martin Roy, *Closed form estimators and small sample size mean and variance approximations for simple linear logistic analysis.*

Sen, David Lawrence, *Robustness of single unit root test statistics in the presence of multiple unit roots.*

University of North Carolina, Chapel Hill
(8;4,0,0,1,0,0,3)

BIOSTATISTICS

Falk, Raymond Walter, *L-superadditive functions and concepts of multivariate dependence.*

Horne, Amelia Dale, *Maternal age at last birth and reproductive span: An analysis of Egyptian fertility.*

Hornung, Richard, *Modeling occupational mortality data with applications to U.S. uranium miners.*

MATHEMATICS

Hoke, Kathy Williamson, *Valid orientations of the d-cube and the behavior of a random local improvement algorithm.*

Oliveira, Filho Fernando, *On the generic existence of homoclinic points.*

OPERATIONS RESEARCH AND SYSTEMS ANALYSIS

Yang, Eugene Keh-Chun, *A class of methods for solving large convex quadratic programs subject to box constraints.*

STATISTICS

Christensen, Soren Kier, *Linear stochastic differential equations on the dual of a countably Hilbert nuclear space with applications to neurophysiology.*

Perez-Abreu, Victor, *Product stochastic measures, multiple stochastic integrals and their extensions to nuclear space valued processes.*

OHIO

Bowling Green State University
(2;0,2,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Logan, Terrence Patrick, *Discriminant analysis using multiple observations.*

Pepple, Patricia Ann, *Simultaneous estimation of exponential means and normal variances using Bayesian methods.*

Case Western Reserve University
(10;1,0,0,9,0,0,0)

MATHEMATICS AND STATISTICS

Chen, Patrick, *Some topics in Lie groups.*

OPERATIONS RESEARCH

Agarwal, Yogesh, *A set partitioning approach to the vehicle routing problem.*

Bao, Chiao-pin, *New tools for detecting influential data in multiple linear regression.*

Dondeti, Venkateswara Reddy, *Minimal resources for fixed job schedules with different processor size requirements and a Hierarchical structure.*

Escueta, Emmanuel Solis, *A foodservice classification and planning model for hospitals and health care facilities.*

Jolayemi, Joel Kolawole, *Multivariate quality control: An hypothesis testing and optimization approach to effective use and measure of performance.*

Lee, Jung Jin, *Classification of time-dependent observations with different population trends.*

Pati, Mahesh Chandra, *Decision support system for capacity planning and operational system.*

Roy, Syamal, *A sequential linear programming approach to the linear complementarity problem.*

Song, Moon Ho, *Development of human capital and its relationship with economic growth.*

Kent State University
(3;3,0,0,0,0,0,0,0)

MATHEMATICAL SCIENCES

Connor, Jeffery, *Some applications of functional analysis to summability theory.*

Leeney, Mark, *Quotient category representations.*

Rajappa, A. K., *Weak continuity of nonlinear maps between Banach spaces.*

Ohio State University
(14;8,2,0,0,2,0,2)

MATHEMATICS

Burdick, Bruce Stanley, *Local Compactness and the cofine uniformity with applications to hyperspaces.*

Butts, Eric C., *Models of glacial flow.*

Char, Shobha, *Contributions to the study of continuous functors.*

Childress, Nancy, *Zeros of p-adic L-functions.*

Choi, Sul-Young, *Maximal $(0, 1, 2, \ldots, t)$-cliques of some association schemes.*

Guan, Puhua, *Factorization of multivariate polynomials.*

Huang, Tayuan, *Some results on the association schemes of bilinear forms.*

Kim, Myung-Hwan, *Higher degree theta-series and representations of quadratic forms.*

Lee, Jong-Eao, *The inverse spectral solution, modulation theory and linearized stability analysis of N-phase quasi-periodic solutions of the nonlinear Schrödinger equation.*

Manickam, Nachimuthu, *Distribution invariants of association schemes.*

Seress, Akos, *The gossip problem (communication problem).*

Song, Hi Ja, *Gaussian measures on certain classes of Banach lattices.*

STATISTICS

Juang, ShingHer, *Changepoint procedure for repeated measures.*

Lee, Shih-Chang, *The probability estimation of survival functions under random censoring models.*

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

MATHEMATICS

Kelsey, Ralph William, *Solitary wave solutions to nonlinear dispersive evolution equations and reduction of complex systems in one and several dimensions.*

Malik, Davender, *A study of q-hypercyclic rings.*

University of Cincinnati
(2;1,0,0,0,0,0,1)

MATHEMATICAL SCIENCES

Callon, George Daniel, *Theory and approximation of the restricted pseudosolution.*

Lee, Kyunghee, *Krull dimension of tensor products of algebras.*

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

MATHEMATICS

Garimella, Ramesh V., *Two problems in the theory of Banach algebras.*

OKLAHOMA

Oklahoma State University
(4;1,3,0,0,0,0,0,0)

MATHEMATICS

Wadleigh, Kevin Richard, *Ring-theoretic properties of semigroup rings.*

STATISTICS

Abid, Ahmed Darwesh, *Fixed-size confidence regions for multiparameter estimation.*

Díaz-Saíz, Joaquín, *Time series analysis with interventions: A Bayesian approach.*

Durongwatana, Supol, *Regression model with censored observations.*

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

MATHEMATICS

Grasse, Patricia J. M., *Results on finite presentation of mapping class groups of certain 3-manifolds.*

OREGON

Oregon State University
(7;1,5,0,0,1,0,0)

MATHEMATICS

Hazou, Irene Anton, *The exponential X-ray transform.*

Helfenstein, Franz Hugo, *A free boundary value problem modeling streambed erosion.*

STATISTICS

Aminzadeh, Mostafa S., *Prediction intervals in exponential families.*

Cid Serrano, Luis, *Estimation of the feedback parameters in a closed-loop system: A geophysical problem.*

Garoui, Abderrazak, *Estimating population totals from area frame samples.*

Pereira, Clifford Brian, *On admissibility among affine sets of linear estimators.*

Rady, El-Houssainy Abdelbar, *Testing fixed effects in mixed linear models.*

University of Oregon
(3;3,0,0,0,0,0,0)

MATHEMATICS

Lang, William Christopher, *The structure of hypergroup measure algebras.*

Pringle, Thomas Holt, *Exceptional Yang-Mills theory.*

Testerman, Donna Marie, *Certain embeddings of simple algebraic groups.*

PENNSYLVANIA

Carnegie-Mellon University
(6;1,3,0,0,2,0,0)

MATHEMATICS

Cayco, Maria Esperanza, *Finite element methods for the stream function formulation of the stationary Navier-Stokes equations.*

Heinricher, Arthur, Jr., *A singular stochastic control problem arising from a calculus of variations problem with non-Lipschitzian minimizers.*

STATISTICS

Follmann, Dean Albert, *Nonparametric mixtures of logistic regression models.*

Laskey, Kathryn, *Bayesian models of strategic interaction.*

Phillips, Kem F., *Compartment models with random parameters.*

Sungur, Engin, *Maximum self-decomposable distributions.*

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

MATHEMATICS AND COMPUTER SCIENCE

Siegler, Miriam, *Improved mathematical models of flat-plate collectors.*

Zhang, Yixin, *Parallel algorithms for problems involving directed graphs.*

Pennsylvania State University
(5;3,2,0,0,0,0,0)

MATHEMATICS

Alves, Carlos Serra, *Partitions of finite substructures.*

Garvan, Francis Gerard, *Generalizations of Dyson's rank.*

Schneider, Todd J., *On Vaught's conjecture and theories order.*

STATISTICS

Becker, Mark P., *Analysis of discrete data using log-multiplicative models and other log-nonlinear models.*

Burn, David A., *The effect of time series outliers on the sample autocorrelation coefficient.*

Temple University
(9;1,4,0,2,2,0,0)

MATHEMATICS

Choie, Young-Ju, *Rational period functions for the modular group and real quadratic fields.*

Li, Shuchen, *Computer prediction of the interaction of...environmental electromagnetic fields...with biostructures... .*

STATISTICS

Bohl, Alan, *A mathematical programming model for strategic management of a portfolio of business units.*

Cupingood, Leonard A., *Linear filtering and the ARIMA approach to seasonal adjustment and stock option pricing.*

Dorfman, Gerald Anthony, *Array calculus with applications in statistics.*

Kingsbury, Lilliam, *Evaluating robust regression estimators in the presence of influential points.*

Nydick, Robert L., Jr., *Evaluating optimal solution value estimation procedures for large scale optimization problems.*

Ramos, Juan, *Statistical procedures for evaluating disease clusters and their epidemiologic interpretations.*

Tan, Joseph Hiemhiem, *Exponential regression and its extension.*

University of Pennsylvania
(3;3,0,0,0,0,0,0)

MATHEMATICS

Beckmann, Sybilla Katherine, *Fields of definition of solvable branched coverings.*

Kaplan, Alexander, *Multi-states on operator algebras.*

Wenzl, Hans, *Representations of Hecke algebras and subfactors.*

University of Pittsburgh
(8;1,4,0,0,1,0,2)

BIOSTATISTICS

Arena, Vincent C., Jr., *Evaluation of the synthetic case-control design for occupational health.*

Schaid, Daniel J., *Evaluation of some multivariate nonparametric statistics for longitudinal studies.*

MATHEMATICS AND STATISTICS

Bueno, Vanderlei C., *Models in negative dependence through stochastic ordering for random variables conditioned on order statistics.*

Khattree, Ravindra, *Some contributions to the statistical theory of prediction: Selection indices and their construction.*

Lee, Meei-Yow Lin, *The reduced basis method for differential algebraic equation systems.*

Naik, Dayanand Narayana, *Ridge regression and other procedures in a prediction problem.*

Vaidya, Hina Prahlad, *Some contributions to the analysis of familial data.*

Yin, Yong Quan, *Spectra for large dimensional random matrices.*

RHODE ISLAND

Brown University
(21;9,1,0,0,9,0,2)

APPLIED MATHEMATICS

Fong, Jefferson, *Supersonic flow over axisymmetric and non-axisymmetric bodies.*

Grillakis, Manoussos, *Nodal characterization and instability for bound states of the Klein-Gordon equation.*

Kwok, Yue-Kuen, *Transonic controversy and regular perturbation methods for subcritical flow.*

Lippman, Alan Francis, *A maximum entropy approach for expert system construction.*

Memory, Margaret Carolyn, *Bifurcation in a population model with delay and diffusion.*

Newton, Paul Kenneth, *Instabilities of the Ginzburg-Landau equation.*

Osborn, Brock, *Parameter estimation in pattern theory.*

Saul, Alan Bruce, *Visual cortical unit response properties in kittens given brief monocular experience following dark rearing.*

Sepulveda, Nicasio, *Solitary waves in the resonant phenomenon between surface and internal waves.*

Soner, Halil Mete, *Optimal control of piecewise deterministic processes with state-space constraint.*

Wang, Wen-Biao, *Stress and strain analysis of fibre-reinforced sheets with bending stiffness.*

Wei, Musheng, *Numerical computation of scattering frequencies.*

Zou, Qisu, *Over-taking collision between two solitary waves.*

MATHEMATICS

Anderson, John T., *Algebras of solutions to partial differential equations.*

Coghlan, C. Leslie, *Tight stable mappings of surfaces.*

Deutsch, Jesse I., *Identities on modular forms in several variables derivable from Hecke transformations.*

Freije, Richard M., *Intersection formulae and volume calculations for Mumford curves.*

Garrity, Thomas, *On ample vector bundles and negative curvature.*

Napolitano, Margaret, *Higher dimensional formal groups and the formal group of the Jacobian.*

O'Grady, Kieran, *Moduli of abelian and $K3$ surfaces.*

Schwalbe, Daniel, *K-theory for discrete subgroups of the Lorentz groups.*

University of Rhode Island
(1;0,0,0,0,1,0,0)

MATHEMATICS

LaTourette, Robert A., *Efficient recursive batch time delay difference estimation in the presence of target motion.*

SOUTH CAROLINA

University of South Carolina
(5;2,1,0,0,2,0,0)

MATHEMATICS

Koo, Reginald, *Sharp inequalities for the conjugate function.*

Miller, Valerie Ann, *Successive overrelaxation methods for solving large scale rank deficient least square problems.*

Wojcicka, Ewa, *Functions of bounded characteristic on multiply connected domains.*

Yan, Zheng, *Monotonicity preserving curve fitting algorithms.*

STATISTICS

Lubecke, Andre, *Nonparametric maximum penalized likelihood estimation of lifetime density functions.*

TENNESSEE

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

MATHEMATICAL SCIENCES

Singh, Karan Pal, *Some carcinogenesis models and effects of metabolism on cancer tumor development.*

University of Tennessee
(2;1,1,0,0,0,0,0)

MANAGEMENT SCIENCE

Melton, Kim Ingrid, *A procedure for initiating process control.*

MATHEMATICS

Choi, Jung-In, *Mappings of* ANR*'s whose images are* ANR*'s.*

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

MATHEMATICS

Chyan, Chuan Jen, *Two linear population models and their associated semigroups.*

Lane, Mark Timothy, *The third axiom of countability characterization of balanced projective abelian groups and applications.*

Lenbury, Youngwinon, *Modelling fermentation processes.*

Patching, David Steven, *Hyperspaces of some direct limit spaces.*

TEXAS

North Texas State University
(1;0,0,0,0,0,0,1)

MATHEMATICS

Race, David M., *Consistency in lattices.*

Rice University
(9;1,1,0,0,7,0,0)

MATHEMATICAL SCIENCES

Carter, Richard Gordon, *Multi-model algorithms for optimization.*

Gonzalez, Ruth, *Domain decomposition for two-dimensional elliptic operators on vector and parallel machines.*

Hüsemann, Joyce Ann Stevens, *Histogram estimators of bivariate densities.*

Killough, John, *A multi-level domain decomposition algorithm suitable for the solution of three-dimensional elliptic partial differential equations.*

Li, Guangye, *Algorithms for solving sparse nonlinear systems of equations.*

McKay, Edward G., *Electromagnetic propagation and scattering in spherically symmetric terrestrial system-models.*

Olkin-Meza, Juan Camilo, *Conjugate residual methods for almost symmetric linear systems.*

Olkin-Meza, Julia Ann, *Linear and nonlinear deconvolution models.*

MATHEMATICS

Li, Hsiu-Hsiang, *Geometrically contained curves and the calculus of variations.*

Southern Methodist University
(7;0,2,0,2,2,0,1)

MATHEMATICS

Allgaier, Darrell E., *Wave number shocks for the tail of Korteweg-de Vries solitary waves in slowly varying media.*

McWilliams, Joseph Graves, *Properties of the transfer function in compartmental models.*

OPERATIONS RESEARCH

Asaad, Elnidani, *The multicommodity, multiperiod assignment problem.*

Harris, E. Douglas, *Development and implementation of a management training program for engineers in product design and manufacturing organizations.*

Rotimi, Aderohunmu, *The solution of multiperiod network models with bundle constraints by aggregation.*

STATISTICS

Carmody, Thomas, *Diagnostics for multivariate smoothing splines.*

Thombs, Lori Ann, *Bootstrap prediction intervals for autoregressive processes.*

Texas A & M University
(5;0,5,0,0,0,0,0)

STATISTICS

Berdine, Ronald James, *Improving risk characterization based on time to response.*

Burguete, Esteban, *On the generalization of a time-to-response cancer risk assessment model.*

Harpaz, Avraham, *Stationary time series, quantile functions, nonparametric inference and rank transform spectrum.*

Stevens, Gary Richard, *Estimation in spatial time series.*

Tsukuda, Yoshihiko, *Asymptotic expansions of the distributions of test statistics for the slope in a simple linear functional relationship.*

Texas Tech University
(1;1,0,0,0,0,0,0)

MATHEMATICS

Mohammad-Ali, Rosihan, *Properties of Möbius transformations of convex mappings.*

University of Houston
(3;3,0,0,0,0,0,0)

MATHEMATICS

Bruni, Anthony James, *Nonnegative nontrivial fixed points of orthogonal projections.*

Muoneke, N'Ekwunife, *On the stochastic and doubly stochastic powers of nonnegative square reducible matrices.*

Zeng, Xianwu, *A qualitative investigation of coupled systems of nonlinear oscillators.*

University of Texas, Arlington
(1;1,0,0,0,0,0,0)

MATHEMATICS

Poorkarimi, Hushang, *Qualitative and quantitative investigation of some hyperbolic partial differential equations.*

University of Texas, Austin
(5;2,1,1,0,1,0,0)

MATHEMATICS

Chou, Shang-ching, *Proving and discovering geometry theorems using Wu's method.*

Luecke, John Edwin, *Finite covers of Haken 3-manifolds.*

McKemie, Marcia Jean, *Quasiconformal groups and quasisymmetric embeddings.*

Moore, Leslie Melissa, *Ordering the points in factorial experiments to protect against early termination.*

Rulla, James Lorin, *A Stefan problem with prescribed convection.*

UTAH

University of Utah
(4;2,0,0,0,0,0,2)

MATHEMATICS

Albano, Alberto, *Infinite generation of the Griffiths group: A local proof.*

Jordan, Michael Charles, *Convolutive curves and surfaces.*

Pulte, Michael Joseph, *The fundamental group of a Riemann surface: Mixed Hodge structures and algebraic cycles.*

Whelan, Tracy M., *Geodesic curves on rectangular polynomial Bezier surface patches.*

VIRGINIA

Old Dominion University
(2;2,0,0,0,0,0,0,0)

MATHEMATICS

Irvine, Larry Dean, *Minimal norm constrained interpolation.*

Saunders, Bonita Valerie, *Algebraic grid generation using tensor product B-splines.*

University of Virginia
(3;1,0,0,0,2,0,0)

APPLIED MATHEMATICS AND COMPUTER SCIENCE

Poole, Eugene L., *Multi-color incomplete Cholesky conjugate gradient methods for vector computers.*

Schlussel, Kent, *Multi-module Markov decision processes.*

MATHEMATICS

Lehman, James Larry, *An application of the Shimura correspondence to the modular curve* $X_0(49)$.

Virginia Commonwealth University
(2;0,0,0,0,0,0,0,2)

BIOSTATISTICS

Rode, Richard A., *The use of Box-Cox transformations in the development of multivariate tolerance regions with applications to clinical chemistry.*

Schwiderski, Ute Ellen, *A unified MANOVA-GMANOVA theory and splines.*

Virginia Polytechnic Institute and State University
(11;0,5,0,0,6,0,0)

MATHEMATICS

Derezinski, Jan, *Existence and analyticity of many body scattering amplitudes at low energies.*

Fabiano, Richard Henry, *Approximations of integro-partial differential equations of hyperbolic type.*

Ganchev, Alexander Hristov, *Boundary value and Weiner-Hopf problems for abstract kinetic equations with nonregular collision operators.*

Noren, Richard Dennis, *Uniform L1 behavior for the solution of a Volterra equation with a parameter.*

Turi, Janos, *Well posedness questions and approximation schemes for a general class of functional differential equations.*

Walus, Wlodzimierz Ignacy, *Stationary solutions of abstract kinetic equations.*

STATISTICS

Chung, Jain, *Control chart procedures based on cumulative ganging scores.*

Hilow, Hisham, *Economic expansible-contractible sequential factorial designs for exploratory experiments.*

Lee, Wonwoo, *Fractional principal components estimation: A general approach to biased estimators.*

Wu, Ying-Keh, *Empirical Bayes procedures in time series regression models.*

Zhang, Nien Fan, *Estimating partial group delay.*

WASHINGTON

University of Washington
(10;7,2,1,0,0,0,0,0)

MATHEMATICS

Asmar, Nakhle, *The conjugate function on locally compact Abelian groups.*

Chacon, Rene Manuel, *Barrier stopping times and the filling scheme.*

Hui, Stefen Yeung-Yin, *Qualitative properties of solutions to* H^∞ *optimization problems.*

Kolinek, Martin, *Geometric methods in computational complexity.*

Noble, Steven, *Diffusions on vector bundles and the heat equation for forms.*

Pearlman, Austin C., *Algebraic extensions of the Brown-Peterson spectrum.*

Ringseth, Paul Frederick, *Invariant Eisenstein systems.*

Salehi, Ebrahim, *Dynamics and unique ergodic properties of functions on semigroups.*

STATISTICS

Ko, Daijin, *Robust statistics on compact metric spaces.*

Zamar, Ruben H., *Robust estimation for the errors-in-variables model.*

Washington State University
(4;1,0,0,1,2,0,0)

MATHEMATICS

Farris, Steven, *Fully transitive polyhedra.*

Gupta, Nilama, *A higher than first order algorithm for non-smooth constrained optimization.*

Ueda, Minour, *Some models for evolution in geographically structured populations with selection and selective-migrates.*

Zhang, Baohuan, *A nonlinear stability analysis of a fixed-boundary model equation for alloy solidification.*

WISCONSIN

University of Wisconsin, Madison
(30;15,9,0,0,1,0,5)

INDUSTRIAL ENGINEERING

Ballakur, Arvind, *An investigation of part family/machine group formation for designing cellular manufacturing systems.*

Peterson, James G., *Personal qualities and job characteristics of expert engineers and planners.*

Qu, Weishuang, *Two-dimensional layout of regular and irregular shapes on stock sheets of multiple sizes.*

Sakman, Guldal, *An empirical study on three methods of problem definition of ill-structured situations.*

Valusek, John, *Information requirements determination: An empirical investigation of obstacles within an individual.*

MATHEMATICS

Ebel, David J., *Stability theory of a toroidal plasma with viscosity, resistivity and Hall effect.*

Haefner, Jeremy A., *Direct sum behavior of lattices over Sigma-I rings.*

Hwang, Suk Geun, *Minimization problems for the permanent function on classes of nonnegative matrices.*

Loper, Kenneth Alan, *On rings without a certain divisibility property.*

McCord, Christopher K., *Mappings and homological properties in the Conley index theory.*

Mischaikow, Konstantin M., *Homoclinic and heteroclinic orbits for a class of 4-dimensional Hamiltonian systems.*

Reed, Robert Charles, *A decidable Ehrenfeucht theory with exactly two hyperarithmetic models.*

Reineck, James Francis, *The connection matrix and the classification of flows arising from ecological models.*

Scofield, Jeremy, *Nielsen fixed-point theory for fiber-preserving maps.*

Shahriari, Shahriar, *Capable groups and fully ramified characters.*

Solheid, Ernie S., *On the spectral radius and the determinant of matrices of zeros and ones.*

Sueiro-Bal, Juan, *On maximal functions and Poisson-Szegő integrals.*

Tatsuoka, Kay S., *The word problem for alternating knots and finite volume hyperbolic groups.*

Thron, Christopher P., *Properties and analytic development of the largest eigenvalue for a class of transfer operators, with applications.*

Zielinski, Michael F., *Highly oscillatory singular integrals along curves.*

Zivaljevic, Rade T., *Infinitesimal analysis and homology theory.*

STATISTICS

Bisgaard-Frantzen, Soren, *Topics in industrial statistics.*

Chow, Shein-Chung, *Resampling procedures for the estimation of nonlinear functions of parameters.*

Jorn, Hongsuk, *An algorithm for unbalanced multifactorial ANOVA model with contrasts.*

Kim, Kyungmann, *Estimation following sequential tests in clinical trials.*

Meyer, Ralph Daniel, *Analysis of factorial experiments.*

Sanders, Elizabeth, *Minimum bias estimation for first and second order rotatable response surface.*

Shiau, Jyh-Jen Horng, *Smoothing spline estimation of functions with discontinuities.*

Thornquist, Mark, *Modelling discrete time ordinal disease progression data by proportional hazards.*

Wolf, Dennis A., *Nonlinear least squares for linear compartmental models.*

University of Wisconsin, Milwaukee
(3;3,0,0,0,0,0,0,0)

MATHEMATICAL SCIENCES

Devine, Thomas Gerard, *Algebraic and topological considerations of quo-primitive rings.*

Muthuvel, Kandasamy, *Existence and nonexistence of independent sets in the generalized linear continua. Behavior of the ordinal functions $\phi(\alpha)$ and $\psi(\alpha)$ defined by $2^{\aleph_\alpha} = \aleph_{\alpha+\phi(\alpha)}$ and $\aleph_\alpha^{(\alpha)} = \aleph_{\alpha+\psi(\alpha)}$.*

Nicol, Sherrie Jean, *Continuous exact sets.*

WYOMING

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

MATHEMATICS

Sochacki, James S., *Mathematical model of seismic wave research.*

STATISTICS

Drummer, Thomas David, *Size-bias in line transect sampling.*

Fenwick, James W., *Information content of land classification systems.*

Lawton, Barbara, *Mixtures of random fields—estimation and simulation.*

Ospina-Bolero, David, *A maximum likelihood approach in multiple frame surveys.*

CANADA

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

MATHEMATICS AND STATISTICS

Idris, Ismail Mohamed, *Valuated division rings, orderings and elliptic Hermitian spaces.*

Prasad, N. G. Narasimha, *Small area estimation and measurement of response error variance in surveys.*

Dalhousie University
(1;1,0,0,0,0,0,0,0)

MATHEMATICS, STATISTICS AND COMPUTING SCIENCE

Higson, Nigel David, *Algebraic K-theory of stable C^*-algebras.*

McGill University
(2;2,0,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Kaczynski, Tomasz, *Topological transversality of condensing set-valued maps.*

Simons, Lloyd Douglas, *The structure of the Hilbert symbol for unramified extensions of 2-adic number fields.*

McMaster University
(2;2,0,0,0,0,0,0,0)

MATHEMATICAL SCIENCES

El-Helaly, Sherif Taha, *Topological algebras with orthogonal M-bases.*

Kamal-ElDeen, Mahmoud Ahmed, *Modules in which complements are summands.*

Queen's University
(1;1,0,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Dean, Andrew Paul, *Characterizing impure epimorphisms and impure monomorphisms.*

Simon Fraser University
(2;2,0,0,0,0,0,0,0)

MATHEMATICS

Chun, Chong C., *Certain minimal theories.*

Loveys, James, *Certain weakly minimal theories.*

Université de Montréal
(5;4,1,0,0,0,0,0,0)

MATHÉMATIQUES ET STATISTIQUE

Bouabdillah, Driss, *Modules directs et fortement directs sur anneaux principaux.*

Bouanane, Abdelmalek, *Sur les TAG-anneaux commutatifs.*

Hattab Ibrahimi, Saadia, *Modules localement rectifiables et rectifiables.*

Krawcewicz, Wieslaw Zbigniew, *Contribution à la théorie des équations non linéaires dans les espaces de Banach.*

Théberge, Alain, *Les modèles linéaires et la théorie de l'estimation pour l'échantillonnage en plusieurs occasions.*

Université Laval
(2;1,0,0,0,1,0,0)

MATHÉMATIQUES, STATISTIQUES ET ACTUARIAT

Bouchoum, Mohamed, *Groupe des unités d'un composé d'un corps quadratique et d'une extension cyclique réelle de degré 4 de $\mathbf{Q}$.*

Manouzi, Hassan, *Approximation par elements finis d'un modèle de simulation de la turbulence.*

University of British Columbia
(4;2,0,0,0,1,0,1)

MATHEMATICS

Hare, Kathryn Elizabeth, *Thin sets and strict 2-associatedness.*

Loewen, Philip Daniel, *Proximal normal analysis in dynamic optimization.*

Swaters, Gordon Edwin, *On the stability and propagation of barotropic modons in slowly varying media.*

Yiu, Paul Yu Hung, *Topological and combinatoric methods for studying sums of squares.*

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

MATHEMATICS AND STATISTICS

Islam, Muhammad Nurul, *Bayesian estimation of some generalized probability distributions.*

Sankaran, Parameswaran, *Vector fields on flag manifolds.*

Wani, Prabhakar R., *Study of the S-module $\mathrm{Hom}_R({}_RM, {}_RN)$ where $S = \mathrm{End}_R M$.*

Yousif, Mohamed Fouad, *V-modules and generalized V-modules.*

Zaguia, Nejib, *Schedules, cutsets and ordered sets.*

University of Toronto
(4;3,0,0,0,1,0,0)

MATHEMATICS

Boivin, Daniel, *Local ergodic theorems for multiparameter resolvents and abelian processes.*

Bose, Christopher John, *Generalized Baker's transformations.*

Li, Zi-Cai, *Numerical methods for elliptic boundary value problems with singularities.*

Poulin, Jean, *Stratification for noetherian families of submodules of $k[[y]]^p$ and metric properties of real analytic sets.*

University of Waterloo
(6;1,1,0,1,2,0,1)

APPLIED MATHEMATICS

McInnis, Celia, *A study of class of Stefan problems.*

Van Roessel, Henry J. J., *Steady and unsteady three-dimensional hypersonic flow theory.*

COMBINATORICS AND OPTIMIZATION

Bourjolly, Pierre-Michel Jean-Marie, *Integral and fractional node-packings, and pseudo-boolean programming.*

Ellingham, Mark Norman, *Isomorphic factorizations of regular graphs.*

PURE MATHEMATICS

Kommel, Helene Janet, *On the non-counting congruence of order 2.*

STATISTICS AND ACTUARIAL SCIENCE

Thavaneswaran, Aerambamoorthy, *Estimation of semimartingales.*

University of Western Ontario
(7;3,2,0,0,2,0,0)

APPLIED MATHEMATICS

Loh, Ching Yuen, *Numerical techniques for free surface problems in viscous incompressible and porous flows.*

Phillips, Stephen Blair, *Green's functions involving gauge-transformed field variables.*

MATHEMATICS

Mayorquin-Garcia, Jesus-Manuel, *Homology and K-theory of loop spaces.*

Moreno-Rodriguez, Guillermo, *Sphericals and primitive classes in the bordism of compact Lie groups.*

Zaldivar-Cruz, Felipe De Jesus, *Localized algebraic K-theory.*

STATISTICAL AND ACTUARIAL SCIENCES

Jandhyala, Venkata Krishna, *Residual processes for regression models with applications to detection of parameter changes at unknown times.*

Koval, John J., *Logistic regression models with correlated observations.*

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

MATHEMATICS

Chew, Kok-Thai, *MHD flows with arbitrary angle between velocity and magnetic fields.*

Grossman, George William, *Finite-difference algorithms for inviscid incompressible flow over an arbitrary symmetric profile.*

Doctoral Degrees Conferred 1984–1985

Supplementary List

The following entries supplement the list of thesis titles published in the November 1985 *Notices*, pages 774–786, and the March 1986 *Notices*, page 298.

COLORADO

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

MATHEMATICS

Meyerowitz, Aaron, *Partial geometric lattices.*

NEW YORK

Cornell University
(1;0,0,0,1,0,0,0)

OPERATIONS RESEARCH

Domich, Paul David, *Residual methods for computing Hermite and Smith normal forms.*

THE BIEBERBACH CONJECTURE: Proceedings of the Symposium on the Occasion of the Proof
Albert Baernstein, David Drasin, Peter Duren and Albert Marden, Editors
(Mathematical Surveys and Monographs, Volume 21)

For 70 years, the Bieberbach conjecture has intrigued the mathematical world. In 1977, Louis de Branges of Purdue University took up the challenge of this famous unsolved problem. He will be recognized as the mathematician who proved Bieberbach's conjecture. And more importantly, his method came from totally unexpected sources: operator theory and special functions.

This book, based on the Symposium on the Occasion of the Proof, tells the story behind this fascinating proof and offers insight into the nature of the conjecture, its history and its proof. A special and unusual feature of the book is the enlightened personal accounts of the people involved in the exciting events surrounding the proof. Especially attractive are the photographs of mathematicians who have made significant contributions to univalent functions, the area of complex analysis which provides the setting for the Bieberbach conjecture.

Research mathematicians, especially analysts, are sure to enjoy the articles in this volume. Most articles require only a basic knowledge of real and complex analysis. The survey articles are accessible to non-specialists, and the personal accounts of all who have played a part in this important discovery will fascinate any reader.

1980 *Mathematics Subject Classifications*: 30, 47
ISBN 0-8218-1521-0, LC 86-10843, ISSN 0076-5376
260 pages (hardcover), 1986
List price $45, Institutional member $36, Individual member $27
Code SURV/21NA

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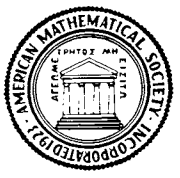

Some Basic Hypergeometric Orthogonal Polynomials that Generalize Jacobi Polynomials

Richard Askey and James Wilson

(Memoirs of the AMS, Number 319)

The classical orthogonal polynomials include those of Hermite, Laguerre, Jacobi and discrete analogues found by Chebychev, Charlier, Meixner and Hahn. In an earlier paper the authors found the most general set of classical orthogonal polynomials whose weight function is discrete. The same polynomials with different choices of parameters have an absolutely continuous weight function. The explicit orthogonality relation is obtained, many special cases are considered, and a few facts about these polynomials are discovered. These include quadratic transformations for some basic hypergeometric series, a solution of the connection coefficient problem which gives Watson's extension of the Rogers-Ramanujan identities, inequalities for the polynomials on the spectral interval, a divided difference equation and a Rodrigues type formula. All of the paper rests on a new extension of the beta integral which has four rather than two free parameters in addition to the q associated with basic hypergeometric series.

1979 *Mathematics Subject Classification*: 05A17
ISBN 0-8218-2321-3, LC 84-28117
ISSN 0065-9266
iv + 56 pages (softcover), March 1985
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Shipping/Handling: 1st book $2, each additional $1, maximum $25; by air, 1st book $5, each additional $3, maximum $100
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Kenneth M. Hoffman

The NSF Budget: A Rocky Road through Congress

Over the summer, while most of the nation's scientific community was concentrating on research, travelling to international conferences, and catching their breath for the start of another academic year, a tense melodrama was being played out in Washington which could seriously affect the amount of basic research done in this country in the next decade or more, as well as the efforts of our community to restore its research funding to a state of health. The focus of the debate: congressional appropriations for the National Science Foundation (NSF) in FY 1987, the year which began October 1, 1986.

The President's budget, submitted last January, had asked for $1.7 billion for NSF, an increase of about 12% over total FY 1986 spending levels, and an increase of 14% in NSF's basic research budget. The administration's rationale: basic research is an investment in the future and must be maintained even in these very tight financial times. Furthermore, the FY 1986 spending level for NSF was actually less than in FY 1985, since Congress provided a 4% increase from 1985 to 1986 and then took away 4.8% in the first round of the Gramm-Rudman-Hollings budget reductions. Mathematics fared much better, in part because it was exempted from the effects of Gramm-Rudman by request of Erich Bloch, Director of the NSF.

The President's budget for NSF went through the authorization process in the House and Senate without a hitch. Then, without warning, the House Appropriations Committee (more specifically, its HUD-Independent Agencies Subcommittee) effectively wiped out all of the $185 million increase for basic research which the budget contained by reducing that increase to a pathetic $39 million. The full House subsequently passed an appropriations bill which set NSF spending levels for research about 3% above FY 1986, rather than the 14% which had been requested.

Not surprisingly, the actions in the House set in motion a flurry of activity by the Washington representatives of the scientific community. The target: the Senate Appropriations Subcommittee on HUD-Independent Agencies. The objective: to persuade them to set their appropriation for NSF as close as possible to the $1.7 billion level authorized. The early feedback from the Subcommittee was discouraging, as key members seemed to be leaning in the direction of the House thinking. Efforts to persuade them otherwise were intensified.

Those efforts lasted for weeks and were ultimately successful. On September 18, 1986, the Subcommittee voted for the full 14% increase for research at NSF.

One positive note with a consistent ring through all these proceedings was that both the House and Senate appropriations added $10 million to the $89 million request for Science Education at NSF.

The table below represents the situation as of September 18, 1986.

In the latter half of September, the pace really picked up. The targets: both House and Senate Appropriations Subcommittees on HUD-Independent Agencies. The objective: to persuade them that the Senate version should prevail when they go to conference; that is, don't be satisfied with splitting the difference–rather, try to persuade all the conferees that the higher appropriation is necessary.

Part of the intensity of the pace was that Congress was hard at work, cleaning up seemingly a million odds and ends, headed toward adjournment in the first week of October. In an election year, adjournment comes in time for the members to go home for the last few weeks of the campaign. Their motivation for "getting things settled" is to ensure that they get home and will not be called back for a lame duck session late in the year, after the elections.

As this article goes to press, the outcome is still unknown.

National Science Foundation Budgetary Trends
($ in millions)

	FY85 ACTUAL	FY86 PLAN	FY87 REQUEST	FY87 HOUSE	FY87 SENATE
Research	1301M	1294M	1479M	1333M	1479M
Science Ed.	87M	85M	89M	99M	99M
Other*	113M	111M	118M	118M	118M
NSF Total	1502M	1490M	1686M	1550M	1696M

* The "other" is primarily the Antarctic program.

Blackwell Receives R. A. Fisher Lectureship and Award

The R. A. Fisher Award of the Committee of Presidents of Statistical Societies was presented to David Blackwell of the University of California, Berkeley, on August 20, 1986, at the Joint Statistical Meetings in Chicago. Blackwell was honored for his contributions to the theory of probability and statistics which provided a foundation for applications of sequential analysis, statistical decision theory, game theory, dynamic programming, information theory, and Markov chains. His 1986 Fisher Lecture is entitled "Likelihood and Sufficiency."

The R. A. Fisher Lectureship was established in 1963 by the Committee of Presidents of Statistical Societies to honor the contributions of Sir Ronald Aylmer Fisher and to recognize distinguished scholarship in statistical science and highly significant impact of statistical methods on scientific investigations.

This year's recipient, David Blackwell, is a professor of mathematics and statistics at the University of California, Berkeley. Blackwell was Vice-President of the American Mathematical Society from 1968-1969 and a Member-at-Large of the Council from 1951–1953 and 1955–1957. He was elected to the National Academy of Sciences in 1965, and as Honorary Fellow of the Royal Statistical Society in 1976. He was the Institute of Mathematical Statistics Wald Lecturer in 1977 and a Guggenheim Fellow in 1979.

–AMSTAT News

Ford Foundation Grants Awarded to Minority Doctoral Students

A new program designed to increase the number of underrepresented minorities on the nation's college and university faculties has awarded fellowships to 50 predoctoral students and 15 doctoral candidates working on dissertations. The National Research Council administers the program for the Ford Foundation.

The 65 graduate students in the arts and sciences were selected from a field of 931 finalists—far more than had been anticipated when the program was established last year. In response to the overwhelming number of qualified applicants, Ford increased the number of originally planned fellowships by 15.

The first group of fellows was selected on a competitive basis by panels of scholars—68 percent of them members of minority groups themselves. Predoctoral and dissertation fellowships consist of annual stipends of $10,000 and $18,000, respectively. The predoctoral awards also include an allowance to the awardee's university in lieu of tuition and fees. Awardees in the mathematical sciences are: PAUL V. FLORES, Massachusetts Institute of Technology (Analytical mathematics); LAURA R. GARCIA, Texas A&M University, College Station (Computer science); BIENVENIDO VELEZ, University of California, Berkeley (Computer science); and JORGE ARAGON, University of New Mexico (Applied statistics).

Students may obtain the 1987 doctoral fellowship applications from the Fellowship Office, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. The deadline for applications is **November 14**.

–News from the National Research Council

Institute for Mathematics and its Applications
Minneapolis

The four weeks from January 5 to 30, 1987, will feature a period of concentration on Inverse Problems and Applications to Bioengineering and Geophysics. Topics to be studied include Tomography and Image Reconstruction, Geophysical Inverse Problems, Mathematical Inverse Problems and Numerical Considerations, and Statistical and Probabilistic Approaches.

Both biological and geophysical applications consist of attempts to determine the structure of the interior of a body from measurement on the boundary or in the exterior of the body. Such measurements may include X-rays or ultrasonic waves in the biological case. In the geophysical case, they usually involve seismic waves. These may originate from earthquakes or may be artificially induced for the purpose of oil exploration.

A period of concentration on Structural Mechanics and Properties of Materials will begin in February.

Reciprocity Agreement with the Irish Mathematical Society

The American Mathematical Society and the Irish Mathematical Society have recently concluded a "reciprocity agreement" under which members of either of these societies may join the other at reduced dues. Members of the Irish Mathematical Society receive the *Bulletin of the Irish Mathematical Society* as a privilege of membership and may subscribe to the *Proceedings of the Royal Irish Academy* (Section A) at a reduced rate.

See **Miscellaneous** in this issue of *Notices* for further details.

Tax Reform and the Mathematical Community

At the time this issue went to press, the House and Senate had approved the new tax bill, but President Reagan had not yet signed it into law. However, because the President has pledged his support of the bill, we are running this article with the expectation that he will sign it.

The new tax legislation will substantially affect every taxpaying individual in the United States. Among its key features are a reduction of the number of individual tax brackets, a reduction of the top tax rate for individuals, and a big increase in corporate taxes. In addition, a number of provisions of the legislation will have widespread effects on colleges and universities and their employees.

Abolishing the present 14-bracket system, the new tax bill has just two rates: 15% for incomes up to $29,750 and 28% for those above that figure. The personal exemption will increase in 1988 to $1,950 (from the present $1,080) and to $2,000 in 1989. Standard deductions for joint filers, heads of households and single filers will also increase, but the special deduction of as much as $3,000 for married couples who both work will be eliminated. The bill retains the deduction for local and state taxes, but abolishes the deduction for sales tax and interest payments.

It is estimated that 81% of all Americans will enjoy a tax break. Indeed, the top rate of 28% is far less than the top rate of 70% that was in effect when President Reagan took office, or the 50% currently in effect.

One of the bill's most controversial provisions is its cutback of deductions for individual retirement accounts, or IRAs. Only workers who are not covered by an employee pension, or families earning less than $40,000 ($25,000 for individuals), can continue to claim the present $2,000 deduction for money put into an IRA. The deduction will be eliminated for families earning more than $50,000 ($35,000 for individuals), and reduced for those in between.

The bill also abolishes a number of loopholes and tax breaks for business, so that over the next five years corporate taxes will rise by about $120 billion, with individual taxes cut by the same amount.

The legislation generally follows the outlines of President Reagan's May 1985 tax reform proposal. Reagan has praised the new plan, calling it a "triumph for the American people and the American system." However, higher education officials have generally denounced the bill. The presidents of three major higher education associations—the American Council on Education, the Association of American Universities, and the National Association of Independent Colleges and Universities—have issued a joint statement saying that the tax bill will "seriously compromise the vitality of America's colleges and universities and impose significant hardship on the institutions and the students they serve."

Here are some effects of the bill that may be of special interest to the mathematical community:

Donations. The bill's reduction of financial incentives for donations will probably have a pronounced effect on private colleges and universities, which could lose about 25% of donated funds per year. Overall, donations to education are expected to decline by about 16% in 1988, and educational institutions could lose as much as $1 billion per year.

Tax-free bonds. By setting a ceiling of $150 million on the amount of tax-free debt that private institutions can have, the bill will prohibit about 30 large private research universities from using any more tax-free bonds to finance their construction and renovation projects. However, most colleges and universities will continue to easily obtain these bonds. In fact, this is something of a victory for higher education, since the House had wanted to impose restrictions that would have made the bonds unavailable to hundreds of colleges.

Scholarships and prizes. Students receiving scholarships and fellowships will have to pay taxes on that portion of the money not spent on tuition and course-related equipment or on incidental expenses such as travel and clerical help. Those who receive fellowships but are not working toward a college degree, such as Guggenheim Fellows, will no longer be able to deduct a portion of that fellowship. Also, a provision of the bill ends a special exclusion for certain prizes and awards in areas such as charity, the arts, and science. For instance, the Nobel prize and financial awards given to good teachers will be taxable.

Employer-paid tuition. Employees will be able only through the end of 1987 to exclude from their taxable income up to $5,250 a year in employer-provided educational aid for continuing education and training, though college lobbyists asked to have this benefit made permanent. In addition, the tax writers had ignored proposals to provide a tax credit for businesses for providing such educational aid.

Retirement savings. The bill cuts the 1987 tax of the average higher education faculty member by 9.4%, but also reduces to $9,500 per year from $30,000 per year the amount that college workers and other employees of nonprofit institutions can set aside in a special type of tax-deferred annuity plan, often called a 403(b) plan. Furthermore, the bill eliminates the flexibility that has made the annuity plan an especially attractive investment by imposing a 10% penalty on most withdrawals made before retirement.

Professional expense deductions. Deductions for professional expenses will be allowed only when the expenses exceed 2% of the taxpayer's

adjusted gross income. Subscriptions to professional journals, dues to professional societies, unreimbursed classroom and reference materials, and research-related travel fall into this category.

Research and development. The bill extends for 3 years the tax credit that technology companies receive for increases in research and development spending, but reduces the credit to 20% from 25% and restricts the definition of qualified research and development. This reduction makes support of campus research more attractive, for the bill provides an extra tax credit for those businesses supporting research in colleges and universities.

Tuition benefits. Tuition benefits for employees' family members and many faculty housing subsidies will continue to be tax-exempt.

Recursion Theory

Anil Nerode and Richard A. Shore, Editors

(Proceedings of Symposia in Pure Mathematics, Volume 42)

The proceedings of the 1982 AMS Summer Research Institute in Recursion Theory, this volume represents the largest and most comprehensive meeting ever devoted to recursion theory. The book contains major surveys with expository papers as well as important new research.

Graduate students and active researchers alike with interests in any aspect of recursion theory, including its interactions with set theory, model theory, constructive mathematics, foundations of mathematics and computer science, will be interested in this book. Some papers require only a basic course in logic or recursion theory; others are aimed at active researchers in the field.

1980 *Mathematics Subject Classifications*: 03D25, 03D30, 03D45, 03D55, and others
ISBN 0-8218-1447-8, LC 84-18525
ISSN 0082-0717
viii + 528 pages (hardcover), March 1985
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"The articles in these two volumes cover an enormous range of numerical methods and an equally vast range of scientific applications... The volumes are indispensable to anyone who wishes to become acquainted with modern practices of large-scale computations."
– Peter D. Lax, New York University

LARGE-SCALE COMPUTATIONS IN FLUID MECHANICS

Bjorn E. Engquist, Stanley Osher and Richard C. J. Somerville, Editors

The purpose of the AMS-SIAM Summer Seminar on Applied Mathematics held at Scripps in 1983 was to bring together scientists interested in computational fluid mechanics and numerical analysts and mathematicians working in large-scale computations.

The numerical modeling included geophysical problems of the atmosphere, ocean, and interior of the earth, and planetary, solar, and stellar atmospheres. Applications ranged from idealized turbulence in laboratory convection models to operational weather prediction. Engineering applications included aerodynamics, combustion, and flow in porous media. Recent advances in numerical analysis which have applications to these problems were stressed. These include shock capturing algorithms, spectral methods, boundary treatments, vortex methods, and parallel computing.

ISBN (*Set*) 0-8218-1122-3; (*Part 1*) 0-8218-1129-0; (*Part 2*) 0-8218-1130-4, LC 84-24534, ISSN 0075-8485
387 pp. (Part 1), 422 pp. (Part 2) (hardcover), July 1985
Set: **Indiv. mem.** $71, List $118, Inst. mem. $94
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Positions at Funding Agencies: An Open Letter

Dear Colleague:

I am writing this to inform the mathematics community of job opportunities for mathematical scientists in Washington.

The work at a federal funding agency is both challenging and rewarding. It provides an opportunity to develop an overview of the mathematical sciences that is otherwise difficult to obtain. While the experience is quite different from an academic position, it conveys intimate and valuable knowledge of the internal workings of the federal funding agencies. The importance of these positions is beyond question. It is essential to the future of the mathematical sciences that these positions be staffed by the best available people. Finally, there is the attraction of living and working in the Washington, DC area. There are few other locations which combine the cultural activities, the scenic beauty of the environs, and the sense of excitement that comes with being at the center of vitally important activity.

During the next academic year, the Division of Mathematical Sciences will be looking for at least six Program Directors and a new Division Director. The Directorate for Science and Engineering Education which supports many activities in mathematics education is actively looking to recruit academic mathematicians. In addition, there will undoubtedly be vacancies at the other funding agencies. Finding the most qualified mathematical scientists to staff the federal funding agencies should be a matter of concern to the entire mathematical community.

Anyone who is interested in any of these positions should feel free to contact me at (202)357-9669. In addition I will list the appropriate contacts below:

Dr. Donald Austin
Division of Engineering,
Mathematics, & Geosciences
Office of Basic Energy Sciences
U.S. Department of Energy (MAIL STOP 226)
Washington, DC 20545
(202) 353-5800

Dr. Jagdish Chandra
U.S. Army Research Office (ARO)
Attn: DRXRO-MA
P.O. Box 12211
Research Triangle Park, NC 27709
(919) 549-0641

Major James Crowley
Acting Director of Mathematical
and Information Sciences
AFOSR/NM
Department of the Air Force
Bolling Air Force Base, DC 20332-6448
(202) 767-5025

Dr. Neal Glassman
Acting Head, Mathematical Sciences
Division (Code 1111)
Office of Naval Research (ONR)
Department of the Navy
800 N. Quincy Street
Arlington, VA 22217-5000
(703) 696-4310

Dr. John Thorpe
Deputy Division Director
Division of Materials Development
and Informal Science Education
National Science Foundation
1800 G Street, N.W.
Washington, DC 20550
(202) 357-7452

Dr. Helena S. Wisniewski
Program Manager
Engineering Applications Office
Defense Advanced Research
Projects Agency (DARPA)
1400 Wilson Blvd.
Arlington, VA 22209-2308
(703) 694-5738

John C. Polking
Division Director
Division of Mathematical Sciences

Awards to Stimulate Competitive Research

The National Science Board (NSB) has approved the awarding of grants totalling $23.5 million to eight governmental jurisdictions to improve the quality of science and engineering research in the nation. The NSB is the policymaking body of the National Science Foundation.

The jurisdictions are Alabama, Kentucky, Nevada, North Dakota, Oklahoma, Puerto Rico, Vermont, and Wyoming. Grants will total between $2.5 and $3 million over five years for each jurisdiction.

The grants will be made under NSF's Experimental Program to Stimulate Competitive Research (EPSCoR). The program is designed to improve the quality of science and engineering, to increase the number of scientists and engineers

that are able to compete successfully for federal grants, and to improve the research environment in participating jurisdictions and institutions.

The awards are based on competitive proposals submitted by the jurisdictions following their in-depth evaluation of their needs. The NSF evaluated the merit of these proposals and the potential of each jurisdiction to meet the program's objectives. The seven states and Puerto Rico have pledged a total of $67.9 million to help implement their EPSCoR proposals.

The awards will constitute the second round of NSF's effort to maintain an equitable geographic distribution of research funding while maintaining scientific and technological quality. In the first round Arkansas, Maine, Montana, South Carolina, and West Virginia received five-year EPSCoR awards. –NSF News Release

Conference on Algebraic Topology in Honor of Peter Hilton

Renzo Piccinini and Denis Sjerve, Editors

(Contemporary Mathematics, Volume 37)

This book contains 18 papers in algebraic topology and homological algebra by collaborators and associates of Peter Hilton. It is dedicated to Peter Hilton on the occasion of his 60th birthday. The various topics covered are homotopy theory, H-spaces, group cohomology, localization, classifying spaces, and Eckmann-Hilton duality.

Students and researchers in algebraic topology will gain an appreciation for Peter Hilton's impact upon mathematics from reading this book.

Contents

J. F. Adams, *The fundamental representations of E_8*
Israel Berstein, *On covering spaces and Lie group actions*
A. K. Bousfield, *On the homotopy classification of K-theoretic spectra and infinite loop spaces*
William Browder, *S^1-actions on open manifolds*
F. R. Cohen, *An analogue of "Hopf invariant one"*
W. G. Dwyer and **D. M. Kan**, *Reducing equivariant homotopy theory to the theory of fibrations*
Beno Eckmann, *Surface groups and Poincaré duality*
Leonard Evens and **Stewart Priddy**, *The cohomology of the semi-dihedral group*
Richard Kane, *Finite H-spaces and the $U(M)$ property*
Kee Yuen Lam, *On stable Hopf invariant one elements in RP^∞*
Charles A. McGibbon and **Joseph A. Neisendorfer**, *Various applications of Haynes Miller's theorem*
Ib Madsen and **Jan-Alve Svensson**, *Induction in unstable equivariant homotopy theory and non-invariance of Whitehead torsion*
Mark Mahowald, *Lin's theorem and the EHP sequence*
J. P. May, *Stable maps between classifying spaces*
Joseph Roitberg, *Residually finite, Hopfian and co-Hopfian spaces*
Victor Snaith, *On the classifying spaces of Galois groups*
James Stasheff, *Hilton-Eckmann duality revisited*
K. Varadarajan, *Projective and free approximations*

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Queries

Edited by Hans Samelson and Stuart Antman

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 Queries Column, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940.

Queries

367. Vladik Ya. Kreĭnovich (P. O. Box 21, Leningrad 22, 197022 USSR). The Elo chess rating is based on the following empirical law: The frequency $p(a,b)$ with which a wins against b is of the form $(1+\exp(r(a)-r(b)))^{-1}$, where $r(a)$ is a certain 1-variable function, called the rating. A similar formula holds for the frequency $p(a,b)$ that some person chooses a from the pair (a,b). Is there some general mathematical fact behind this coincidence? E.g., if one assumes that the real strength is $r(a)+z$ with z random, then the probabilistic law for z must be such that for $w=z_1+z_2$ (with z_1, z_2 independent) one has $\text{prob}(w>a)=(1+\exp a)^{-1}$. Are any characteristic properties of this law known (which might lead to a model for the rating formula)?

368. Vladik Ya. Kreĭnovich (P. O. Box 21, Leningrad 22, 197022 USSR). I have proved (on the physical strictness level) that any closed subgroup of the group G of all homeomorphisms of R^3 that contains the group L of all linear transformations coincides either with G or with L. (Replacing R^3 with projective 3-space one also gets the group of all projective transformations as possibility.) What is known about these questions (also for other dimensions, e.g. $n=1$)?

369. Barry L. Zaslove (Department of Mathematics, Northeastern University, Boston, Massachusetts 02115). In his biography of Ramanujan, G. Hardy described a rational prime, 'Littlewood's Number', so immense that "we shall probably never know [its value]." Have modern computers made it possible to find the number?

PARTIALLY ORDERED ABELIAN GROUPS WITH INTERPOLATION

K. R. Goodearl

(Mathematical Surveys and Monographs, Volume 20)

In the past decade a new branch of ordered algebraic structures has grown, motivated by K-theoretic applications and mainly concerned with partially ordered abelian groups satisfying the Riesz interpolation property. This book is the first source in which the algebraic and analytic aspects of these interpolation groups have been integrated into a coherent framework for general reference. The author provides a solid foundation in the structure theory of interpolation groups and dimension groups (directed unperforated interpolation groups), with applications to ordered K-theory particularly in mind.

High points of the development include the following: characterization of dimension groups as direct limits of finite products of copies of the integers; the double-dual representation of an interpolation group with order-unit via affine continuous real-valued functions on its state space; the structure of dimension groups complete with respect to the order-unit norm, as well as monotone sigma-complete dimension groups and dimension groups with countably infinite interpolation; and an introduction to the problem of classifying extensions of one dimension group by another. The book also includes a development of portions of the theory of compact convex sets and Choquet simplices, and an expository discussion of various applications of interpolation group theory to rings and C^*-algebras via ordered K_0. A discussion of some open problems in interpolation groups and dimension groups concludes the book.

Of interest, of course, to researchers in ordered algebraic structures, the book will also be a valuable source for researchers seeking a background in interpolation groups and dimension groups for applications to such subjects as rings, operator algebras, topological Markov chains, positive polynomials, compact group actions, or other areas where ordered Grothendieck groups might be useful.

1980 *Mathematics Subject Classifications*: 06, 46, 19, 16
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358 pages (hardcover), 1986
List price $68, Institutional member $54, Individual member $41
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San Antonio Meetings, January 21–24, 1987

Supplement to Announcement in October Notices

Please refer to the Preliminary Announcement for this meeting which appears on pages 801–829 of the October 1986 issue of *Notices*. The Table of Contents for the preliminary announcement is reproduced below for convenience.

Josiah Willard Gibbs Lecture

The title of the Gibbs lecture to be presented by THOMAS C. SPENCER is *Schrödinger operators and dynamical systems.*

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IMPORTANT DEADLINES

AMS Abstracts	
For consideration for special sessions	**Expired**
Of contributed papers	**Expired**
MAA Abstracts	
Of contributed papers	**Expired**
Employment Register (Applicants & Employers)	**November 15**
EARLY Preregistration and Housing	**October 31**
Preregistration and Housing	**November 15**
MAA Minicourse Preregistration	**November 15**
Motions for AMS Business Meeting	**December 22**
Preregistration cancellations (50% refund)	**January 16**

AMS Special Sessions

Updated lists of speakers are now available for some of the special sessions.

Geometric methods in group theory, ROGER ALPERIN, University of Oklahoma, Thursday 8:00 a.m., Friday 1:00 p.m., and Saturday 8:00 a.m. No change.

Nonlinear partial differential equations, RONALD J. DIPERNA, University of California, Berkeley, Wednesday 2:15 p.m., Thursday 8:00 a.m., and Friday 1:00 p.m. Russell Caflisch, Peter Constantin, Craig Evans, Greg Forest, Kenneth Golden, Robert Kohn, Andrew Majda, David McLaughlin, Graeme Milton, John Neu, George Papanicolaou, Gilbert Strang, and Michael Weinstein.

Classical real analysis, MICHAEL J. EVANS, North Carolina State University, Raleigh, and PAUL D. HUMKE, St. Olaf College, Thursday 8:00 a.m., Friday 1:00 p.m., and Saturday 8:00 a.m. Steven Agronsky, Aliasghar Alijani, J. M. Ash, Jack Brown, Peter Bullen, George Cross, Geraldo Soares de Souza, Jerry Gibson, Paul D. Humke, Lee Larson, Cheng-Ming Lee, Daniel Mauldin, Ibrahim Mustafa, Richard O'Malley, Krzysztof Ostaszewski, Washek F. Pfeffer, Karel Prikry, H. W. Pu, Dan Rinne, Kevin Taylor, S. J. Taylor, Brian Thomson, Daniel Waterman, Clifford Weil, and Wladyslaw Wilczynski.

Brauer groups and Galois theory, BURTON FEIN, Oregon State University, DAVID J. SALTMAN, University of Texas at Austin, and MURRAY SCHACHER, University of California, Los Angeles, Thursday 8:00 a.m., Friday 1:00 p.m., and Saturday 8:00 a.m. Lindsay Childs, Frank Demeyer, Burton Fein, Walter Feit, Timothy Ford, Gary Greenfield, William Habousch, Darrell Haile, Raymond Hoobler, Bill Jacob, Nathan Jacobson, David Leep, Patrick Morandi, N. Shepherd-Baron, and Leonid Stern.

Geometric inequalities, MICHAEL GAGE, University of Rochester, and ERWIN LUTWAK, Polytechnic Institute of New York, Wednesday 2:15 p.m., Thursday 8:00 a.m., and Friday 1:00 p.m. No change.

Stochastic processes and analysis, JOSEPH GLOVER, University of Florida, and A. O. PITTENGER, University of Maryland, Thursday 8:00 a.m., Friday 1:00 p.m., and Saturday 8:00 a.m. R. Banuelos, M. Bramson, A. Carverhill, J. T. Cox, R.W.R. Darling, B. Davis, Joseph Glover, L. Gray, F. Knight, T. Liggett, P. March, T. McConnell, M. Nagasawa, M. Pinsky, L. Pitt, A. O. Pittenger, M. Rao, and R. Schonmann.

Combinatorics and group representations, PHILIP J. HANLON, University of Michigan,

Wednesday 2:15 p.m., Thursday 8:00 a.m., and Friday 1:00 p.m. Lynn Butler, A. R. Calderbank, Persi Diaconis, Adriano Garsia, Ira Gessel, Curtis Greene, Philip J. Hanlon, David Jackson, Joe Kung, Robert Proctor, Jeffrey Remmel, Bruce Sagan, Richard Stanley, Dennis Stanton, John Stembridge, Sheila Sundaram, Dennis White

Theoretical optimization, LYNN MCLINDEN, University of Illinois, Urbana-Champaign, and JAY S. TREIMAN, West Michigan University, Friday 1:00 p.m. and Saturday 8:00 a.m. G. A. Beer, J. M. Borwein, R. W. Chaney, F. H. Clarke, J. Gauvin, K. Georg, A. A. Goldstein, M. S. Gowda, S.-P. Han, L. McLinden, J.-S. Pang, N. S. Papageorgiou, A. B. Poore, H. M. Strojwas, S. Simons, R. A. Tapia, J. S. Treiman, D. E. Ward, and H. Wolkowicz.

Orthogonal polynomials and the moment problem, PAUL G. NEVAI, Ohio State University, Friday 1:00 p.m. and Saturday 8:00 a.m. R. Askey, E. Bannai, T. Chihara, G. Chudnovski, C. Chui, J. Dombrowski, G. Gasper, W. Gautschi, M. Ismail, A. Mate, C. Micchelli, B. Mityagin, J. Nuttall, M. Rahman, E. Saff, and D. Stanton.

Recent results in gauge field theory and Riemannian geometry, LESLEY M. SIBNER, Polytechnic Institute of New York, Wednesday 2:15 p.m., Thursday 8:00 a.m., and Friday 1:00 p.m. Robert Bryant, Dennis DeTurck, Jerry Kazdan, Robert Sibner, and Lorenzo Sadun.

Mathematical physics, GREGORY P. WENE, University of Texas, San Antonio, Saturday 8:00 a.m. A. Bohm, L. C. Biedenharn, John R. Klauder, Robert H. Oehmke, James Stasheff, and R. O. Wells, Jr.

Geometrical variational problems, BRIAN WHITE, Stanford University, Friday 1:00 p.m. and Saturday 8:00 a.m. No change.

Panel Discussion on the Effect of Department of Defense Funding on Mathematics

A panel discussion on *The effect of Department of Defense funding on mathematics* is being organized by WILLIAM BROWDER of Princeton University and RONALD G. DOUGLAS of SUNY at Stony Brook. This panel will take place at 7:30 p.m. on Thursday, January 22.

Other MAA Sessions

There will be a panel on *Approval voting* on Saturday, January 24, from 2:15 p.m. to 3:30 p.m. The moderator is PHILIP D. STRAFFIN, JR., Beloit College. Speakers are STEVEN J. BRAMS, New York University, and SAMUEL MERRILL, III, Wilkes College and Yale University.

The session on *The leading edge of software*, being organized by WARREN PAGE, has been moved to Thursday, January 22, from 7:30 p.m. to 9:30 p.m. Speakers include THOMAS BANCHOFF, Brown University, *The educational differential geometry environment (EDGE)*; HARRY LEWIS, Harvard University, *Computer graphics for teaching and learning multivariable calculus*; and JUDAH L. SCHWARTZ, Massachusetts Institute of Technology and Harvard University, *Fostering conjectures and exploration in Euclidean geometry*. For further information contact the session organizer, Warren Page, New York City Technical College, 300 Jay Street, Brooklyn, New York 11201.

The name of the organizer of the presentation on *The mathematical competition in modeling (MCM)* on Thursday, January 22, at 2:15 p.m. was incorrectly given in the October issue. The correct name is BERNARD A. FUSARO.

MAA Films

The program for the MAA films is as follows:

7:30 p.m. – *Fly Lorenz*

7:50 p.m. – *Planar double pendulum*

8:25 p.m. – *On size and shape: Overview*

9:00 p.m. – *The impossible dream: Election theory*

Activities of Other Organizations

The days and times of the program for the Association for Women in Mathematics have changed as follows:

The seventh annual Emmy Noether Lecture has moved to 9:00 a.m. on Thursday, January 22.

The panel discussion on *Responses to the David Report: Initiatives for women and minorities* has been moved to Wednesday, January 21 at 3:20 p.m.

The AWM Business Meeting will be held at 4:20 p.m. on Wednesday, January 21.

A reception being planned by AWM will be held at 9:30 p.m. on Wednesday, January 21.

The name of the speaker in the National Meeting of Department Heads on Thursday, January 22, at 7:00 p.m. who will be speaking on *Master's degrees in the mathematical sciences for small schools* was incorrectly given in the October issue. The correct name is BERNARD A. FUSARO.

AMS-MAA Symposium

The AMS-MAA Symposium on *The role of mathematicians in pre-college education* has been changed to begin at 7:30 p.m. on Thursday, January 22. An additional speaker is LARRY HATFIELD, University of Georgia.

The Preregistration/Housing Form, Employment Register Forms, with instructions, and the Minicourse Preregistration Form can be found at the back of this issue.

Robert M. Fossum
Urbana, Illinois — Associate Secretary

Honolulu, March 26–28, 1987, University of Hawaii at Manoa

First Announcement of the 832nd Meeting

The eight hundred and thirty-second meeting of the American Mathematical Society will be held at the University of Hawaii in Honolulu, Hawaii, on Thursday, Friday and Saturday, March 26–28, 1987. This meeting will be held in conjunction with the Northern California section of the Mathematical Association of America.

The sessions will be held in Keller Hall, 3rd and 4th floors. The invited addresses will be delivered in the auditorium of the Physical Science Building which is connected to Keller Hall by overpasses. Keller Hall is across The Mall from the Hamilton Library.

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:

EDWARD A. BERTRAM, University of Hawaii at Manoa.

MARTIN SCHARLEMANN, University of California, Santa Barbara.

The titles of their talks are not yet available.

Special Sessions

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

Algebraic topology, CHRISTOPHER J. ALLDAY and HEINER DOVERMANN, University of Hawaii at Manoa.

Low-dimensional topology, STEVEN BLEILER, University of British Columbia.

Complex function theory, GEORGE CSORDAS, WAYNE SMITH, and DAVID STEGENGA, University of Hawaii at Manoa.

Rings and modules, KENT R. FULLER, University of Iowa.

Combinatorics, JERROLD GRIGGS, University of South Carolina, Columbia.

Set theory and its applications, THOMAS JECH, Pennsylvania State University.

Differential geometry, PETER LI, University of Utah, RICHARD M. SCHOEN, University of California, Berkeley, and S.-T. YAU, University of California, San Diego.

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 12, 1987**, three weeks before the deadline for contributed papers, in order that it may be considered for inclusion. Participants are reminded that a charge of $16 is 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, Post Office Box 6248, Providence, Rhode Island 02940, so as to arrive before the **February 2, 1987**, abstract deadline. Participants are reminded that a charge of $16 is imposed for retyping abstracts that are not in camera-ready form. Late papers will not be accommodated.

MAA Program

The MAA program will take place mostly on Saturday and will include addresses by VICTOR KLEE, JR., University of Washington; IVAN NIVEN, University of Oregon; and HENRY O. POLLAK, Bell Communications Research. The titles of their lectures will be announced at a later date.

Registration

The meeting registration desk will be located on the fourth floor of Keller Hall and will be open from 9:00 a.m. to 11:00 a.m. and 1:00 p.m. to 3:00 p.m. on Thursday and Friday, and from 9:00 a.m. to 11:00 a.m. on Saturday. The registration fees are $10 for members of the AMS or MAA, $16 for nonmembers, and $5 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information can be found in a box in the San Antonio meeting announcement in the October issue of *Notices*.

Accommodations

A block of rooms is being held for meeting participants in the Hale Manoa and Hale Kuahine residence halls at the East-West Center on the campus. Participants should make reservations by writing to Dr. Adolf Mader, Department of Mathematics, 2565 The Mall, University of Hawaii at Manoa, Honolulu, Hawaii 96822. The rates are $14 for single occupancy, $17 for single occupant in a double room, and $19 per person for double occupancy. A deposit is not required, but the one-night rate for a room reserved will be charged if the reservation is not cancelled at least 72 hours prior to anticipated check-in.

Lincoln Hall, also at the East-West Center, has hotel-like rooms with rates ranging from $22 to $37 per night, however it is uncertain whether these rooms will be available since priority is given to visitors at the East-West Center.

NOTE: Childen cannot be accommodated in sleeping rooms at the East-West Center residence halls.

A block of rooms is also being held at the following hotel at Waikiki. Participants should make their reservations as early as possible, and be sure to mention participation in the AMS-MAA meeting at the University of Hawaii. Rates are subject to change by 1987, and do not include the 4.17 percent state sales tax and 5.25 percent hotel room tax. A credit card number or check as a deposit to cover the room rate for one night must be provided when making reservations. The deposit will be refunded if necessary, provided that cancellation is received a minimum of 72 hours prior to anticipated check-in.

Waikiki Plaza Hotel
2045 Kalakaua Avenue, Honolulu 96815
Telephone: 800-367-8047, extension 101, or 808-955-6363
Single $44 Double $44
Triple $54 Quadruple $64

Although rooms have **not** been blocked at the following locations, they are included here for information purposes. Again, rates do not include applicable taxes and are subject to change. Unless indicated otherwise, the rate indicated for single occupancy is generally the same when room is occupied by two persons.

Ala Wai Terrace Hotel
1547 Ala Wai Boulevard, Honolulu 96815
Telephone: 800-367-5170 (U.S.), 800-826-6786 (Canada), or 808-926-0679
Single $28 to $47

The Ala Wai Terrace also has special weekly and 30-day rates, and all rooms have kitchen facilities equipped with pots, pans, and linens.

Hilton Hawaiian Village
2005 Kalia Road, Honolulu 96815
Telephone: 800-HILTONS or 808-949-4321
Single $80 to $140

Holiday Inn-Waikiki Beach
2570 Kalakaua Avenue, Honolulu 96815
Telephone: 800-HOLIDAY or 808-922-2511
Single $68 to $78, $85, $98

Hyatt Regency Waikiki
2424 Kalakaua Avenue, Honolulu 96815
Telephone: 800-228-9000 or 808-922-9292
Single $90 to $190

Island Colony Hotel
445 Seaside Avenue, Honolulu 96815
Telephone: 800-367-5124 or 808-923-2345
Single $55 to $85 (Studios)

New Otani Kaimana Beach Hotel
2863 Kalakaua Avenue, Honolulu 96815
Telephone: 800-421-8795 or 808-923-1555
Single $56 to $125 Double $62 to $125

The New Otani is at the outer end of Waikiki and on the beach.

Quality Inn Waikiki
175 Paoakalani Avenue, Honolulu 96815
Telephone: 800-367-2317
Single $39 to $52 Double $42, $55

Reef Hotel
2169 Kalia Road, Honolulu 96815
Telephone: 800-367-5170 or 808-923-3111
Single $45 to $85

Food Service

The Campus Center Cafeteria is scheduled to be open Monday through Friday from 7:00 a.m. to 1:30 p.m. during the meeting. In addition, a variety of restaurants are located on University Avenue, Beretania, and King Streets, within easy walking distance (10 to 15 minutes). A list of restaurants with street map attached will be available at the meeting registration desk. In addition to the usual fast food places, there is a variety of Chinese, Hawaiian, Korean, Mexican, and Japanese restaurants.

Travel

Honolulu is located on the island of Oahu, two time zones west of the Pacific Time Zone states. It is served by most major airlines, and there are many flights daily. Flying time from the west coast of the U.S. mainland to Honolulu is approximately four and one-half hours. Because this is a vacation resort area and March is still the high season, participants are advised to make hotel, airline, and car rental reservations as early as possible.

The University of Hawaii at Manoa is situated east of Honolulu, near Waikiki Beach. The bus system in Honolulu is quite good. To go from Waikiki to the University, take bus #4 Nuuanu-Dowsett and for the reverse trip take bus #4 University-Waikiki; the bus stops are located on University Avenue. The buses run every 15 minutes and require 60 cents in exact change each way.

Participants driving to the campus from Waikiki are advised to proceed northwest on Ala Wai Boulevard and take the first right onto McCully Street; take the first right turn off McCully onto Kapiolani Boulevard, then turn left onto University Avenue (the first street which **crosses** Kapiolani). Proceed north to Dole Street and turn right; continue on Dole Street to East-West Road and turn left. Visitor parking is at the lot between the Kennedy Theater of the East-West Center and the Keller Hall/Physical Sciences Building. The parking fee is 50 cents per hour.

Persons driving to the campus via the Lunalilo Freeway should take the University Avenue exit and proceed north on University Avenue,

then follow the instructions in the preceding paragraph.

Weather

The weather at this time of the year should be warm and sunny, with occasional showers in the morning and near the mountains. The average high for March is 81.5° F, and the average low is 67.5° F; the record high is 88° F and record low is 55° F. Only light, informal clothing is required.

Salt Lake City, Utah

Hugo Rossi
Associate Secretary

"This book is a must for anyone deeply interested in Geometric Function Theory."
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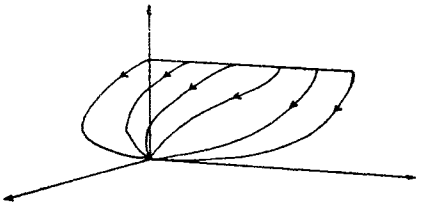
– David A. Brannan
The Open University, U. K.

Topics in Complex Analysis

Dorothy Brown Shaffer, Editor



The unifying theme of the lectures, presented at the AMS meeting in October, 1983, at Fairfield University was Geometric Function Theory. Some of the papers concern: the class Σ, its support points and extremal configuration; support points for the class S, Loewner chains and the process of truncation; estimates on the radial growth of the derivative of univalent functions; and a conjecture of Bombieri proved for some cases. Because the proof of the Bieberbach conjecture was not known at the time of preparation of the papers, many of the authors, as well as experts in the field, were interviewed regarding the effect of the proof of the conjecture. Their ideas regarding future trends in research in complex analysis are presented in the epilogue. A graduate level course in complex analysis provides a sufficient background for understanding this material.

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Kent, April 3–4, Kent State University

First Announcement of the 833rd Meeting

The eight hundred and thirty-third meeting of the American Mathematical Society will be held at Kent State University in Kent, Ohio, on Friday and Saturday, April 3–4, 1987.

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 are as follows:

WILLIAM G. DWYER, University of Notre Dame, *Solving classification problems in algbraic topology.*

PETER LOEB, University of Illinois, Urbana-Champaign, *Standard Brownian motion in non-standard coin tossing.*

RIDGWAY SCOTT, University of Michigan, Ann Arbor, title to be announced.

LUCIEN SZPIRO, Ecole Normale Superieure and Mathematical Sciences Research Institute, Berkeley, title to be announced.

Special Sessions

By invitation of the same committee, there will be special sessions of selected twenty-minute papers. The topics of the sessions and the names and affiliations of the organizers have not been finalized at this writing. The information will be published in the January issue of *Notices.*

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, Post Office Box 6248, Providence, Rhode Island 02940, so as to arrive before the **February 4, 1987**, abstract deadline. Participants are reminded that a charge of $16 is imposed for retyping abstracts that are not in camera-ready form.

Information concerning registration, accommodations, food service, etc., will be available in the January issue of *Notices.*

Robert M. Fossum
Urbana, Illinois — Associate Secretary

Ten Lectures on Operator Algebras

William Arveson

This book makes available to a wider audience the lectures on nonselfadjoint operator algebras given by the author at a conference in Texas in 1983. The theory of nonselfadjoint algebras has for long been the Cinderella of operator algebra theory but, mainly because of the work of Arveson and his students, it is now beginning to establish itself alongside the "ugly sisters" of $C*$-algebra and von Neumann algebra theory.

Those familiar with the author's expository style will not be surprised to find that these ten lectures are beautifully presented, extremely readable and full of new insights. Topics covered include commutative subspace lattices and problems of spectral synthesis, the absorption principle and its application to solve the similarity problem, quasitriangular algebras and applications to single operator theory. There is also a very interesting section on dilation theory and its use in proving the Feynman-Kac formula.

– *E. Christopher Lance*
University of Leeds

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Newark, April 25–26, New Jersey Institute of Technology

First Announcement of the 834th Meeting

The eight hundred and thirty-fourth meeting of the American Mathematical Society will be held at New Jersey Institute of Technology in Newark, New Jersey, on Saturday and Sunday, April 25–26, 1987.

Invited Addresses

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

ROBERT V. KOHN, New York University, Courant Institute of Mathematical Sciences, *Determining conductivity by boundary measurements*, 1:30 p.m. Sunday.

RODOLFO R. ROSALES, Massachusetts Institute of Technology, title to be announced, 11:15 a.m. Saturday.

BIRGIT SPEH, Cornell University. *Local behavior in finite element methods: An overview*, 11:00 a.m. Sunday.

LARS B. WAHLBIN, Cornell University, *Local behavior in finite element methods: An overview*, 11:00 a.m. Sunday.

These four invited lectures will be presented in the Theater on the NJIT Campus.

Special Sessions

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

Inverse problems, DALJIT SINGH AHLUWALIA, New Jersey Institute of Technology, and ROBERT V. KOHN.

Computational mathematics and applications, ROMAN ANDRUSHKIW and ROY PLASTOCK, New Jersey Institute of Technology.

Nonlinear dynamics and chaos, DENIS BLACKMORE, New Jersey Institue of Technology.

Cellular automata and symbolic dynamics, ROBERT H. GILMAN, Stevens Institute of Technology.

Differential geometry, VLADISLAV V. GOLDBERG, New Jersey Institute of Technology.

Harmonic analysis on reductive p-adic Lie groups, C. DAVID KEYS, Rutgers University, Newark.

Unitary representations, cohomology and G/Γ, ANTHONY W. KNAPP, SUNY at Stony Brook and Cornell University.

Nonlinear functional analysis, PETRONIJE MILOJEVIĆ, New Jersey Institute of Technology.

Group actions on manifolds, JOHN D. RANDALL and MARK STEINBERGER, Rutgers University, Newark.

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 16, 1987**, three weeks before the deadline for contributed papers, in order that it may be considered for inclusion. Participants are reminded that a charge of $16 is 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, Post Office Box 6248, Providence, Rhode Island 02940, so as to arrive before the **February 2, 1987**, abstract deadline. Participants are reminded that a charge of $16 is imposed for retyping abstracts that are not in camera-ready form. It is unlikely that late papers can be accommodated.

Computer Mathematics Exhibit

By invitation of the Center for Nonlinear Science and Mathematical Computation of NJIT, several leading computer vendors will display their latest mathematics (graphics) hardware and software in the Ballroom of The Center at NJIT during and after the Saturday dinner (see below). Mathematicians interested in participating as exhibitors should contact Denis Blackmore at the NJIT Department of Mathematics; the telephone number is 201-596-3492.

Registration

The meeting registration desk will be located in the Lobby of The Center. The desk will be open from 8:15 a.m. to 3:00 p.m. on Saturday, and from 8:15 a.m. to 11:00 a.m. on Sunday. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Social Event

A buffet dinner featuring Spanish and Portugese cuisine will take place from 5:30 p.m. to 7:00 p.m. on Saturday, April 25, in the Ballroom at The Center. The price for the dinner will

be announced in the January issue of *Notices*. Reservations are necessary and may be obtained by calling or writing to Denis Blackmore at the Department of Mathematics; the telephone number is 201-596-3492. Participants must pay for their dinner ticket at the registration desk prior to 3:00 p.m. on Saturday; tickets will not be available after that time.

Petition Table

A petition table will be set up in the registration area. Additional information can be found in a box in the San Antonio meeting announcement in the October issue of *Notices*.

Accommodations

Rooms have been blocked at the Hilton Gateway Hotel in downtown Newark, which is about 3/5 mile from campus. Participants should make their own reservations directly with the hotel, identifying themselves as attending the American Mathematical meeting at NJIT. The cutoff date for reservations is April 10, 1987.

Hilton Gateway Hotel
Gateway Center
Raymond Boulevard
Newark, NJ 07102
Telephone: 201-622-5000
Single $62 Double $62

A number of additional motels which are located three to five miles from the campus will be listed in the next announcement.

Food Service

The Center cafeteria will be open from 8:30 a.m. to 4:30 p.m. on Saturday, and from 11:00 a.m. to 5:00 p.m. on Sunday. The Center Pub, offering food as well as alcoholic beverages, will also be open during the weekend.

Several fine Spanish and Portuguese restaurants are located in the Ironbound district of Newark, within easy walking distance of the Hilton Gateway Hotel. A list of restaurants will be available at the meeting registration desk.

Travel

Newark International Airport, which is about five miles from the NJIT campus, is served by most major airlines. Several car rental agencies have counters at the airport terminal. The taxi fare from the airport to downtown Newark is approximately $10 to $12. An inexpensive ($2.50) minibus, Newark Airlink, provides service on the half hour to Newark's Pennsylvania Station which is across the street from the Hilton Gateway Hotel. Most hotels and motels provide complimentary limousine service to their guests, which can be summoned by using the courtesy phones at the airport terminal.

Regularly scheduled limousine service between the airport and downtown Newark is available through Newark Airport Limousine and Car Service. The current one-way fare is a flat rate of $15 for one to four persons per car. Reservations should be made a day in advance by calling 201-242-5012.

Newark is also served by AMTRAK trains and Greyhound Bus Lines, with both arriving at and departing from Newark's Pennsylvania Station.

Participants staying at the Hilton Gateway Hotel who do not wish to walk to the NJIT campus can cross the street to Pennsylvania Station and take the subway train to the Warren Street station, which is adjacent to the campus. The current one-way fare is 30 cents.

Persons arriving by car may reach New Jersey Institute of Technology via the Garden State Parkway and the New Jersey Turnpike from North and South, and via Interstate Route 280 from East and West.

From the Garden State Parkway: Take Exit 145 to Route 280 East, staying in the right lane, and follow signs marked "High Street-Harrison". Take High street Exit 14A and turn right at the traffic light; proceed through three traffic lights and NJIT campus is one block further on the right.

From New Jersey Turnpike: Take Exit 15W to Route 280 West and proceed to the State Street Exit, Newark. Turn left at foot of the ramp and go one short block to stop sign. Turn left onto Dr. Martin Luther King, Jr. Boulevard and proceed through four traffic lights. The NJIT campus is one block further on the right.

From Routes 1, 9 or 22: Northbound traffic departs at exit marked "Newark" which leads to McCarter Highway (Route 21) through Newark. At the major business district, turn left onto Raymond Boulevard; the NJIT campus is several blocks west of the business district, at the end of Raymond Boulevard.

From New York Thruway: Exit 14A connects directly to the Garden State Parkway, then follow the Parkway directions above.

From George Washington Bridge: Follow New Jersey Turnpike south to Exit 15W onto Route 280 West; then follow westbound directions above.

From Lincoln Tunnel: Proceed west on Route 3 to New Jersey Turnpike, south to Exit 15W to Route 280 West, and follow westbound directions above.

From Holland Tunnel: Follow signs to New Jersey Turnpike; take the Turnpike north to Exit 15W to Route 280 West, and follow westbound directions above.

Parking

Ample free parking for meeting participants will be available in Lots #3 and #11 on the NJIT campus.

W. Wistar Comfort
Middletown, Connecticut Associate Secretary

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.

San Antonio, January 1987

Marc Culler
Ronald J. DiPerna
Richard T. Durrett
Robert M. Hardt
Peter D. Lax (Colloquium Lecturer)
Edward N. Lorenz (AMS-MAA)
Robert J. McEliece
Uta C. Merzbach (AMS-MAA)
David J. Saltman
Lesley M. Sibner
Thomas C. Spencer (Gibbs Lecturer)

Honolulu, March 1987

Edward A. Bertram
Martin Scharlemann

Kent, April 1987

William G. Dwyer
Peter Loeb
Ridgway Scott
Lucien Szpiro

Newark, April 1987

Robert V. Kohn
Rodolfo R. Rosales
Birgit Speh
Lars B. Wahlbin

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 *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

January 1987 Meeting in San Antonio

Associate Secretary: Robert M. Fossum

Deadline for organizers: Expired
Deadline for consideration: Expired

Roger Alperin, *Geometric methods in group theory*
Ronald J. DiPerna, *Nonlinear partial differential equations*
Michael J. Evans and Paul D. Humke, *Classical real analysis*
Burton Fein, David J. Saltman, and Murray Schacher, *Brauer groups and Galois theory*
Michael Gage and Erwin Lutwak, *Geometric inequalities*
Joseph Glover and A. O. Pittenger, *Stochastic processes and analysis*
Philip J. Hanlon, *Combinatorics and group representations*
Paul G. Nevai, *Orthogonal polynomials and the moment problem*
Lesley M. Sibner, *Recent results in gauge field theory and Riemannian geometry*
Lynn McLinden and Jay S. Treiman, *Theoretical optimization*
Gregory P. Wene, *Mathematical physics*
Brian White, *Geometrical variational problems*

March 1987 Meeting in Honolulu

Far Western Section

Deadline for organizers: Expired
Deadline for consideration: January 12, 1987

Christopher J. Allday and Heiner Dovermann, *Algebraic topology*
Steven Bleiler, *Low dimensional topology*
George Csordas, Wayne Smith, and David Stegenga, *Complex function theory*
Kent R. Fuller, *Rings and modules*
Jerrold Griggs, *Combinatorics*
Thomas Jech, *Set theory and its applications*
Peter Li, Richard Schoen, and S.-T. Yau, *Differential geometry*

April 1987 Meeting in Kent

Central Section

Deadline for organizers: Expired
Deadline for consideration: January 14, 1987

April 1987 Meeting in Newark

Eastern Section

Deadline for organizers: Expired
Deadline for consideration: January 16, 1987

Daljit Singh Ahluwalia and Robert V. Kohn, *Inverse problems*
Roman Andrushkiw and Roy Plastock, *Computational mathematics and applications*
Denis Blackmore, *Nonlinear dynamics and chaos*
Robert H. Gilman, *Cellular automata and symbolic dynamics*
Vladislav V. Goldberg, *Differential geometry*
C. David Keys, *Harmonic analysis on reductive p-adic Lie groups*
Anthony W. Knapp, *Unitary representations, cohomology and G/Γ*
Petronije Milojević, *Nonlinear functional analysis*
John D. Randall and Mark Steinberger, *Group actions on manifolds*

Spring 1987 Meeting

Southeastern Section
No meeting will be held

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 *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 *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. Contributors should know that there is a limitation in size of a single special session, so that it is sometimes true that all places are filled by invitation. Papers not accepted for a Special Session are considered as ten-minute contributed papers.

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.

Symposium on Some Mathematical Questions in Biology
Models in Population Biology

Chicago, Illinois, February 18, 1987

The twenty-first annual Symposium on Some Mathematical Questions in Biology will be held on Wednesday, February 18, 1987, in the Acapulco Room of the Hyatt Regency Chicago in conjunction with the annual meeting of the American Association for the Advancement of Science. The symposium is sponsored by the American Mathematical Society, the Society for Industrial and Applied Mathematics, and Section A (Mathematics) of the American Association for the Advancement of Science.

Details regarding registration, local arrangements, and program information for the AAAS meeting will appear in the November 21 issue of *Science*.

The AMS-SIAM Committee on Mathematics in the Life Sciences serves as the Organizing Committee for the symposium. The committee consists of Gail A. Carpenter (Northeastern University); Kenneth L. Lange (Massachusetts Institute of Technology); Hans G. Othmer (University of Utah); Alan S. Perelson (Los Alamos National Laboratory); Richard E. Plant, chairman (University of California, Davis); and John Rinzel (National Institutes of Health).

The theme of the symposium is Models in Population Biology. There will be two half-day sessions, each including three one-hour lectures.

PROGRAM

Chairman: Alan M. Hastings

9:00 a.m. **Some Mathematical Questions in Biology—Models in Population Biology**
Presiding: ROBERT BOYD, University of California, Los Angeles

Evolutionary models of social learning. ROBERT BOYD, University of California, Los Angeles

Diffusion model for migration and selection. THOMAS NAGYLAKI, University of Chicago

Multilocus population genetics models. ALAN M. HASTINGS, University of California, Davis

2:30 p.m. **Some Mathematical Questions in Biology—Models in Population Biology**
Presiding: ALAN M. HASTINGS, University of California, Davis

The maintenance of plasmids and transposons in bacterial populations. BRUCE R. LEVIN, University of Massachusetts, Amherst

Interactions between environment and competition: Community structure in a variable environment. PETER L. CHESSON, Ohio State University

Detecting order in the chaos of nature: Nonlinear ecology and epidemiology. WILLIAM M. SCHAFFER, University of Arizona

1987 Summer Seminar In Applied Mathematics, April 30 – May 9

Computational Aspects of VLSI Design with an Emphasis on Semiconductor Device Simulation

The eighteenth AMS-SIAM Summer Seminar in Applied Mathematics will be held April 30 – May 9, 1987, at the Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. The seminar will be sponsored jointly by the American Mathematical Society, the Society for Industrial and Applied Mathematics and the Institute for Mathematics and its Applications. It is anticipated that it will be supported by grants from federal agencies. The topic, *Computational aspects of VLSI design with an emphasis on semiconductor device simulation*, was selected by an AMS-SIAM Committee on Applied Mathematics whose members at the time were C. K. Chu, Constantine M. Dafermos, James M. Hyman, Alan G. Konheim, George C. Papanicolaou (chairman), and Robert F. Warming. The proceedings of the seminar will be published by the Society in the *Lectures in Applied Mathematics* series.

The seminar will form a part of the 1986–1987 Institute for Mathematics and its Applications program on Scientific Computation. The design of very large scale integrated (VLSI) semiconductor devices is an important problem in a variety of technological applications. The goal of simulation is to remove the need of actually fabricating prototype chips in order to study their behavior and optimize their design. Even the simplest system of partial differential equations which can be used to model semiconductor devices poses severe computational challenges. This is true partly because of the strong nonlinearity of the system and partly because of the large and rapid variations in the solution.

The first three days of the seminar will feature a series of three lectures each on process modeling by R. W. DUTTON of Stanford University, on device modeling by W. FICHTNER of the ETH, Zurich, and on circuit modeling by A. SANGIOVANNI-VINCENTELLI of the University of California, Berkeley. These lectures will be expository in nature and will introduce the subject to the participants. The following week will feature lectures of a more technical nature by a set of speakers including R. BANK of University of California, San Diego; J. BLUE of National Bureau of Standards; F. BREZZI of the Universita di Pavia; W. COUGHRAN of AT&T Bell Labs; P. DEGOND of Ecole Polytechnique; J. JEROME of Northwestern University; T. KERKHOVEN of Yale University; P. MARKOWICH of Technical University of Vienna; H. MITTLEMAN of Arizona State University; L. PETZOLD of Lawrence Livermore National Laboratories; C. RAFFERTY of Stanford University; C. RINGHOFER of Arizona State University; and D. ROSE of Duke University. These speakers have been invited by the Organizing Committee which consists of Randolph Bank (chairman), William Coughran, Eric Grosse, R. Kent Smith, and Mitchell Luskin. In order to allow ample time for informal discussion among participants, only three lectures per day will be presented.

A brochure will be available from the AMS office which includes a description of the scientific program, information on accommodations, and local information. Each participant will pay a $20 social fee to cover the cost of refreshments served at breaks and for social events. There will also be a seminar registration fee. A copy of the proceedings will be available to registered participants as a privilege of participation in the seminar.

Those interested in attending the seminar should send the following information to Betty A. Verducci, Conference Coordinator, American Mathematical Society, P. O. Box 6248, Providence, RI 02940 **by February 13, 1987**.

Please type or print the following:

1. Full name;
2. Mailing address;
3. Telephone number and area code for office and home;
4. Anticipated arrival and departure dates;
5. Your scientific background relevant to the topic of the seminar;
6. Financial assistance requested (please estimate cost of travel);
7. Indicate if support is not required, and if interested in attending even if support is not offered.

Participants who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are very limited and individuals who can obtain support from other sources should do so.

Graduate students who have completed at least one year of graduate school are encouraged to participate.

Joint Summer Research Conferences in the Mathematical Sciences

University of Colorado, Boulder, June 14 to July 25
and Cornell University, July 12 to August 15, 1987

The 1987 Joint Summer Research Conferences in the Mathematical Sciences will be held at the University of Colorado, Boulder, from June 14 to July 25, and at Cornell University, from July 12 to August 15. It is anticipated that the series of conferences will be supported by grants from the National Science Foundation and other agencies.

There will be five conferences in five different areas of mathematics to be held at each institution. The topics and organizers for the conferences were selected by the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences from proposals submitted by individuals and topics suggested by committee members. 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 are similiar in scientific structure to those held throughout the year at Oberwolfach. They 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 support 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. In the spring a brochure will be mailed to all who are invited to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel and local information and a Residence Housing Form to use for on-campus housing accommodations. Information on off-campus housing will also be included in the brochure. Participants are required to make their own housing and travel arrangements. Each participant will be required to pay a fee of $25 to cover the cost of social events and refreshments served at breaks, in addition to a $15 registration fee.

Those interested in attending one of the conferences should send the following information to Carole Kohanski, Summer Research Conference Coordinator, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

Please type or print the following:

1. Title and dates of conference desired
2. Full name
3. Mailing address
4. Telephone number & area code for office and home
5. Your scientific background relevant to the topic of the conference
6. Financial assistance requested. Please estimate cost of travel.
7. Indicate if support is not required, and if interested in attending even if support is not offered.

The deadline for receipt of applications is March 2, 1987. After that date the Organizing Committee for each conference will consider the requests (selection of the participants and the allocation of support is made by the Organizing Committee.) You will be notified by the AMS of the committee's decision no later than May 1, 1987. Funds available for these conferences are limited and individuals who can obtain support from other sources should do so. Women and members of minority groups are encouraged to apply and participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the chairman or any member of the Organizing Committee.

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. The following Committee members chose the topics for the 1987 conferences: William B. Arveson, Ronald L. Graham, Benedict H. Gross, Malcolm R. Leadbetter, Angus J. Macintyre, Jerrold E. Marsden (Chairman), John R. Martin, James McKenna, Tilla Klotz Milnor, Evelyn Nelson, Katusumi Nomizu.

Descriptions of the subject matter of each of the 1987 Conferences appeared in the October *Notices*, pages 836 to 839; they were accompanied by lists of members of the respective organizing committees.

University of Colorado, Boulder

June 14 to June 20

Categories in computer science and logic

JOHN W. GRAY (University of Illinois at Urbana-Champaign), Chairman

June 21 to June 27

Hamiltonian dynamical systems

KENNETH MEYER (University of Cincinnati), Co-Chairman

DON SAARI (Northwestern University), Co-Chairman

June 28 to July 4

Graphs and algorithms

JOE BUHLER (Reed College), Co-Chairman

PHYLLIS CHINN (Humboldt State University), Co-Chairman

July 5 to July 11

Geometry of group representations

WILLIAM GOLDMAN (University of Maryland), Co-Chairman

ANDY MAGID (University of Oklahoma), Co-Chairman

July 19 to July 25

The connection between infinite dimensional and finite dimensional dynamical systems

BASIL NICOLAENKO (Los Alamos National Laboratories), Chairman

Cornell University

July 12 to July 18

Mathematical developments arising from linear programming

JEFFREY C. LAGARIAS (AT&T Bell Laboratories), Co-Chairman

MICHAEL TODD (Cornell University), Co-Chairman

July 19 to July 25

Geometry of random motion

RICHARD DURRETT (Cornell University), Co-Chairman

MARK PINSKY (Northwestern University), Co-Chairman

July 26 to August 1

Crystal growth and pattern formation in phase transitions

STUART P. HASTINGS (SUNY at Buffalo), Co-Chairman

NICHOLAS D. KAZARINOFF (SUNY at Buffalo), Co-Chairman

August 2 to August 8

Complex analytic dynamics

JOHN H. HUBBARD (Cornell University), Chairman

August 9 to August 15

Statistical inference from stochastic processes

NARAHARI U. PRABHU (Cornell University), Chairman

Joint Mathematics Meetings

August 5–8, 1987
University of Utah
Salt Lake City, Utah

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 *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. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on special meetings should be sent to the Editor of *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 *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.

1986–1987. **Academic Year Devoted to Algebraic Geometry**, Mittag-Leffler Institute, Djursholm, Sweden. (January 1986, p. 130)

1986–1987. **Special Year in Modern Analysis**, University of Illinois at Urbana-Champaign, Urbana, Illinois.
Program: Synthesis of Modern and Classical Analysis.
Invited Speakers: G. Weiss, Y. Meyer, A. Pelczynski, E. Hewitt, P. Enflo, J. Kahane, B. Beauzamy, R. Fefferman, A. Chang, J. Arazy, J. Lindenstrauss, P.W. Jones, N. Varopoulos, T. Wolff, W. Johnson, W. Davis, J. Shapiro.
Information: Special Year in Modern Analysis, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801.

October 12, 1986–December 13, 1987. **Mathematisches Forschungsinstitut Oberwolfach** (Weekly Conferences), Federal Republic of Germany. (October 1986, p. 840)
Information: Institute Director, Albertstrasse 24, D-7800 Freiburg, Federal Republic of Germany.

NOVEMBER 1986

2–6. **Fall Joint Computer Conference**, Dallas, Texas. (March 1986, p. 370)

3. **Inner Product Modules over C*-algebra**, Quaid-I-Azam University, Islamabad, Pakistan.
Speaker: N. Mohammad.
Information: Q. Mushtaq, Department of Mathematics, Quaid-I-Azam University, Islamabad, Pakistan. Telephone: 829189.

3–7. **Workshop on Numerical Algorithms for Modern Parallel Computer Architectures**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. (March 1986, p. 370)

9–15. **Austrian Symposium on History of Mathematics**, Neuhofen an der Ybbs, Austria. (June 1986, p. 559)

10. **Coset Diagrams for the Homomorphic Image of** $\Delta(2,3,6)$, Quaid-I-Azam University, Islamabad, Pakistan.
Speaker: F. Shaheen.
Information: Q. Mushtaq, Department of Mathematics, Quaid-I-Azam University, Islamabad, Pakistan. Telephone: 829189.

10–15. **Workshop on Artin *L*-functions and Related Topics**, Université de Montréal, Québec, Canada. (March 1986, p. 370)

10–28. **Workshop on Representation Theory of Lie Groups**, International Centre for Theoretical Physics, Trieste, Italy. (June 1986, p. 560)

17. **Some Problems in Unbiased Estimation**, Quaid-I-Azam University, Islamabad, Pakistan.
Speaker: A. Baloch.
Information: Q. Mushtaq, Department of Mathematics, Quaid-I-Azam University, Islamabad, Pakistan. Telephone: 829189.

18–22. **Didactique des Mathématiques**, Marseille, France. (June 1986, p. 560)

19–21. **Cours Modulef: Une Bibliothèque Modulaire d'Éléments Finis**, Rocquencourt, France. (August 1986, p. 653)

24. **An Application of Algebra to Absolute Centre Problems**, Quaid-I-Azam University, Islamabad, Pakistan.
Speaker: J. Zaidi.
Information: Q. Mushtaq, Department of Mathematics, Quaid-I-Azam University, Islamabad, Pakistan. Telephone: 829189.

24–26. **Trois Journées sur le Codage**, Cachan, France. (August 1986, p. 653)

24–28. **Géométrie Symplectique**, Marseille, France. (June 1986, p. 560)

DECEMBER 1986

1. **Focus on Fusion**, Quaid-I-Azam University, Islamabad, Pakistan.
Speaker: I. Durrani.
Information: Q. Mushtaq, Department of Mathematics, Quaid-I-Azam University, Islamabad, Pakistan. Telephone: 829189.

1–5. **Minisymposium on Numerical Simulation in Oil Recovery**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. (August 1986, p. 653)

2–5. **Second International Conference on Artificial Intelligence**, Marseilles, France. (August 1986, p. 653)

3–5. **Forty Second Annual Conference on Applied Statistics**, Atlantic City, New Jersey. (March 1986, p. 370)

3–6. **Theory of Robots Symposium**, Vienna, Austria. (January 1986, p. 134)

6–8. **Annual Winter Meeting of the Canadian Mathematical Society**, University of Ottawa, Ottawa, Canada.
Principal Speakers: H. Bass, G. Métivier and R. Zimmer.

Special Sessions: Ergodic Theory, Groups, Probability, Operators, and a session in honor of J. Lambek.
Information: W. Burgess, University of Ottawa, Ottawa, Canada, K1N 6N5, 613-564-3443.

11–12. **International Conference on the Numerical Modeling of Semiconductors**, Los Angeles, California. (October 1986, p. 842)

15–17. **Cryptography and Coding**, Cirencester, Glos., England. (June 1986, p. 560)

15–19. **International Workshop on Multivariate Approximation**, Santiago, Chile. (October 1986, p. 842)

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JANUARY 1987

January–May. **Nonlinear PDE's**, Brigham Young University, Provo, Utah. (June 1986, p. 560)

5–7. **First International Symposium on Domain Decomposition Methods for Partial Differential Equations**, Rocquencourt, France. (October 1986, p. 842)

7–9. **American Statistical Association Winter Conference: Statistics in the Information Age**, Orlando, Florida. (October 1986, p. 842)

12–14. **Conference on Industry-University Collaborations in the Mathematical Sciences**, Claremont, California. (August 1986, p. 653)

12–16. **Seminar on Approximation and Optimization**, Havana, Cuba. (August 1986, p. 653)

19–23. **Structures for Documents**, Aussois, France. (August 1986, p. 653)

19–30. **Twenty-seventh Summer Research Institute of the Australian Mathematical Society**, University of New England, Armidale, N.S.W., Australia. (August 1986, p. 653)

20–24. **Workshop on Iwasawa Theory and Special Values of L-functions**, Mathematical Sciences Research Institute, Berkeley, California. (August 1986, p. 653)

29–31. **Utah State University Department of Mathematics Second Conference on Matrix Theory**, Utah State University, Logan, Utah. (August 1986, p. 653)

FEBRUARY 1987

February. **Séminaire International Grands Calculateurs Scientifiques**, Paris, France. (August 1986, p. 653)

8–12. **Applied Mathematics Conference**, Wairakei, New Zealand. (October 1986, p. 842)

13–18. **Annual Meeting, American Association for the Advancement of Science**, Chicago, Illinois. (March 1986, p. 370)

16–20. **Workshop on Materials with Nonlinear Constitutive Laws**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. (August 1986, p. 653)

17–19. **Association for Computing Machinery Computing Science Conference**, St. Louis, Missouri. (October 1986, p. 842)

MARCH 1987

7. **Third Southeastern Logic Symposium**, Charleston, South Carolina.
Program: The symposium will consist of two invited addresses and sessions for contributed papers.
Organizers: S. Comer and R. Mignone.
Information: S. Comer, Department of Mathematics, The Citadel, Charleston, South Carolina 29409 or R. Mignone, Department of Mathematics, College of Charleston, Charleston, South Carolina 29424.

8–11. **Computer Science and Statistics: 19th Symposium on the Interface**, Temple University, Philadelphia, Pennsylvania. (October 1986, p. 842)

16–20. **Seminaire de Probabilités XXII**, Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse. France. (August 1986, p. 653)

22–25. **Institute of Mathematical Statistics Central Regional Meeting**, Dallas, Texas. (March 1986, p. 370)

22–29. **Fifth International Conference on Geometry**, University of Haifa, Haifa, Israel. (October 1986, p. 842)

23–27. **Workshop on Galois Groups over Q and Related Topics**, Mathematical Sciences Research Institute, Berkeley, California. (October 1986, p. 842)

23–27. **Workshop on Scientific Software**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. (August 1986, p. 654)

23–30. **NSF-CBMS Conference on Mathematical Statistics**, Ohio State University. (June 1986, p. 560)

25–27. **Conference on Information Sciences and Systems**, Johns Hopkins University, Baltimore, Maryland. (October 1986, p. 843)

27–28. **Eleventh Annual Southeastern Section–Society for Industrial and Applied Mathematics Conference**, University of Georgia, Athens, Georgia.
Program: There will be a panel discussion on Supercomputers and a contributed papers sessions, including a special session for student papers.
Call for papers: Contributors should send title and abstract to address below by February 1, 1987.
Information: T. Gard, Department of Mathematics, University of Georgia, Athens, Georgia 30602, 404-542-2211.

28–31. **Eighteenth Iranian Mathematical Conference**, Birjand University, Iran.
Information: M. Toomanian, President of the Iranian Mathematical Society, Department of Mathematics, Tabriz University, Tabriz, Iran.

30–15 April. **Workshop and Conference on Number Theory and Dynamical Systems**, University of York, York, United Kingdom. (October 1986, p. 843)

APRIL 1987

6–8. **Conference on Combinatorial Optimization**, University of Southampton, United Kingdom. (October 1986, p. 843)

8–10. **Charter Centenary Conference of the Royal Statistical Society**, Cambridge, United Kingdom.
Information: I. Blenkinsop, Executive Secretary, Royal Statistical Society, 25 Enford Street, London W1H 2BH, United Kingdom. Telephone: (01)723-5882; (+441) 723-5882.

8–10. **Third Workshop on the Mathematical Foundations of Programming Semantics**, Tulane University, New Orleans, Louisiana. (October 1986, p. 843)

21–25. **Conference on Nonlinear Numerical Methods Based on the Use of Rational Functions**, University of Antwerp, Belgium. (August 1986, p. 654)

23–24. **The Eighteenth Annual Modeling and Simulation Conference**, Pittsburgh, Pennsylvania. (October 1986, p. 843)

27–30. **Workshop on Mathematical Modeling in Combustion and Related Topics**, École Centrale de Lyon, France. (August 1986, p. 654)

28–May 1. **The Mathematics of Finite Elements and Applications 1987**, Uxbridge, United Kingdom. (October 1986, p. 843)

29–May 8. **AMS-SIAM Summer Seminar on Computational Aspects of VLSI Design with an Emphasis on Semiconductor Device Simulation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota. (August 1986, p. 654)

MAY 1987

11–15. **Thirty-first Annual Meeting of the Australian Mathematical Society**, Deakin University, Geelong, Victoria, Australia. (August 1986, p. 654)

18–21. **Eighth Symposium on Computer Arithmetic**, Como, Italy. (October 1986, p. 843)

20–23. **Combinatorial Matrix Analysis Conference**, University of Victoria, Victoria, British Columbia, Canada. (October 1986, p. 843)

25–26. **Foundations and Philosophy of Probability and Statistics, A Symposium in Honor of I. J. Good**, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Information: K. Hinkelmann, Department of Statistics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, 703-961-5657.

25–29. **The Ninth International Symposium on Noise in Physical Systems**, Université de Montréal, Québec, Canada. (March 1986, p. 370)

26–28. **Workshop on Nonlinear Hyperbolic Waves**, Mathematical Sciences Research Institute, Berkeley, California. (August 1986, p. 654)

28–1 June. **Fourth Southeast Asian Conference on Mathematical Education**, Singapore. (August 1986, p. 654)

31–June 3. **1987 Annual Meeting, Statistical Society of Canada**, Quebec City, Canada.

Information: M. Moore, Département Mathématiques Appliquées, Ecole Polytechnique, C.P. 6079, Succursale A, Montréal PQ, Canada H3C 3A7 or H. Morin, Département Mathématiques, Statistique et Actuariat, Université Laval, Cité Universitaire, Québec PQ, Canada G1K 7P4.

JUNE 1987

1–4. **Second International Tampere Conference in Statistics**, Tampere, Finland.

Information: Conference Secretary, C123, Department of Mathematical Sciences, University of Tampere, Post Office Box 607, SF-33101 Tampere, Finland.

1–10. **Second Annual Meeting of the International Workshop in Analysis and Its Applications**, Dubrovnik-Kupari, Yugoslavia. (October 1986, p. 843)

4–6. **Congress on Educational Computing in Mathematics**, Università di Roma I, Roma, Italia. (*Note change from August 1986, p. 654)

8–19. **Singapore Group Conference Theory**, National University of Singapore, Republic of Singapore. (March 1986, p. 370)

15–16. **NASECODE V SHORT COURSE: The Interfaces and Integration of Process, Device and Circuit Models—An Introduction**, Trinity College, Dublin, Ireland. (October 1986, p. 843)

15–July 3. **Microprogram on Commutative Algebra**, Mathematical Sciences Research Institute, Berkeley, California. (October 1985, p. 679)

16–19. **Second Annual Conference on Structure in Complexity Theory**, Cornell University, Ithaca, New York.

Topics: Topics of interest include, but are not limited to, structure of complexity classes, resource-bounded reducibilities, applications of recursion theory, Kolmogorov complexity, applications of finite model theory, properties of complete sets, theory of relativizations, random and interactive proof systems, cryptographic complexity, and independence results.

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Information: S. Mahaney, Room 2C-454, AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974.

17–19. **NASECODE V Conference: The Fifth International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits**, Trinity College, Dublin, Ireland. (October 1986, p. 843)

22–25. **Second Annual Symposium on Logic in Computer Science**, Cornell University, Ithaca, New York.

Topics: Suggested topics of interest include abstract data types, computer theorem proving, verification, concurrency, type theory and constructive mathematics, data base theory, foundations of logic programming, program logics and semantics, knowledge and belief, software specifications, logic-based programming languages, and logic in complexity theory.

Call for papers: Authors should send 16 copies of a detailed abstract by December 9, 1986, to D. Gries, Logic in Computer Science, Department of Computer Science, Cornell University, Ithaca, New York 14853. Abstracts should be no more than 2500 words.

Information: A. Chandra, IBM Thomas J. Watson Research Center, Post Office Box 218, Yorktown Heights, New York 10598, 914-945-1752.

23–26. **Sixth IMACS International Symposium on Computer Methods for PDE's**, Lehigh University, Bethlehem, Pennsylvania. (January 1986, p. 134)

23–27. **International Conference on Generalized Functions, Convergence Structures and Their Applications**, Dubrovnik, Yugoslavia. (June 1986, p. 560)

29–July 3. **Première Conférence Internationale sur les Mathématiques Appliquées et Industrielles**, Paris, France. (August 1986, p. 654)

29–July 4. **Joint IMA-GAMM-SIAM-SMAI Conference on First Joint International Conference on Industrial and Applied Mathematics**, Paris, France. (January 1986, p. 134)

30–July 4. **Third International Seminar on Random Graphs and Probabilistic Methods in Combinatorics**, Poznań, Poland. (October 1986, p. 844)

JULY 1987

July–August. **Low Dimensional Topology Symposium**, University of Sussex, Brighton, Great Britain. (August 1986, p. 654)

6–10. **Third Gregynog Symposium on Differential Equations**, University of Wales, United Kingdom. (October 1986, p. 844)

6–16. **A Research Symposium in Complex Analysis**, Imperial College, South Kensington, London, England. (October 1986, p. 844)

13–17. **Automata, Languages, and Programming**, Karlsruhe, Federal Republic of Germany. (August 1986, p. 654)

13–17. **Eleventh British Combinatorial Conference**, London, United Kingdom.

Topics: Coding theory, combinatorial group theory, combinatorial matrix theory, combinatorial set theory, designs, enumeration, finite geometries, graphs and networks, history of combinatorics, hypergraphs, matroids, Ramsey theory, and applications.

Deadline for Applications: May 29, 1987.

Information: C. Whitehead, Department of Mathematical Sciences, University of London, Goldsmiths' College, London SE14 6NW, United Kingdom.

13–17. **Inequalities: Fifty Years on From Hardy, Littlewood and Polya**, University of Birmingham, Birmingham, England. (October 1986, p. 844)

19–24. **Conference on Potential Theory**, Charles University, Prague, Czechoslovakia. (June 1986, p. 560)

AUGUST 1987

1–6. **Fifth Conference on Graph Theory of China**, People's Republic of China. (August 1986, p. 654)

9–15. **International Conference on Abelian Groups**, Perth, Western Australia. (June 1986, p. 560)

9–22. **Harmonic Analysis on Real and p-adic Groups**, Bowdoin College, Brunswick, Maine. (October 1986, p. 844)

10–13. **Sixth International Conference on Mathematical Modelling: An Interdisciplinary Integrative Forum for Researchers and Educators in Engineering, Economics, Biological, Medical, Environmental, Social and other Sciences**, Washington University, St. Louis, Missouri. (October 1986, p. 844)

16–21. **Sixteenth Conference on Stochastic Processes and their Applications**, Stanford University, Stanford, California. (August 1986, p. 654)

17–20. **International Conference on Rings, Modules, and Radicals**, Hobart, Tasmania. (June 1986, p. 560)

24–28. **Conference on Differential Equations "Equadiff '87"**, Democritus University of Thrace, Greece. (January 1986, p. 134)

24–28. **International Conference on Web Geometry and Related Fields**, Szeged University, Szeged, Hungary. (June 1986, p. 560)

24–28. **Second International Conference on Combinatorial Mathematics and Computing**, Canberra, Australia. (March 1986, p. 370)

24–28. **Sixth National Conference on Artificial Intelligence**, Seattle, Washington. (March 1986, p. 370)

24–29. **Meeting on Geometry of Banach Spaces**, Mons, Belgium. (August 1986, p. 655)

SEPTEMBER 1987

9–12. **Internationale Konferenz über Anwendungen und Modellbildung im Mathematikunterricht**, Kassel, Federal Republic of Germany. (June 1986, p. 560)

13–19. **Journées Arithmétiques 1987**, Ulm, Federal Republic of Germany. (June 1986, p. 560)

20–26. **DMV-Jahrestagung 1987**, Berlin, Federal Republic of Germany. (June 1986, p. 560)

OCTOBER 1987

October. **87 ICAR-International Conference on Advanced Robotics**, Paris or Nice, France. (August 1986, p. 655)

October. **Journées Méthodes Numériques en Méchanique des Fluides**, Sophia-Antipolis, France. (August 1986, p. 655)

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Michael E. Taylor

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Some mathematical questions in biology. III, edited by J. D. Cowan. Concerns the theoretical biology of development. 1972, 151 pp. (ISBN 0-8218-1154-1)	LLSCI/4	23	7
Some mathematical questions in biology. IV, edited by J. D. Cowan. Covers problems in molecular biology, embryology, and neurobiology. 1973, 150 pp. (ISBN 0-8218-1155-X)	LLSCI/5	29	9
Some mathematical questions in biology, edited by Simon A. Levin. Deals with problems in epidemiology, allergic reactions, resource management, and presents a model of respiration. 1979, 218 pp. (ISBN 0-8218-1162-2)	LLSCI/12	25	8
Some mathematical questions in biology, edited by George F. Oster. Covers material in three general categories: population dynamics, development and pattern formation, and physiological design. 1980, 274 pp. (ISBN 0-8218-1163-0)	LLSCI/13	28	8
Translations of Mathematical Monographs			
Additive theory of prime numbers, by L. K. Hua; translated by N. H. Ng, 1965; reprinted 1966, 190 pp. (ISBN 0-8218-1563-6)	MMONO/13	32	10
Intrinsic geometry of surfaces, by A. D. Aleksandrov and V. A. Zalgaller; translated by J. M. Danskin, 1967, 327 pp. (ISBN 0-8218-1565-2)	MMONO/15	34	10
The operator of translation along the trajectories of differential equations, by M. A. Krasnosel'skiĭ; translated by Scripta Technica, 1968, 294 pp. (ISBN 0-8218-1569-5)	MMONO/19	40	12
Statistical problems with nuisance parameters, by Ju. V. Linnik; translated by Scripta Technica, 1968, 258 pp. (ISBN 0-8218-1570-9)	MMONO/20	34	10
Constructive real numbers and function spaces, by N. A. Šanin; translated by E. Mendelson, 1968, 325 pp. (ISBN 0-8218-1571-7)	MMONO/21	45	14
Mahler's problem in metric number theory, by V. G. Sprindžuk; translated by B. Volkmann, 1969, 192 pp. (ISBN 0-8218-1575-X)	MMONO/25	26	8
The functional method and its applications, by E. V. Voronovskaja; translated by R. P. Boas, 1970, 204 pp. (ISBN 0-8218-1578-4)	MMONO/28	42	13
Linear differential equations in Banach space, by S. G. Kreĭn; translated by J. M. Danskin, 1972, 390 pp. (ISBN 0-8218-1579-2)	MMONO/29	54	16
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Game theory and its applications, edited by William F. Lucas, 1981; reprinted 1983, 136 pp. (ISBN 0-8218-0025-6) Softcover	PSAPM/24	15	5

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Algebraic topology, edited by A. Liulevicius, 1971, 294 pp. (ISBN 0-8218-1422-2)	PSPUM/22	42	13
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Numerical solution of field problems in continuum physics, edited by G. Birkhoff and R. S. Varga, 1970, 280 pp. (ISBN 0-8218-1321-8)	SIAMS/2	29	9
Mathematical aspects of electrical network analysis, edited by F. Harary and H. S. Wilf, 1971, 206 pp. (ISBN 0-8218-1322-6)	SIAMS/3	28	8
Computers in algebra and number theory, edited by G. Birkhoff and M. Hall, Jr., 1971; reprinted 1980, 200 pp. (ISBN 0-8218-1323-4) Softcover	SIAMS/4	20	6
Mathematical aspects of statistical mechanics, edited by J. C. T. Pool, 1972, 90 pp. (ISBN 0-8218-1324-2)	SIAMS/5	24	7
Stochastic differential equations, edited by J. B. Keller and H. P. McKean, 1973, 210 pp. (ISBN 0-8218-1325-0)	SIAMS/6	42	13
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Mathematical psychology and psychophysiology, edited by Stephen Grossberg, 1981, 318 pp. (ISBN 0-8218-1333-1)	SIAMS/13	38	11

Selected Translations in Mathematical Statistics and Probability

Twenty-two papers on statistics and probability, 1966, 274 pp. (ISBN 0-8218-1456-7)	STAPRO/6	38	11
Twenty-two papers on statistics and probability, 1973, 279 pp. (ISBN 0-8218-1461-3)	STAPRO/11	35	11
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Twenty papers on statistics and probability, 1973, 298 pp. (ISBN 0-8218-1463-X)	STAPRO/13	59	18
Eighteen papers on statistics and probability, 1981, 317 pp. (ISBN 0-8218-1465-6)	STAPRO/15	62	19

Mathematical Surveys and Monographs

The problem of moments, by J. A. Shohat and J. D. Tamarkin, 1943; revised edition 1950; reprinted 1983, 144 pp. (ISBN 0-8218-1501-6)	SURV/1	32	10
The algebraic theory of semigroups, Volume I, by A. H. Clifford and G. B. Preston, 1961; reprinted with corrections 1977, 224 pp. (ISBN 0-8218-0271-2)	SURV/7.1	29	9
The algebraic theory of semigroups, Volume II, by A. H. Clifford and G. B. Preston, 1967; reprinted with corrections 1971, 352 pp. (ISBN 0-8218-0272-0)	SURV/7.2	38	11
Topics in operator theory, edited by C. Pearcy, 1974; second printing with addendum 1979, 235 pp. (ISBN 0-8218-1513-X) Softcover	SURV/13	34	10

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Symplectic groups, by O. Timothy O'Meara, 1978; reprinted with corrections 1982, 122 pp. (ISBN 0-8218-1516-4) Softcover	SURV/16	38	11
Approximation by polynomials with integral coefficients, by LeBaron O. Ferguson, 1980, 160 pp. (ISBN 0-8218-1517-2)	SURV/17	37	11

Proceedings of the Steklov Institute of Mathematics

Parametric normed spaces and normed massives (1969), by K. K. Golovkin, 1971, 128 pp. (ISBN 0-8218-3006-6)	STEKLO/106	42	13
Approximation of periodic functions (1971), edited by S. B. Stečkin, 1974, 133 pp. (ISBN 0-8218-3009-8)	STEKLO/109	45	14
Collection of articles. I (1971), edited by I. G. Petrovskiĭ and S. M. Nikol'skiĭ, 1973, 408 pp. (ISBN 0-8218-3012-0)	STEKLO/112	84	25
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Selected Tables in Mathematical Statistics

Tables of the cumulative non-central chi-square distribution, by G. E. Hayman, Z. Govindarajulu and F. C. Leone; **Tables of the exact sampling distribution of the two-sample Kolmogorov-Smirnov criterion** D_{mn} $(m \leq n)$, by P. J. Kim and R. I. Jennrich; **Critical values and probability levels for the Wilcoxon rank sum test and the Wilcoxon signed rank test**, by F. Wilcoxon, S. K. Katti and R. A. Wilcox; **The null distribution of the first three product-moment statistics for exponential half-gamma, and normal scores**, by P. A. W. Lewis and A. S. Goodman; **Tables to facilitate the use of orthogonal polynomials for two types of error structures**, by K. B. Stewart, 1970; second printing with revisions 1973, 403 pp. (ISBN 0-8218-1901-1)	TABLES/1	26	8
Probability integral of the doubly noncentral t-distribution with degrees of freedom n and non-centrality parameters δ and λ, by W. G. Bulgren; **Doubly non-central F distribution–Tables and applications**, by M. L. Tiku; **Tables of expected sample size for curtailed fixed sample size tests of a Bernoulli parameter**, by C. R. Blyth and D. Hutchinson; **Zonal polynomials of order 1 through 12**, by A. M. Parkhurst and A. T. James, 1974, 388 pp. (ISBN 0-8218-1902-X)	TABLES/2	32	10
Variances and covariances of the normal order statistics for sample sizes 2 to 50, by G. L. Tietjen, D. K. Kahaner and R. J. Beckman; **Means, variances and covariances of the normal order statistics in the presence of an outlier**, by H. A. David, W. J. Kennedy and R. D. Knight; **Tables for obtaining optimal confidence intervals involving the chi-square distribution**, by G. R. Murdock and W. O. Williford, 1977, 263 pp. (ISBN 0-8218-1905-4)	TABLES/5	29	9
The distribution of the size of the maximum cluster of points on a line, by Norman D. Neff and Joseph I. Naus, 1980, 207 pp. (ISBN 0-8218-1906-2)	TABLES/6	20	6
The product of two normally distributed random variables, by William Q. Meeker, Jr., Larry W. Cornwell and Leo A. Aroian, 1981, 256 pp. (ISBN 0-8218-1907-0)	TABLES/7	25	8

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Personal Items

Thomas Erber, Professor of Physics at Illinois Institute of Technology, has received an additional appointment as Professor of Mathematics at that institution.

Michel L. Lapidus of the University of Georgia, Athens, has been appointed Associate Professor of Mathematics at that institution.

Richard I. Resch, Associate Dean of Faculty at the College of Staten Island of City University of New York, has been appointed Dean of Science and Technology at that institution.

Deaths

Nelson Dunford, retired professor of mathematics at Yale University, died on September 7, 1986, in Sarasota, Florida, at the age of 79. He was a member of the Society for 51 years.

Visiting Mathematicians

(Supplementary Listing)

Mathematicians visiting other institutions during the 1986-1987 academic year have been listed in recent issues of *Notices*: June 1986, pages 569–571; August 1986, pages 672-673; and October 1986, pages 851-852. The listing below gives the name and home country, the host institution, period of visit, and field of special interest of additional visiting mathematicians.

E. M. Chirka (U.S.S.R.), Université de Montréal, May 1987 to August 1987, complex analysis.

Carl E. Sarndal (Canada), Statistika Centralbyran, June 1986 to December 1986 and Université Paul Sabatier, January 1987 to May 1987, statistics.

Bruno Forte (Canada), SASIAM, Tecnopolis, Italy, September 1986 to April 1987, information theory.

New Reciprocity Agreements

Ireland

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Officers: M. Newell (President), S. Dineen (Vice-President), G. M. Enright (Treasurer), and R. M. Timoney (Secretary).

Recent Appointments

Committee members' terms of office on standing committees expire on December 31 of the year given in parentheses following their names, unless otherwise specified.

William S. Massey (1989) has been appointed by President Irving Kaplansky to the *Committee to Select the Winner of the Steele Prize.* Continuing members of the committee are Frederick J. Almgren (1989), Richard W. Beals (1987), chairman, Jerry L. Bona (1987), Hermann Flaschka (1988), John P. Hempel (1988), Lawrence E. Payne (1987), Frank A. Raymond (1989), Louis Solomon (1989), and Richard P. Stanley (1989). Terms expire on June 30.

The name of the AMS-ASL-IMS *Committee on Translations from Russian and Other Foreign Languages* has been changed to the AMS-ASL-IMS *Committee on Translations from Russian and Other Slavic Languages.* The chairman of the committee is Boris M. Schein (1987). The AMS subcommittee members are Michael I. Brin (1987), David V. Chudnovsky (1986), Charles V. Coffman (1988), Allen Devinatz (1988), Igor Dolgachev (1987), Richard Ericson (1987), Vladislav V. Goldberg (1988), Jack K. Hale (1986), John R. Isbell (1988), Dmitry Khavinson (1987), and Boris M. Schein (1987), chairman. The ASL subcommittee members are Vladimir Lifschitz (1987), Elliott Mendelson, Gregory Minc (1987) and B. F. Wells. The IMS subcommittee members are Eugene Dynkin, chairman, B. Pittel, A. Rukhin and W. J. Studden.

Unpublished Lecture Notes and Tapes

This section of *Notices* provides a forum for departments in the mathematical sciences, research institutes, and other organizations in the nonprofit sector to announce the availability of unpublished lecture notes. These may be in written form or in electronic form, i.e., audio and videotapes, videodiscs, etc. Readers are invited to submit material for this section and it will be published in the next available issue.

In addition to the initial listing of lecture notes and tapes, *Notices* will publish, in November, a complete list of material received during the year.

Items for inclusion in this section of *Notices* should be accompanied by the following information:

Pertinent information regarding the media in which the lecture notes are being presented;

Name of author(s), title, year, number of pages or length of tape, price;

Address for orders and information about payment (postal surcharge, if any, or whether postpaid, to whom checks should be made).

Items should be sent to the Providence office (*Notices* Lecture Notes and Tapes, American Mathematical Society, P.O. Box 6248, Providence, RI 02940).

Lecture Notes

The following lecture notes are available from the sources listed.

New listings:

Brandeis University

1. Claudio Procesi (notes by Giandomenico Boffi), "A Primer of Invariant Theory," Brandeis Lecture Notes 1, September 1982 (218 pages), $10.
2. Mark Jankins and Walter D. Neuman, "Lectures on Seifert Manifolds," Brandeis Lecture Notes 2, March 1983 (97 pages), $10.
3. David A. Buchsbaum (notes by Giandomenico Boffi), "Generic Free Resolutions and Schur Complexes," Brandeis Lecture Notes 3, December 1983 (160 pages), $10.
4. C. S. Seshadri (notes by Peter Littlemann and Pradeep Shukla), "Introduction to the Theory of Standard Monomials," Brandeis Lecture Notes 4, June 1985 (251 pages), $10.

Checks or money orders should be made payable to The Chairman's Discretionary Fund, Brandeis University, Department of Mathematics, Waltham, MA 02254.

Reprinted listings:

University of British Columbia

1. James V. Whittaker, "Elementary Linear Modelling," 1984 (191 pages), $12 (Canadian funds) postpaid.

Cheques or money orders should be made payable to James V. Whittaker. Send orders to the author at the Department of Mathematics, University of British Columbia, Vancouver, British Columbia, V6T 1W5 Canada.

University of Delaware

1. M. Schneider, "Introduction to Partial Differential Equations of Mixed Type," Technische Universität-Berlin (55 pages), $3.
2. R. P. Gilbert, "Elliptic Systems in the Plane," University of Delaware (99 pages), $5.
3. Z. Schuss, "Theory and Application of Stochastic Differential Equations," Tel-Aviv University, Israel (199 pages), $5.
4. H. Begehr, "Topics in Complex Analysis," Freie Universität-Berlin (49 pages), $3.
5. D. L. Colton, "Integral Operator Methods in the Theory of Wave Propagation and Heat Conduction," University of Strathclyde-Glasgow, Scotland (54 pages), $3.
6. R. Kress, "Integral Equation Methods for Boundary Value Problems in Electromagnetism," University of Göttingen, Germany (56 pages), $3.
7. R. Timman, "Water Waves," Delft Technical University (95 pages), $3.50.
8. R. Reemtsen, "Local Best Chebyshev Approximations," University of Delaware (68 pages), $3.50.

Checks made payable to Department of Mathematical Sciences, University of Delaware, Newark, Delaware 19716.

University of Missouri-Rolla

1. L. J. Grimm, O. R. Plummer, and S. Y. Trimble (eds.), "Differential and Integral Equations," Proceedings of the Seventh Midwest Conference, 1980 (117 pages), $5.
2. J. L. Henderson (ed.), "Differential and Integral Equations," Proceedings of the Twelfth and Thirteenth Midwest Conferences, 1985 (168 + 87 pages), $10.

These items are postpaid in the U.S. and Canada. Foreign postage is $5 additional. Checks should be made payable to University Bookstore, University of Missouri-Rolla, Rolla, Missouri 65401.

University of Washington

1. Frederic Y. M. Wan, "Some Mathematical Models and Their Analysis," 1980 first printing; 1985 second printing (161 pages), $15, postpaid.

Checks should be made payable to Frederic Wan. Send orders to Applied Mathematics Department FS-20, University of Washington, Seattle, Washington 98195.

Tapes

The following tapes are available from the sources listed.

Reprinted listing:

Lehigh University

1. M. Atiyah, "The Mystery of Four Dimensions," video tapes of the 1985-1986 Pitcher Lectures including Lecture 1: "Algebraic curves and surfaces," Lecture 2: "New ideas from physics," and Lecture 3: "New results," $30.

Checks should be made payable to Lehigh University. Send orders to L. Milet, Media Center, Fairchild-Martindale Library, Lehigh University, Bethlehem, Pennsylvania 18015.

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 1985 special issue have been updated with information received in preparation for the December 1986 issue. For information about the various programs, the reader is referred to the appropriate part of the Stipends Section of the December 1985 *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 1985 issue not yet confirmed for this year.

• Refers to a news item in this issue of *Notices*.

October 1

American Philosophical Society [PS]
John Simon Guggenheim Memorial Foundation Fellowships [PS]

October 15

Bunting Institute of Radcliffe College (Science Scholar Fellowships) [PS]

October 24

Kennedy Scholarships [SFN]

November 1

American-Scandinavian Foundation [TSA]
Fannie and John Hertz Foundation Fellowships [GS]
North Atlantic Treaty Organization (Postdoctoral Fellowships) [TSA]

November 14

NSF Graduate Fellowships [GS]
NSF Minority Graduate Fellowships [GS]
• National Research Foundation (Ford Foundation Predoctoral and Dissertation Fellowships for Minorities) [GS]

November 15

Kosciuszko Foundation [SFN]
NSF Mathematical Sciences Postdoctoral Research Fellowships [PS]

November 30

North Atlantic Treaty Organization [TSA]

December 1

AMS Research Fellowships [PS]
American Philosophical Society [PS]
IBM Thomas J. Watson Research Center (Postdoctoral and Junior Faculty Fellowships for Research in Mathematical Sciences) [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 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

R H Bing Faculty Fellowship [PS]
Brown University (Jacob David Tamarkin Assistant Professorships) [PS]
California Institute of Technology (Harry Bateman Research Instructorships) [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]
University of California, Los Angeles (Earle Raymond Hedrick Assistant Professorships in Mathematics) [PS]
University of Chicago (Leonard Eugene Dickson Instructorships in Mathematics) [PS]
Weizmann Institute of Sciences (Feinberg Graduate School Postdoctoral Fellowships) [TSA]
Weizmann Institute of Sciences (Feinberg Graduate School. Openings for Scientists and Postdoctoral Fellowships) [TSA]

January 6

University of Michigan, Ann Arbor (T. H. Hildebrandt Research Assistant Professorships) [PS]

January 15

AAAS Science, Engineering and Diplomacy Fellowships [PS]
Dartmouth College (John Wesley Young Research Instructorships) [PS]
* Institute for Mathematics and its Applications [PS]
Kosciuszko Foundation [GS]
* 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 Pittsburgh (Andrew Mellon Postdoctoral Fellowships) [PS]

January 16

Fulbright Program (Collaborative Research Grants) [TSA]

January 17

* National Research Council (Postdoctoral Fellowships for Minorities) [PS]

January 19

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 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]
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 31

Hubert H. Humphrey Doctoral Fellowships [GS]
North Atlantic Treaty Organization [TSA]

April 1

American Philosophical Society [PS]

May 15

Weizmann Institute of Sciences (Feinberg Graduate School Postdoctoral Fellowships) [TSA]
Weizmann Institute of Sciences (Feinberg Graduate School. Openings for Scientists and Postdoctoral Fellowships) [TSA]

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]

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 $.65 per word with a minimum of $30.00. The same ad in 6 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 $6.00. A word is defined as a group of characters with space at each end. Prepayment is required of individuals but not of institutions. For an additional $10.00 charge, announcements can be placed anonymously. Correspondence will be forwarded.

DEADLINES are listed on the inside front cover.

U. S. LAWS PROHIBIT discrimination in employment on the basis of color, age, sex, race, religion or national origin. "Positions Available" advertisements from institutions outside the U. S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U. S. laws. Details and specific wording may be found following the Classified Advertisements in the January and August issues of the *Notices*.

SITUATIONS WANTED ADVERTISEMENTS from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-556-7774 and speak to Wahlene Siconio for further information.

SEND AD AND CHECK TO: Advertising Department, AMS, P. O. Box 6248, Providence, Rhode Island 02940. Individuals are requested to pay in advance, institutions are not required to do so.

POSITIONS AVAILABLE

The Department of Mathematics and Statistics at McGill University wishes to sponsor a strong candidate for the Natural Sciences and Engineering Research Council of Canada (NSERC) 1986-87 University Research Fellowship Competition. These Fellowships are five year research positions (with a review in the third year), in the nature of Research Assistant Professorships, and carry a teaching load of at most one course throughout the academic year. Applicants should have shown some substantial research ability beyond their Doctoral thesis. They should be Canadian Citizens or landed immigrants by October 17, 1986.

Interested candidates should send their curricula vitae to:

Professor M. Herschorn, Chairman
Department of Mathematics and Statistics
McGill University
805 Sherbrooke Street West
Montreal, Quebec, Canada
H3A 2K6

They should arrange for at least two letters of reference from competent referees to be sent directly to the same address. All documentation should reach the department by September 12, 1986. The department will make its recommendations to NSERC early in October 1986. NSERC will announce its decision in March 1987.

University of California, Santa Barbara

Department of Mathematics

Applications are invited for the KY FAN ASSISTANT PROFESSORSHIP. The Ky Fan assistant professorship is a special two-year non-renewable position which carries a research stipend. Appointment is effective July 1, 1987. Candidates must possess a Ph.D by September 1987. Selection will be based primarily on demonstrated research achievement. Teaching experience is desirable. Teaching load will consist of four quarter courses per year. To apply send vita and publication list, and arrange to have 3 letters of recommendation sent to: Faculty Search Committee, Department of Mathematics, University of California, Santa Barbara, CA 93106. All applications received by January 9, 1987 will be given thorough consideration.

UCSB is an equal opportunity/affirmative action employer.

LAWRENCE UNIVERSITY
DEPARTMENT OF MATHEMATICS

Tenure-track position at the assistant professor level starting fall 1987. The Department has slight preference for candidates specializing in geometry/topology of probability, 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 resume, transcripts, and three or four supporting letters to Bruce Pourciau, Chair, 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 February 1. Equal Opportunity Employer.

LAWRENCE UNIVERSITY
DEPARTMENT OF MATHEMATICS

Tenure-track position at the assistant professor level starting fall 1987. The Department has slight preference for candidates specializing in geometry/topology of probability, 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 resume, transcripts, and three or four supporting letters to Bruce Pourciau, Chair, 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 February 1. Equal Opportunity Employer.

UNIVERSITY OF CALIFORNIA, IRVINE
DEPARTMENT OF MATHEMATICS
IRVINE, CALIFORNIA 92717

Two faculty positions at the level of Assistant Professor in Applied Mathematics, available beginning academic year 1987-88. A Ph. D. degree, publications, and evidence of active interest in quality teaching are required. Examples of preferred research areas: partial differential equations, nonlinear phenomena, applied functional analysis, and numerical analysis. Send applications, a curriculum vitae, and the names of three or more references to Professor Martin Schechter, Department of Mathematics, University of California, Irvine, CA 92717. An Affirmative Action/Equal Opportunity Employer.

POSITIONS AVAILABLE

Department of Mathematics
VANDERBILT UNIVERSITY

CENTENNIAL PROFESSORSHIP
in computer-related mathematics
beginning Fall, 1987

This position will become a named, endowed, chair. It is intended for a person of distinction whose primary research involves actual computing.

Have curriculum vitae and letters of recommendation sent to

Professor R. R. Goldberg, Chairman
Mathematics Department
Vanderbilt University
Nashville, TN 37235

Inquiries are welcome.

VANDERBILT UNIVERSITY IS AN EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER.

DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE
RUTGERS UNIVERSITY AT NEWARK

The Department of Mathematics and Computer Science anticipates several tenure track assistant and associate professorships, as well as one one-year visiting research lecturer at the rank of associate or full professor to begin September 1987. Candidates should exhibit strong research accomplishments or potential. Salary and teaching load are negotiable.

Applicants from all fields are invited. Areas of research interest in the department include number theory, representation theory and automorphic forms, combinatorics and logic, topology, and low dimensional topology and Teichmüller theory.

Candidates should send a resume and have three references write to:

Jane Gilman, Chair
Department of Mathematics & Computer Science
Rutgers – The State University
Newark, New Jersey 07102

The closing date for applications is January 15, 1987. However, late applications will be accepted until the position is filled. Rutgers University is an equal opportunity, affirmative action employer.

DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE
RUTGERS UNIVERSITY AT NEWARK
PROFESSOR OF MATHEMATICS

The Department of Mathematics and Computer Science anticipates an opening at the Rank of Professor beginning Fall 1987. Candidates should exhibit strong research accomplishments. Salary and teaching load are negotiable.

Applicants from all fields are invited. Areas of research interest in the department include number theory, representation theory and automorphic forms, combinatorics and logic, topology, and low dimensional topology and Teichmüller theory.

Candidates should send a resume and the names of three references to:

Jane Gilman, Chair
Department of Mathematics & Computer Science
Rutgers – The State University
Newark, New Jersey 07102

The closing date for applications is January 15, 1987. However, late applications will be accepted until the position is filled. Rutgers University is an equal opportunity, affirmative action employer.

AUBURN UNIVERSITY

The Division of Mathematics at Auburn University invites applications and nominations for the position of Coordinator of Undergraduate Mathematics, whose principal concern will be freshman and sophomore mathematics service courses. The Coordinator will be responsible for scheduling, teaching assignments, registration of students, oversight of curriculum revisions and textbook selections, administration of course and teaching evaluations, and supervision and evaluation of Graduate Teaching Assistants.

Ph.D in mathematics and significant undergraduate teaching experience required. Academic rank, eligibility for tenure, and salary commensurate with qualifications.

The Division has approximately 70 faculty members and 40 Graduate Teaching Assistants (in M.S. and Ph.D. programs) in two departments of mathematics. Enrollment in about 475 sections of lower division service courses is approximately 13,000 students annually. The Coordinator will hold a 12 month position and be responsible to the heads of the two departments.

Auburn University, located in Auburn, Alabama, is a state land-grant university enrolling more than 19,000 students. The city of Auburn is a picturesque university community located about 120 miles southwest of Atlanta in a region of farms and woodlands.

Women and minorities are encouraged to apply. Send nominations, or applications including resume and names of three references to Robert E. Kribel, Acting Dean, College of Sciences and Mathematics, Auburn University, AL 36849.

AUBURN UNIVERSITY IS AN EQUAL OPPORTUNITY, AFFIRMATIVE ACTION EMPLOYER

MATHEMATICAL SCIENCE DEPARTMENT CHAIR

The Mathematical Sciences Department at Worcester Polytechnic Institute seeks a department chair to lead its faculty of 23. Active areas of faculty research include classical applied mathematics, statistics-applied probability, applications of discrete mathematics, algebra, and graph theory. The new department chair will be asked to guide the department through a period of growth and development that will see the addition of several new faculty positions, a strengthening of the department's research and professional activities, and the introduction of a graduate program. In addition the person selected must be committed to maintaining high quality teaching in the department's project-oriented undergraduate program and in service courses.

The nation's third oldest engineering college, WPI is located in Worcester, Massachusetts. It offers degrees through the Ph.D. with an undergraduate enrollment of 2,500, full time faculty of 200, and a graduate and continuing education enrollment of 1,200.

Nominations and applications should be directed to D. W. Woods, Mathematical Sciences Department Chair Search Committee, Department of SS&PS, Worcester Polytechnic Institute, Worcester, MA 01609.

Worcester Polytechnic Institute is an AA/EOE.

THE GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have available some visiting and tenure-track positions beginning in the Fall of 1987. Priority will be given to applicants in statistics, scientific computing (parallel and vector computing, robotics) and differential equations. Excellent accomplishments or potential in research is required. Send resume to W. F. Ames, 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.

POSITIONS AVAILABLE

The Ohio State University
Department of Mathematics

The Department of Mathematics of The Ohio State University hopes to fill several positions, both visiting and permanent, effective Autumn Quarter 1987. Candidates in all 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 Joseph Ferrar, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210. Reviews of resumes will begin immediately.

The Ohio State University is an Equal Opportunity/Affirmative Action 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 1987-88. 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 Joseph Ferrar, 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.

The Ohio State University
CHAIR IN NUMERICAL ANALYSIS AND SCIENTIFIC COMPUTATION

The Department of Mathematics has been awarded a Chair in Numerical Analysis and Scientific Computation. Applications are invited from individuals with outstanding credentials in any area of applied mathematics whose research activities make significant use of large scale computing. The appointee will hold the academic rank of Professor of Mathematics and will be expected to provide the academic leadership in the developing field of scientific computation at Ohio State.

Individuals interested in this position should contact

Joseph Ferrar, Chairman
Department of Mathematics
The Ohio State University
231 W. 18th Avenue
Columbus, Ohio 43210
Telephone: 614/422-7173

The Ohio State University is an Equal Opportunity/Affirmative Action Employer.

Carnegie-Mellon University
Department of Mathematics

The Department plans to make several tenure-track appointments beginning in Fall 1987. Although these appointments are expected to be at the Assistant Professor level, we also solicit exceptionally well-qualified applicants for more advanced positions. Areas of particular interest are numerical analysis, combinatorics/combinatorial optimization, and operations research although applicants with any research interests which strongly intersect those of the Department will be welcomed. Candidates should send a resume to: Appointments Committee, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA 15213. Carnegie-Mellon University is an Affirmative Action/Equal Opportunity Employer.

University of Virginia
Department of Applied Mathematics

Tenure-track assistant professorships and senior positions for January, 1987, and later. Preferred areas are partial differential equations, scientific computing, and optimization. Ph.D. required with strong research and teaching ability. Applicants for senior positions must have established record of research and grant support. Send vita and names of three references to James M. Ortega, Chairman, Applied Mathematics, Thornton Hall, University of Virginia, Charlottesville, VA 22903. An EO/AA Employer.

UCLA DEPARTMENT OF MATHEMATICS
REGULAR POSITIONS IN MATHEMATICAL COMPUTER SCIENCE

One or two positions in mathematical computer science. Preference will be given to candidates in analysis of algorithms, coding theory, computational complexity, and the theory of programming languages. Very strong research and teaching background required. Positions initially budgeted at the assistant professor level. Sufficiently outstanding candidates at higher levels and/or in other fields will also be considered. Teaching load: Five quarter courses per year.

To apply, write to Yiannis N. Moschovakis, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024.

UCLA is an equal opportunity/affirmative action employer.

UCLA DEPARTMENT OF MATHEMATICS
REGULAR POSITIONS IN APPLIED/COMPUTATIONAL MATHEMATICS

Three or four regular positions in applied and computational mathematics. Preference will be given to candidates in numerical analysis, mathematical modeling, and scientific/engineering computing. Very strong research and teaching background required. Positions initially budgeted at the assistant professor level. Sufficiently outstanding candidates at higher levels and/or in other fields will also be considered. Teaching load: Five quarter courses per year.

To apply, write to Yiannis N. Moschovakis, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024.

UCLA is an equal opportunity/affirmative action employer.

U. S. NAVAL ACADEMY
Department of Mathematics

Applications are invited for several tenure-track appointments at the rank of Assistant or Associate Professor commencing in January or August of 1987. The initial salary will be competitive and commensurate with experience and qualifications. Research opportunities exist for augmenting salary during the summer intersessional period. Specialization in applied mathematics or operations research is of particular interest. Applicants must possess an earned Ph.D. by the date of appointment, have a commitment to excellence in teaching, and be capable of pursuing an independent program of research. Inquiries and applications should be sent to Prof. J. M. D'Archangelo, Mathematics Department, U. S. Naval Academy, Annapolis, Maryland 21402-5002. Required of all applicants are a resume, transcripts of academic records, and at least three letters of recommendation from persons familiar with the applicant's teaching and research. Interviews will be conducted at the annual AMS/MAA meeting in San Antonio in January. The Naval Academy is an EO/AA employer

POSITIONS AVAILABLE

UCLA DEPARTMENT OF MATHEMATICS REGULAR POSITIONS IN PURE MATHEMATICS

Four or five regular positions in pure mathematics. Specific fields of interest include algebra/number theory, analysis, differential equations, geometry/topology, logic, probability, and statistics. Very strong research and teaching background required. Positions initially budgeted at the assistant professor level. Sufficiently outstanding candidates at higher levels and/or in other fields will also be considered. Teaching load: Five quarter courses per year.

To apply, write to Yiannis N. Moschovakis, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024.

UCLA is an equal opportunity/affirmative action employer.

Associate or Assistant Professor position in Probability is anticipated for Fall 1987. Demonstrated excellence in research and a strong commitment to teaching at the graduate and undergraduate level required. Candidates with established research records as well as new Ph.Ds are encouraged to apply. Women and minorities are especially encouraged to apply. Send vita and three letters of reference to: Professor Murad Taqqu, Probability Position, Department of Mathematics, 111 Cummington Street, Boston University, Boston, MA 02215.

The Department of Mathematics at Boston University anticipates an opening for an Assistant Professor in Fall 1987. Preference given to applicants in Applied Mathematics, Dynamical Systems, Statistics and related fields. Women and minorities are encouraged to apply. Send vita and three letters of reference to: Search Committee, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215.

Senior level appointment in Mathematical Statistics anticipated for Fall 1987. Record of distinguished achievements in research, commitment to excellence in teaching required. Women, minorities esp. encouraged to apply. Send nominations and applications to: Search Committee, Department of Mathematics, 111 Cummington Street, Boston University, Boston, MA 02215.

DEPARTMENT OF MATHEMATICS UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

New (1987) and recent Ph.D's are invited to apply for tenure-track positions at the assistant professor level, commencing August 1987, salary to be at least $28,000. Candidates should send letter of application, vita, and publication list and arrange for three letters of reference to be sent directly to:

Heini Halberstam, Head
Department of Mathematics
University of Illinois at Urbana-Champaign
1409 W. Green St.
Urbana, IL 61801
tel. (217) 333-3352

Candidates are expected to present evidence of potential for excellence in both teaching and research. Interviews may be conducted prior to closing date but all applications received by December 1, 1986 will receive full consideration. The University of Illinois is an Equal Opportunity/Affirmative Action Employer.

Department of Mathematics University of Kansas

Anticipate some instructorships beginning fall semester 1987, 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 resume 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: December 1, 1986, then monthly until August 1, 1987.

The University of Kansas is an Affirmative Action/Equal Opportunity Employer.

Department of Mathematics University of Kansas

Applications are invited for tenure-track and temporary positions at all levels, commencing August 16, 1987 or as negotiated. Field is unrestricted but preference will be given to algebra and numerical analysis, and to areas meshing well with the department's needs. Require Ph.D or Ph.D. dissertation accepted with only formalities to be completed.

Application, detailed resume with description of research, and three recommendation letters shoud be sent to C. J. Himmelberg, Chairman, Department of Mathematics, University of Kansas, Lawrence, KS 66045-2142.

Deadlines: December 1, 1986 for first consideration, then monthly until August 1, 1987.

The University of Kansas is an AA/EOE.

University of California, Riverside

Applications are invited for a tenure-track or tenure position in Computer Science beginning Fall 1987. Candidates must have demonstrated excellence in research and teaching. Research specialties in all areas of Computer Science will be considered but we are particularly interested in research areas in Computer Systems or Computer Methodology and Applications. The position is open as to the level of appointment.

Applicants should send a curriculum vitae and see that at least three letters of recommendation are sent to:

Professor Theodore J. Barth, Chair
Computer Science Search Committee
Department of Mathematics and Computer Science
University of California
Riverside, CA 92521

University of California, Riverside, is an Affirmative Action/Equal Opportunity Employer.

OKLAHOMA STATE UNIVERSITY DEPARTMENT OF MATHEMATICS

Several tenured, tenure-track and visiting positions at all professorial ranks for Fall, 1987. All areas are currently under consideration, but we especially encourage applications in Algebraic Geometry, Complex/Harmonic Analysis, Differential Geometry, Lie Groups and Representation Theory, and Partial Differential Equations.

Minimum qualifications are a Ph.D. in Mathematics, evidence of research achievement or potential, and a commitment to teaching. Post-doctoral experience is desirable. Normal duties include research and at most six hours teaching per semester. For full consideration, send a resume and arrange to have three letters of reference sent by January 15, 1987 to William Jaco, Head, Department of Mathematics, Oklahoma State University, Stillwater, OK 74078-0613. OSU is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

POSITIONS AVAILABLE

UNIVERSITY OF WISCONSIN-MADISON
Department of Mathematics

The Department of Mathematics at the University of Wisconsin-Madison solicits applications for tenure-track or possible tenure positions to begin fall 1987. Appointments will be made at the assistant professor level unless qualifications and experience require appointment at higher rank. We are interested in candidates of established excellence as researchers as well as recent recipients of the PhD who exhibit outstanding potential. All candidates should have a strong commitment to good teaching. Consideration of established candidates will begin November 24, 1986. Consideration of recent PhD recipients will begin December 31. Applications will continue to be accepted until all positions are filled; however, only applications received by these dates along with all supporting materials are assured full consideration.

Application forms are available from the Tenure Track Screening Committee, Department of Mathematics, 223 Van Vleck Hall, 480 Lincoln Drive, Madison, WI 53706.

The University of Wisconsin-Madison is an AA/EOE.

DREXEL UNIVERSITY
Head, Department of Mathematics and Computer Science

Candidates must have a strong research record and a demonstrated commitment to applied mathematics, probability and statistics, and computer science. Send vita and names of references to Dr. Jet Wimp, Search Committee, Department of Mathematics and Computer Science, Drexel University, Philadelphia, Pennsylvania 19104.

Applications from women and minorities are actively solicited.

Drexel University is an AA/EOE.

The University of Wyoming
Head—Department of Mathematics

The Department of Mathematics at the University of Wyoming invites applications for the position of Department Head. The University is the sole four-year institution of higher education in the state of Wyoming with an enrollment of 10,000 students. The mathematics program offers degrees in mathematics, applied mathematics, and several joint-degree options at the bachelor, master and doctoral levels. The department has a growing major research component in applied mathematics including a petroleum research institute with funding from major industrial supporters. Other active research areas in the department include numerical analysis, partial differential equations, functional analysis, optimization theory, dynamical systems, rigidity theory, and combinatorics.

Candidates should have a strong research record compatible with department interests and a commitment to excellence in instruction. Applicants should submit a current curriculum vita and the names of at least three suitable references to

Myron P. Ballen, Chair
Search Committee
Mathematics Department
University of Wyoming
Laramie, WY 82070

Applications will be considered through January 31, 1987. The University of Wyoming is an equal opportunity employer.

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

The University of Illinois at Urbana-Champaign invites applications for a senior level appointment in Mathematics. Candidates must have a strong research record in an area of algebra which is compatible with the interests of the present faculty; these areas include, but are not limited to, representation theory of orders and integral representations of finite groups. The appointee will be expected to give leadership in the supervision of research.

Applicants should submit a vita with complete publication record and three reference letters to

Professor Heini Halberstam
Department of Mathematics
University of Illinois at Urbana-Champaign
1409 W. Green St.
Urbana, IL 61801
tel. (217) 333-3352

Salary commensurate with experience. A starting date of August 1987 is preferred but is negotiable.

In order to receive full consideration, complete applications must be received by December 1, 1986. The University of Illinois is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF ARIZONA, DEPARTMENT OF MATHEMATICS
TUCSON, ARIZONA 85721

Tenure track positions at all levels. Ph.D., excellent research record or potential, strong commitment to teaching required. Field is less important than ability but should complement existing strengths in algebra, computational science, differential equations, dynamical systems, geometry, mathematical physics, nonlinear analysis, number theory, probability and statistics. Closing date for applications is February 1, 1987 or whenever position is filled. Send application to Department Head, Department of Mathematics. The University of Arizona is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF ARIZONA, DEPARTMENT OF MATHEMATICS
TUCSON, ARIZONA 85721

The Mathematics Department at the University of Arizona is happy to announce several postdoctoral fellowships (Research Associate) which will be available beginning August '87. Applicants with areas of strength in applied mathematics, computational science and nonlinear optics may qualify for special Center of Excellence Awards. Only candidates with outstanding research records or potential should apply. Closing date for applications is February 1, 1987, later applications will be considered if position remains open. Send applications to Department Head, Department of Mathematics. The University of Arizona is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF ARIZONA, DEPARTMENT OF MATHEMATICS
TUCSON, ARIZONA 85721

The Mathematics Department at the University of Arizona will have several visiting positions for next year. Closing date for applications is February 1, 1987, later applications will be considered if position remains open. Send applications to Department Head, Department of Mathematics. The University of Arizona is an Equal Opportunity/Affirmative Action Employer.

POSITIONS AVAILABLE

UNIVERSITY OF SOUTHERN MISSISSIPPI DEPARTMENT OF MATHEMATICS

Applications are invited for three tenure-track positions, one of which may be at a senior rank. Candidates must have the Ph.D. in mathematics, serious research interests, and a dedication to teaching. Preference will be given to those candidates whose research interests complement those of the current faculty. These interests include algebra, combinatorics, differential geometry, graph theory, linear algebra, and mathematical physics. We are also interested in developing a research base in numerical analysis and differential equations. Success in attracting external funding to support basic and/or applied research, though not required, will enhance the application.

The normal teaching load is 6-9 credit hours per semester (15-16 per academic year), including both undergraduate and graduate courses. The successful applicant will be expected to establish an active mathematical research program and to participate in the usual faculty service activities (e.g., advisement, curriculum development, committee assignments).

The salary is negotiable and competitive, dependent upon qualifications. The starting date will be Fall, 1987-88. While the application deadline is open, selection may begin as early as 2/1/87. Interviews will be conducted at the 93rd Annual Meeting of the AMS, January 21–24, 1987, in San Antonio, TX. Candidates should contact the Department prior to January 16 to schedule interviews of duration longer than those available through the MSER.

The University of Southern Mississippi is one of the State's three designated comprehensive universities, with an on-campus enrollment of 10,000+. The Department has 25 full-time faculty members and offers the B.S., B.A., and M.S. degrees in mathematics. We also offer the course work to support the Ph.D. in secondary education with mathematics as a specialization area. Hattiesburg is a city of about 45,000 people in the pine-forested, rolling hills just 70 miles north of the beautiful and bustling Mississippi Gulf Coast. Outdoor recreational opportunities are abundant. The white sands and emerald water of the Florida Gulf Coast are just a few hours away, while New Orleans is within an easy two-hour drive. The climate is subtropical, with mild winters. The average daily high in January is 65°F. Early spring produces an astounding display of color from the indigenous azalea, dogwood and magnolia.

Send résumé and three letters of recommendation to: Chair, Search Committee, Department of Mathematics, University of Southern Mississippi, Hattiesburg, MS, 39406-5045. The University of Southern Mississippi is an affirmative action, equal opportunity employer. Applications from women and minority group members are encouraged.

AUBURN UNIVERSITY
Department of Algebra, Combinatorics and Analysis

The department expects to make one or more tenure track appointments beginning September 1987 in each of the following areas: algebra (abelian groups, ring theory, module theory, with emphasis on non-Artinian) combinatorics (candidates with extensive knowledge of computer science); probability; ordinary differential equations or partial differential equations; numerical analysis. Rank open, salary negotiable. Additional visiting positions expected in these and other areas.

Send resume and arrange for three letters of reference to be sent to James R. Wall, Division of Mathematics, Auburn University, AL 36849.

AUBURN UNIVERSITY IS AN EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER.

OREGON STATE UNIVERSITY

Visiting appointments in mathematics for 1987-88. Ph.D. or equivalent training and experience. All ranks considered. Preference to applicants who augment research areas in the department, or who meet instructional needs. Full or part-time appointments. Renewals may be possible.

No closing date.

Write to:

Professor P. M. Anselone, Chairman
Department of Mathematics
Oregon State University
Corvallis, OR 97331-4605
Attn: Staff Selection Committee

Oregon State University is an Affirmative Action/Equal Opportunity Employer and complies with Section 504 of the Rehabilitation Act of 1973.

OREGON STATE UNIVERSITY

Applications are invited for an Associate Professor position that may become available in applied mathematics or numerical analysis. Salary negotiable, depending on qualifications. Start September 1987. Closing date January 15, 1987. Write to:

Professor P. M. Anselone, Chairman
Department of Mathematics
Oregon State University
Corvallis, OR 97331-4605
Attn: Staff Selection Committee

Oregon State University is an Affirmative Action/Equal Opportunity Employer and complies with Section 504 of the Rehabilitation Act of 1973.

OREGON STATE UNIVERSITY

Applications are invited for an Assistant Professor position that may become available in applied mathematics, numerical analysis, geometry, or probability. Salary negotiable, depending on qualifications. Start September 1987. Closing date January 15, 1987. Write to:

Professor P. M. Anselone, Chairman
Department of Mathematics
Oregon State University
Corvallis, OR 97331-4605
Attn: Staff Selection Committee

Oregon State University is an Affirmative Action/Equal Opportunity Employer and complies with Section 504 of the Rehabilitation Act of 1973.

NORTHEASTERN UNIVERSITY
Department of Mathematics

Applications are invited for position of Assistant or Associate Professor and possibly one Post-Doctoral Lectureship. A Ph.D. is required, and priority will be given to candidates with strong records of scholarship and excellence in teaching. Particular needs of the department are in Statistics and Applied Mathematics. All positions start Fall 1987. Please send resume and 3 letters of reference to: Hiring Committee Chairman, Department of Mathematics, Northeastern University, Boston, MA 02115. Northeastern is an Equal Opportunity/Affirmative Action Employer.

PIKEVILLE COLLEGE
PIKEVILLE, KENTUCKY 41501

Two positions beginning January or August, 1987. Applicants should have the ability and willingness to teach undergraduates mathematics. Ph.D. required, experience desired. Salary and fringe benefits competitive. Send resume, transcripts, and three letters of reference to Robert Mayfield, Dean. Pikeville is an AA/EO Employer.

POSITIONS AVAILABLE

University of California, Santa Barbara
Department of Mathematics

Applications are invited for two tenure track appointments at the assistant professor level, effective July 1, 1987. Candidates in the area of applied discrete mathematics are especially sought, but junior candidates in all areas of the mathematical sciences will be given serious consideration. Outstanding research and teaching accomplishments and potential will be the primary criteria for selection. Ph.D. required by the time of appointment. Applicants should send vitae and publication list, and arrange to have three letters of recommendation sent to: Alex Rosenberg, Chairman, Department of Mathematics, South Hall 6607, University of California, Santa Barbara, CA 93106 by January 10, 1987.

UCSB is an equal opportunity/affirmative action employer.

THE GEORGE WASHINGTON UNIVERSITY
DEPARTMENT OF MATHEMATICS

Applications are invited for one or more tenure track positions at the Assistant Professor level beginning September 1987. Candidates must have a Ph.D. in teaching, a serious commitment to excellence in teaching, and must give evidence of strong research potential in the areas of Logic, Combinatorics, or Applied Mathematics. Applicants should send vita, statement of current research activities, and three letters of recommendation to: H. D. Junghenn, Chairman, Department of Mathematics, George Washington University, Washington, D.C. 20052. Applications will be accepted until February 15, 1987. The George Washington University is an Equal Opportunity Educational Institution/Affirmative Action Employer.

OTTO SZASZ VISITING PROFESSORSHIP

The Department of Mathematical Sciences of the University of Cincinnati has established a visiting professorship named in honor of the late Otto Szasz. The professorship will be tenable for a period of one year. Applicants with strong research accomplishments in an area compatible with one of the existing research groups of the Department may address inquiries to C. W. Groetsch, Head, Department of Mathematical Sciences, Mail Location 25, University of Cincinnati, Cincinnati, Ohio 45221.

The University of Cincinnati is an AA/EOE.

The Mathematics and Statistics Department of Radford University is seeking applicants for tenure track positions beginning September 1987. A doctorate in mathematics by June 30, 1987 is required. The department is seeking one person with speciality in analysis or applied mathematics but will consider applicants from several selected areas for other positions. This position entails a four course, twelve semester hour teaching load, in a department which offers Bachelor's degrees. Rank and salary are dependent on experience and qualifications. Send letter of application, vita, three recent letters of reference and copies of all graduated and undergraduate transcripts by December 1, 1986 to:

Dr. David L. Albig, Chairman
Department of Mathematics and Statistics
Radford University
Radford, VA 24142

Applications will be accepted until the position is filled. Radford University does not discriminate on the basis of handicap, race, national origin, sex, or age. Inquiries may be directed to the Equal Opportunity Programs Office in Preston Hall (Phone 703-831-5421).

UNIVERSITY OF CALIFORNIA, IRVINE
DEPARTMENT OF MATHEMATICS

Applications for the following two openings in 1987 are invited:

a) Assistant Professor in Probability/Statistics

b) Assistant Professor in areas where Analysis and Geometry overlap

Candidates for these positions must have a Ph.D. and a research record. Duties include research, undergraduate and graduate teaching. Send applications, curriculum vitae, work in print or in preparation, and three letters of recommendation to Professor Abel Klein, Chairman of the Recruitment Committee, Department of Mathematics, University of California, Irvine, CA 92717. Appointments begin on July 1, 1987. U.C. Irvine is an Affirmative Action Equal Opportunity Employer.

COMPUTATIONAL AND APPLIED MATHEMATICS
Northern Illinois University
Fall 1987

Several anticipated tenure track positions at the Assistant/Associate Professor levels. All areas of computational and applied mathematics considered, with Numerical Optimization being a top priority. There are active groups in Numerical and Applied Linear Algebra, Control Theory, Nonlinear PDE and Numerical PDE. Candidates must have a Ph.D. and a strong commitment to research and teaching.

Research faculty have a two course load. The department has strong undergraduate and graduate programs (Master's and Ph.D).

Send vita and three letters of reference to Professor B. N. Datta (for Numerical Computational Mathematics and Optimization) or to Professor Fred Bloom (for Theoretical Partial Differential Equations). Department of Mathematical Sciences, Northern Illinois University, DeKalb, IL 60115. Closing: January 15, 1987 or until positions filled.

Northern Illinois University is an Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF MATHEMATICS
The University of Texas at Austin
Austin, Texas 78712

A number of appointments are expected for Fall 1987 at the Instructor level (customarily new Ph.D.'s) and the Assistant Professor level (customarily at least two years experience beyond the Ph.D.). Candidates should have strong research credentials. Salaries will be competitive. Applicants should send vita, detailed summary of research interests, and at least three letters of recommendation to the Recruiting Committee Chairman at the above address as soon as possible and in any event no later than January 15, 1987. The University of Texas is an equal opportunity employer.

NORTH CAROLINA STATE UNIVERSITY
DEPARTMENT OF MATHEMATICS

Beginning July 1, 1987, junior level tenure track positions are available in applied analysis (PDE, dynamical systems, optimal control).

Applicants must have a Ph.D. in Mathematics and have a strong record or potential in both research and instruction. Send a resumé, relevant reprints, thesis abstract, and three letters of reference to Professor R. H. Martin, Search Committee Chairman, Department of Mathematics, Box 8205, North Carolina State University, Raleigh, North Carolina 27695-8205.

North Carolina State University is an Affirmative Action and Equal Opportunity Employer.

POSITIONS AVAILABLE

UNIVERSITY OF ILLINOIS AT CHICAGO DEPARTMENT OF MATHEMATICS, STATISTICS, AND COMPUTER SCIENCE

Applications are invited for tenure-track/tenure positions from excellent researchers in algorithms, complexity theory, numerical analysis, combinatorial and probabilistic analysis, and other areas of theoretical or mathematical computer science.

The Department has an active research group in computer science, with current focus on algorithms, complexity, combinatorics, coding theory, and language design. It offers the stimulating research environment of a highly rated mathematics department, with strong research groups in many areas related to computer science, including group theory, symbolic algebra, logic, queuing theory, and matrix theory. The Department has very successful B.S. and M.S. programs in Computer Science, and a growing Ph.D. program in Theoretical Computer Science. Applications in other areas of the mathematical sciences may be considered if positions become available. Send vita and direct 3 letters of reference to Chairman, Search Committee, Dept. of Math., Stat., and Comp. Sci., Univ. of Illinois at Chicago, Box 4348, Chicago, Il 60680. UIC is an affirmative action/equal opportunity employer.

Faculty Openings

The Department of Mathematics of Baruch College/ The City University of New York seeks candidates for five or more tenure-track positions beginning September 1, 1987. PhD, evidence of a strong research record, and a strong commitment to undergraduate teaching required. Applicants from all fields invited. Send resume and names only of three references to: Chair, Department of Mathematics, Baruch College/CUNY, 17 Lexington Avenue, Box 509, New York, NY 10010. Baruch College is an AA/EOE.

UNIVERSITY OF CALIFORNIA, IRVINE DEPARTMENT OF MATHEMATICS

Applications for a tenured position in Differential Geometry opening in 1987 are invited:

Candidates for this position must have a Ph.D. and a research record. Duties include research, undergraduate and graduate teaching. Send applications, curriculum vitae, work in print or in preparation, and three names of references to Professor Abel Klein, Chairman of the Recruitment Committee, Department of Mathematics, University of California, Irvine, CA 92717.

Appointment begins on July 1, 1987. U.C. Irvine is an Affirmative Action Equal Opportunity Employer.

WASHINGTON COLLEGE CHESTERTOWN, MARYLAND

Washington College announces a tenure track position at the assistant professor level. This is a teaching position, involving instruction throughout the normal undergraduate mathematics curriculum. A PhD is required, with experience in computer science desirable. Applicants should send, by 15 December 1986, a resumé, transcripts, at least three letters of recommendation, and a letter of application including a brief essay on the role of mathematics in a liberal arts education to Dr. Albert W. Briggs, Jr.; Department of Mathematics and Computer Science; Washington College; Chestertown, MD 21620. Washington College is an equal opportunity employer.

LOYOLA UNIVERSITY DEPARTMENT OF MATHEMATICAL SCIENCES

The Department of Mathematical Sciences anticipates several tenure-track positions beginning in August, 1987. Requirements are the Ph.D., an active research program, and a commitment to quality teaching. All areas will be considered, but for at least one of the positions preference will be given to individuals interested in participating in our computer science and/or statistics programs. Interviews will begin in January and continue until all positions are filled. To apply send detailed C.V. and three letters of recommendation to:

Professor R. J. Lucas
Department of Mathematical Sciences
Loyola University of Chicago
6525 N. Sheridan Road
Chicago, IL 60626

Loyola University of Chicago is an Equal Opportunity/Affirmative Action Employer.

Applications are invited for a tenure-track position in Mathematics at Bard College for the Fall of 1987. Bard is a Liberal Arts College with a young and expanding Mathematics Department. We are seeking someone with a strong interest in building an innovative mathematics program in a liberal arts context. Candidates must have a Ph.D. by the Fall of 1987 and a commitment to teaching and continued mathematical activity. To apply, submit a resume, a statement of teaching and research interests, and 3 letters of recommendation (at least one concerning teaching) to Prof. Ethan Bloch, Mathematics Search Committee, Box 91, Bard College, Annandale-on-Hudson, NY 12504. Deadline for applications is January 15, 1987; late applications will be considered until the position is filled. Bard College is an AA/EOE.

UNIVERSITY OF CINCINNATI, DEPT. OF MATH. SCIENCES MAIL LOCATION #25, CINCINNATI, OH 45221

The Department of Mathematical Sciences expects to make several tenure-track appointments at the assistant professor level. There is also the possibility of visiting positions. Preference for two of these tenure-track positions will be given to numerical analysis and applied statistics or closely related fields. Candidates in other fields with outstanding potential for research, scholarship and teaching and the ability to strengthen existing research areas in the Department are also encouraged to apply. Send vitae and 3 letters of reference to C. W. Groetsch, Head, Department of Mathematical Sciences, Mail #25, University of Cincinnati, Cincinnati, OH 45221. U.C. is an AA/EOE.

Senior level positions, August 1987, in Applied Mathematics (Probability, Statistics included) Qualifications: Ph.D. in Mathematics, excellent research record in some area of Applied Mathematics, commitment to teaching, be able to supervise M.S. and Ph.D. students. Specializations in Numerical Analysis, Control Theory, Stochastic Processes, Probability given special consideration. EO/AAE

Send application letter, detailed resume, three letters of reference directly to:

Dharam V. Chopra, Chairman
Department of Mathematics/Statistics
The Wichita State University
Wichita, KS 67208

Deadline: November 15, then monthly until May 15, 1987.

POSITIONS AVAILABLE

NORTH CAROLINA STATE UNIVERSITY DEPARTMENT OF MATHEMATICS

Beginning July 1, 1987, junior level tenure track positions are available in algebra and geometry. Candidates should have a Ph.D. in Mathematics and have a strong record or potential in both research and instruction. Send resumé, relevant reprints, thesis abstract and three letters of reference to Professor M. F. Singer, Search Committee Chairman, Department of Mathematics, Box 8205, North Carolina State University, Raleigh, North Carolina 27695-8205.

North Carolina State University is an Affirmative Action and Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT CHICAGO MATHEMATICS AND COMPUTER EDUCATION

The Department of Mathematics, Statistics, and Computer Science invites applications for tenure-track, tenured or visiting positions in Mathematics and Computer Science Education.

The Department offers the stimulating environment of a highly rated Mathematics Department along with a strong commitment to the improvement of pre-college education. It currently has a number of successful programs in the area of pre-college mathematics and computer education. These include undergraduate programs for the certification of elementary and secondary teachers; an M.S.T. degree program; a Doctor of Arts program; courses for gifted pre-college students; and extensive teacher in-service and continuing education programs.

The department has received funding to expand and improve these programs and to set up a center for further development of the following activities: research in the teaching and learning of mathematics; study of the impact and applications of new technology such as microcomputers; curriculum improvement in pre-college mathematics and computer instruction; inservice programs for the enhancement of primary and secondary teachers.

Applicants must have a Ph.D. or a D.A. in Mathematics, Mathematics Education, Computer Science, or related field, an outstanding research and publication record, experience in undergraduate and graduate teaching and previous involvement with teacher education programs. Applications are also invited for visiting positions of 1 or more quarters. Send vita and direct 3 letters of reference to Chairman, Search Committee, Dept. of Mathematics, Statistics, and Computer Science, Univ. of Illinois at Chicago, Box 4348, Chicago, IL 60680.

UIC is an affirmative action/equal opportunity employer.

MATHEMATICS UNIVERSITY OF MARYLAND BALTIMORE COUNTY

The UMBC Mathematics Department invites applications for tenure and tenure track faculty positions in Applied Mathematics, beginning September 1, 1987. Candidates should have a Ph.D. and research and teaching experience commensurate with position applied for. Faculty with strengths in Combinatorics, Control and Communication, Operations Research, Scientific Computing, and Applied Analysis are encouraged to apply. The department has a faculty of about 25 at present. Applications should be received at an early date, but no later than January 15, 1987. Send curriculum vitae, reprints and/or preprints, names of at least three referees, and a summary of current research activity to: James M. Greenberg, Chairman, Department of Mathematics, UMBC, Catonsville, MD 21228. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. MINORITIES AND WOMEN ARE ENCOURAGED TO APPLY.

STATISTICS UNIVERSITY OF MARYLAND BALTIMORE COUNTY

The UMBC Mathematics Department invites applications for tenure and tenure track faculty positions in Statistics, beginning September 1, 1987. 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 and Statistics and undergraduate major program in mathematics leading to the baccalaureate degrees. The department has a faculty of about 25 at present. Applications should be received at an early date but no later than January 15, 1987. Send curriculum vitae, reprints and/or preprints, names of at least three referees and a summary of current research activity to: James M. Greenberg, Chairman, Department of Mathematics, UMBC, Catonsville, MD 21228. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. MINORITIES AND WOMEN ARE ENCOURAGED TO APPLY.

YORK UNIVERSITY Department of Mathematics Toronto, Canada

Applications are invited for one or more tenure-track or limited-term positions, rank and field open, to begin July 1, 1987. Applicants should have proven ability or demonstrated potential for research and teaching. Special consideration will be given to candidates in statistics or operations research. Positions are subject to university approval. Resumes and at least three letters of recommendation should be received by January 15, 1987. Address all correspondence to: Joan Wick Pelletier, Chair, Department of Mathematics, 4700 Keele Street, North York, Ontario, M3J 1P3 Canada. York University is implementing a policy of employment equity. Qualified women and men are invited to apply. In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents of Canada.

Northern Kentucky University

The Department of Mathematical Sciences, Northern Kentucky University invites applications for the position of chairperson to lead 26 full-time and 18 part-time faculty members. The department offers undergraduate degrees in mathematics, computer science, and mathematics education, with growing offerings in statistics. The department emphasizes excellence in undergraduate instruction in hiring, promotion, and tenure decisions.

Northern Kentucky University, founded in 1968, has a student body of 9000, and is located just 7 miles from downtown Cincinnati, Ohio. Greater Cincinnati, with its rich cultural heritage, is an excellent place to live.

Candidates must have an earned doctorate in one of the mathematical sciences or computer science, a strong undergraduate teaching record and demonstrated academic leadership.

Applicants should submit a curriculum vitae and three letters of recommendation to:

Daniel Curtin, Chair
Search Committee
Department of Mathematical Sciences
Northern Kentucky University
Highland Heights, KY 41076

Review of applications will begin February 1, 1987 and continue until the position is filled. The anticipated appointment date is July 1, 1987.

Northern Kentucky University is an Affirmative Action/Equal Opportunity Employer and actively seeks the candidacy of minorities and women.

POSITIONS AVAILABLE

INDIANA UNIVERSITY
PURDUE UNIVERSITY AT INDIANAPOLIS
DEPARTMENT OF MATHEMATICAL SCIENCES

The Department of Mathematical Sciences at IUPUI is seeking applicants from all areas of pure and applied mathematics for two tenure-track positions to begin in August, 1987. The applicant must have an earned doctorate and excellent research record or potential. Special consideration will be given to applicants from the following areas: Dynamical systems, numerical analysis, mathematical physics, classical and functional analysis, mathematical economics, index theory of elliptic operators, operator algebras, probability and applied statistics.

IUPUI is a comprehensive urban university with over 23,000 students. The department offers B.S., M.S., and Ph.D. degrees from Purdue University. The normal teaching load is two courses per semester. The university offers excellent fringe benefits and competitive salary. Send resume and three letters of recommendation to Professor Bart Ng, Chairman, Department of Mathematical Sciences, IUPUI, 1125 East 38th Street, P. O. Box 647, Indianapolis, IN 46223. Closing date: January 15, 1987. Late applications will be considered until positions are filled. IUPUI is an Affirmative Action/Equal Opportunity Employer.

ALLEGHENY COLLEGE
DEPARTMENT OF MATHEMATICS
MEADVILLE, PA 16335

Tenure-track positions in an expanding department are available beginning in September 1987. Applicants should have a PhD in mathematics and strong commitments to the teaching of undergraduate students and to continued professional development. Rank and salary are competitive and commensurate with qualifications and experience. Fringe benefits include TIAA-CREF, health and life insurance, full tuition benefits for family, and IBM PC's in faculty offices. There may also be a sabbatic replacement position open to persons with at least a Master's degree and teaching experience.

Screening of applicants will begin December 1, and continue until all positions are filled. Send application, graduate transcripts, and three letters of recommendation to Ronald E. Harrell, Search Committee Chairperson. Early applicants should also indicate whether they plan to attend the Joint Mathematics Meetings in San Antonio. Allegheny College is an Equal Opportunity Employer.

UNIVERSITY OF LIVERPOOL
DEPARTMENT OF PURE MATHEMATICS
SENIOR RESEARCH ASSISTANT

Applications are invited for a Senior Research Assistant to work with Dr. H. R. Morton on the geometry of knot polynomials. A knowledge of knot theory, 3-manifolds or related topics is necessary. Applicants should possess a Ph.D. in mathematics or expect to receive such an award in the near future.

The post is SERC-funded and is tenable for up to three years, starting on 1 April 1987 or as soon as possible thereafter.

Initial salary is within the range £8020–£9495 per annum.

Applications, together with the names of three referees, should be received not later than 20 November 1986 by the Registrar, The University, P. O. Box 147, Liverpool, L69 3BX, from whom further particulars may be obtained. Late applications will be considered until the post is filled. Quote ref. RV/981./NAMS.

TEACH IN ASIA OR EUROPE

The University of Maryland University College seeks excellent teachers for openings on U.S. military bases overseas. Most appointments begin in August, 1987, though there may be several openings in January. Requirements include M.A. or Ph.D., recent college teaching experience, and U.S. citizenship. Competence to teach in another discipline desirable. Benefits include transportation and military base privileges (PX, commissary, etc.). Frequent travel and the cost of schooling make these positions difficult for those with children. Send resume to Dr. Lois A. Mohr, Assistant to the Chancellor, Overseas Programs, The University of Maryland, University College, College Park, MD 20742. AA/EEO.

CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO
DEPARTMENT OF MATHEMATICS

Applications are being accepted for the position of Assistant Professor (tenure-track) or Lecturer. Successful candidates will be expected to teach twelve hours per week, and participate in scholarly activities, curriculum development and associated activities. A doctorate in mathematics, statistics, or mathematical education is required. Salary range is $24,168-$29,064, (an approximately 6.8 percent salary raise is pending), dependent upon qualifications and experience. Applicants should submit a letter of application, vita, three letters of recommendation and all transcripts. Applications received after February 13, 1987, cannot be guaranteed consideration. Materials should be sent to:

Dr. Robert G. Stein
Chairman, Department of Mathematics
California State University
5500 University Parkway
San Bernardino, California 92407

AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION, SECTION 504, TITLE IX EMPLOYER.

OGLETHORPE UNIVERSITY
ATLANTA, GA 30319-2797

Applications invited for a regular faculty position in mathematics, starting August, 1987. Any one of a variety of special fields would be appropriate to program, but appointee required to teach range of undergraduate courses.

Oglethorpe is a very selective, small (1000) undergraduate institution of arts and sciences. Focus is on teaching, advising of students, participation in campus life.

Respond by December 1 to Dr. Daniel L. Schadler with résumé, list of graduate courses, letter. Have three reference letters sent. EOE.

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 1987-88. Application, vita, and three letters of recommendation should be sent to William A. Kirk, Chair, 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. Ph.D. or equivalent training required. Special attention will be given to applicants in partial differential equations, differential geometry, and numerical analysis. The selection process will begin as applications are received. The University of Iowa is an Affirmative Action and Equal Opportunity Employer and specifically encourages applications from women and minorities.

POSITIONS AVAILABLE

UNIVERSITY OF MISSOURI-COLUMBIA, Dept. of Math., Columbia, MO 65211 Aug. 1987

Applications at all faculty levels are invited for up to three tenure track positions. The positions require a Ph.D. degree and a commitment to a distinguished research career. The department hopes to hire one person in harmonic or probabilistic analysis at the rank of Associate Professor or above. Selection for all positions will be based primarily on demonstrated research achievement. Quality teaching is expected of all candidates. Send vita and three letters of recommendation to Keith Schrader at address above. Deadline for applications is Jan 15, 1987, or until positions are filled. Equal opportunity/affirmative action employer.

CALIFORNIA STATE UNIVERSITY, LONG BEACH

Four tenure-track positions, Fall 1987: (1) Numerical Analysis; (2) Applied PDE (preferred) or Operator Theory; (3) Algebra, Analysis or Topology with preference to specialties matching faculty interests; (4) Math. Education, with grant-writing experience and interests in geometry, history of math or computer applications. Asst. or Assoc. Prof. preferred, Professor possible for senior applicants with distinguished records in teaching and research. PhD in Mathematics required for (1)–(3), acceptable for (4); PhD in Math. Ed. preferred for (4). Must be U.S. citizen or permanent resident prior to appointment. Applicants in other specialties or without permanent residence may be considered for temporary appointment as Lecturer; PhD in Math required. Evidence of teaching excellence and strong research potential required. Normal teaching load 3–4 courses, 12 hrs. per week. Positions open until filled, but selection begins Dec. 1 from applicants with complete files (resume, transcript, 3 reference letters). Send to C. W. Austin, Chairman, Math. & Comp. Sci., CSU, Long Beach, CA 90840.

CSULB is an Affirmative Action/Equal Opportunity Employer

SAINT LOUIS UNIVERSITY DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE St. Louis, MO 63103

Two tenure track positions are available at the Assistant Professor level to begin fall 1987. The department offers undergraduate majors in Mathematics and Computer Science and a doctorate in mathematics. Persons holding a Ph.D. in Mathematics or Computer Science who are committed to teaching and research and are willing to participate in the undergraduate Computer Science program are invited to apply. Have a vita and three letters of recommendation sent to Professor Charles Ford at the above address. An AA/EOE employer.

UNIVERSITY OF SOUTH ALABAMA DEPARTMENT OF MATHEMATICS AND STATISTICS

Tenure-track position at the Assistant Professor level starting September 1, 1987. Applicants must have a Ph.D. in Mathematics (earned or anticipated by appointment date). Strong research potential and a commitment to excellence in teaching are required. Preference given to fields complementing existing research specialities. Closing date: January 15, 1987. Please send detailed resumé and three letters of recommendation to Dr. Suzanne McGill, Chair, Department of Mathematics and Statistics; University of South Alabama, Mobile, AL 36688. An Equal Opportunity/Affirmative Action Employer.

Van Vleck Assistant Professorships

The Department of Mathematics at the University of Wisconsin-Madison solicits applications for the position of Van Vleck Assistant Professor to begin fall 1987. Positions are for a specified term of three academic years at a salary of at least $28,000. Candidates must receive their doctorate prior to September 1987.

Candidates should have a strong commitment to good teaching and exhibit outstanding potential for mathematical research. Preference will be given to candidates who are likely to interact well with other members of the Department.

The usual teaching load is two courses per semester. There is a high probability of additional income through research or teaching during summers between consecutive years of appointment.

Application forms are available from the Hiring Committee, Department of Mathematics, 223 Van Vleck Hall, 480 Lincoln Drive, Madison, WI, 53706. Supporting materials should include a vita, a one to three page abstract of the candidate's dissertation, and three or four letters of recommendation at least one of which discusses the candidate's experience and capabilities as a teacher in detail.

Applications will be accepted until all positions are filled; however, in order to ensure full consideration, the application and all supporting materials must be received by December 31, 1986. AA/EOE

UNIVERSITY OF WYOMING Department of Mathematics

Invites applications for the following positions:

1. A senior-level position in the area of computational mathematics. Candidates should have an outstanding record of accomplishment in an area of applied mathematics that makes significant use of high speed computers. The appointee will be expected to interact with our newly established Center for Computational Mathematics and Mechanics and to provide leadership in the developing field of scientific computation.

2. One or more tenure-track positions at the assistant professor level. The Department plans to build on existing strengths, which include applied mathematics and combinatorics, but may make appointments in other areas as well.

3. One or more visiting positions at levels appropriate for the applicant.

Send resume and direct three letters of recommendation to:

Professor Ben Roth
Chairman, Recruiting Committee
Mathematics Department
University of Wyoming
Laramie, WY 82071

Applications completed by January 31, 1987 will be given first consideration. The University of Wyoming is an Equal Opportunity Employer.

CENTRE COLLEGE MATHEMATICS POSITION

Applications are invited for a tenure-track position at the rank of instructor or assistant professor, beginning September, 1987. A Ph.D (or the early anticipation of one) is required. The position requires the teaching of a wide range of undergraduate courses and a strong commitment to liberal arts education. The ability to teach mathematical statistics or computer programming is desirable. Letters of application, résumés, transcripts and three letters of reference should be sent to Dean Leonard DiLillo, Centre College, Danville, KY 40422. Centre College is an AA/EOE

POSITIONS AVAILABLE

Rice University
Department of Mathematics

Applications are invited for one or more research/teaching positions in the fields of algebra, analysis, geometry, or topology at the rank of Assistant Professor or higher.

Applications should be received by February 15, 1987.

Applications are also invited for two Griffith Conrad Evans Instructorship postdoctoral appointments for two to three years for a promising research mathematician with research interests in common with the active research areas at Rice.

Applications should be received by February 15, 1987.

Please mail inquiries to:

Appointments Committee
Department of Mathematics
Rice University
P. O. Box 1892
Houston, TX 77251

Rice University is an Equal Opportunity/Affirmative Action Employer.

OCCIDENTAL COLLEGE

The Department of Mathematics invites applications for a Regular Assistant Professorship beginning September 1987. A Ph.D. in Computer Science or Ph.D. in Mathematics with expertise in Computer Science is required. Candidates are expected to demonstrate excellence in teaching and have active research interests. Occidental is a liberal arts college offering a degree in Mathematics with an optional emphasis in Computer Science. The teaching load is two courses per term (8–9 hours). The salary range $26,500–$30,000. Occidental actively supports affirmative action; applications from ethnic minorities and women are strongly encouraged. Interviews will be held at AMS meeting in San Antonio, January 1987. Send vita and three letters of reference (one about teaching) to Nalsey Tinberg, Department of Mathematics, Occidental College, 1600 Campus Road, Los Angeles, California 90041, by February 10, 1987. Applications received after that date will still be considered as long as the position remains open.

FACULTY APPOINTMENTS

The Department of Mathematical Sciences at The Johns Hopkins University invites applications for junior (tenure-track) and senior (tenured) appointments, effective Fall 1987, in the area of operations research, broadly defined. Specializations of particular interest include (but are not limited to) decision science, mathematical programming, network flows, combinatorial optimization, algorithms, numerical methods, discrete mathematics, and large-scale systems. Candidates should be active researchers having outstanding accomplishments or demonstrated potential in research, teaching and/or innovative applications. Interested persons are asked to send their vitas to

Professor Robert J. Serfling, Chairman
Department of Mathematical Sciences
The Johns Hopkins University
Baltimore, Maryland 21218

Junior applicants are asked also to write describing their professional interests and aspirations, and to have three letters of reference sent; recent or new Ph.D.'s are asked also to furnish official university transcripts.

The Johns Hopkins University is an Equal Opportunity/Affirmative Action Employer. Employment is offered without discrimination on the basis of race, color, religion, sex or national origin.

University of Puerto Rico
Department of Mathematics
Río Piedras, PR 00931

Tenure-track positions in Computer Sciences (all areas), Operations Research, Statistics, Numerical Analysis, Ordinary and Partial Differential Equations. Ph.D. required. Applications considered until June 1, 1987 to start on August 1987. Salary around $21,000, payable in 12 months. Teaching load: 6 to 9 hours depending on research activity. Conversational Spanish is a plus. The University of Puerto Rico is an equal opportunity employer. Send resumé, transcripts and three letters of recommendation to D. E. Pastor, Chairman.

DEPARTMENT OF MATHEMATICAL SCIENCES, NORTHERN ILLINOIS UNIVERSITY

Several tenure-track positions in pure and applied mathematics beginning Fall 1987. Applicants should have strong research record or potential and strong commitment to teaching. Mathematicians in any area of pure and applied mathematics may apply. Applicants should anticipate completion of the Ph.D. by August 1987. Preference for research complementing that of present faculty. Salary range competitive. Research-oriented department, offers Ph.D. Two-course teaching load. Send vita and three letters of reference by January 15, 1987 to

Dr. John Selfridge
Chair, Department of Mathematical Sciences
Northern Illinois University
DeKalb, Illinois 60115-2888

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DEPARTMENT OF STATISTICS
UNIVERSITY OF CALIFORNIA, BERKELEY

Pending final budgetary approval, applications are invited for a position at the Assistant, Associate, or Full-Professor rank beginning Fall 1987. Applicants should have strong research potential (Assistant Professor candidates) or demonstrated research ability (all other candidates) in any of the following areas: theoretical or applied statistics, computational statistics, probability theory, applied probability. Send inquiries or applications (including resumé and names of three references) by February 15, 1987 to: P. W. Millar, Personnel Committee, Department of Statistics, University of California, Berkeley, CA 94720. The University of California is an Equal Opportunity Affirmative Action Employer.

COLLEGE OF CHARLESTON
DEPARTMENT OF MATHEMATICS

Applications are invited for at least 3 tenure-track positions at the Assistant Professor level beginning August 1987, at least one of which is in an applied area. Candidates must have a Ph.D. in one of the mathematical sciences, a commitment to undergraduate teaching, and potential for continuing research. The normal teaching load is 9 hrs/wk for those engaged in research. The salary is competitive. Internal grants for release time or financial support for research projects are available as is travel support. Applicants should send a vita and have three letters of recommendation sent to William L. Golightly, Chairman, Department of Mathematics, College of Charleston, Charleston, SC 29424. The process of evaluating applications will begin on January 15, 1987, but applications will be considered until the positions are filled. The College of Charleston is an Affirmative Action/Equal Opportunity Employer.

POSITIONS AVAILABLE

THE UNIVERSITY OF ALABAMA MATH FACULTY POSITIONS

The Mathematics Department expects approximately three vacancies beginning August 16, 1987, contingent upon funding. Will probably hire at the rank of assistant professor, but applicants with qualifications for higher rank will be considered. Applicants should have or reasonably expect to have by August 16, a Ph.D. or the equivalent. Excellence in both teaching and research required. Will consider applicants in all areas, particularly applied math and topology. Applications invited both for tenure track and visiting positions. (Each position may be filled either way.) Women and minorities particularly encouraged to apply. A curriculum vita, reprints and/or preprints, and at least three letters of recommendation should be sent to: Search Committee, Box 1416, Tuscaloosa, AL 35487-1416. THE UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

Department of Mathematics, University of Louisville Louisville, Kentucky 40292

CHAIR. University of Louisville, Department of Mathematics, is seeking an established person to be Department Chair. The Chair must provide leadership for growth, development, and renewal of the faculty and programs of the Department during a time of change and expanding resources. Successful candidate must also be willing to devote considerable effort to the general administration of the Department and to enhancement of its research mission. Ph.D. Program is currently being explored. Candidates should have active research program, substantial scholarly achievement, teaching and administrative experience, and interest in undergraduate and graduate (Master's and Ph.D.) program development. Ph.D. in mathematics is required. Research area compatible with department emphases and experience directing Ph.D. theses is also preferred. Depending upon experience, appointment will be at Associate Professor or Professor level. Interested candidates should send letter of application with vitae and at least three letters of recommendation to Wiley Williams, Search Committee Chair, Department of Mathematics. Application deadline January 16, 1987. AA/EOE.

WORCESTER POLYTECHNIC INSTITUTE

The Department of Mathematical Sciences anticipates filling for fall, 1987, several tenure track assistant professorships in the following areas of applied mathematics:

Classical Applied Mathematics (mathematical modeling, mathematical physics, dynamical systems, nonlinear PDE)

Statistics/Applied Probability (times series, estimation)

Discrete Mathematics (coding theory, combinatorics and graph theory, computational complexity)

Applicants should have a Ph.D., evidence of quality teaching, and a commitment to ongoing scholarship. Duties include undergraduate/graduate teaching four hours per week and advising student projects. Further, one will be expected to carry out a program of professional development in teaching skills and in research.

WPI, the nation's third oldest college of science and engineering, offers a unique project based undergraduate education. Graduate programs are available in mathematics, science, engineering and management. Applications must include curriculum vitae, transcripts, thesis abstract and names of at least three references. Application materials to: Professor Gordon C. Branche, Department of Mathematical Sciences, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609. An Equal Opportunity Employer.

SUNY THE COLLEGE AT NEW PALTZ

Tenure track positions in Computer Science beginning 9/87, for faculty to support undergraduate and masters programs. Requirements: Ph.D. in Computer Science or in a related field with a Master's or equivalent in Computer Science. Evidence of excellence in teaching and scholarly achievement. College in Hudson Valley/Catskill Mountains region of New York. Departmental research includes database design, computational complexity, neural networks for AI, logic programming, operating systems, graphics. Hardware expertise desirable for one position. Send resumé with names, addresses and telephone numbers of 3 references to: D. Clark, Chairman, Department of Mathematics and Computer Science, Box 10, The College at New Paltz, SUNY The College at New Paltz, New Paltz, NY 12561. Review of applications beginning 1/12/87. Pending funding approval. AA/EOE. Women and minorities urged to apply.

THE COLLEGE AT NEW PALTZ STATE UNIVERSITY OF NEW YORK

has tenure track positions available beginning September 1987 for persons capable of making a substantial contribution to teaching and research in Mathematics. Research areas of the department are Applied Mathematics, PDE, Functional Analysis, Operator Theory, Probability, Logic, (Universal) Algebra and Lattice Theory. The salary is competitive. Applicants should have completed a Ph.D. by September 1987. The College is located 75 miles north of New York City, in the Catskill Region known for its natural beauty and abundant recreational facilities. The department offers Bachelors and Masters degrees in Mathematics and in Computer Science. Send a cover letter with resumé and the names, addresses and phone numbers of three references to: Prof. David M. Clark, Chairman, Department of Mathematics & Computer Science, Box 10, SUNY The College at New Paltz, New Paltz, NY 12561. Review of candidates will begin December 1, 1986. Pending funding approval. AA/EOE. Women and minorities urged to apply.

NEW MEXICO STATE UNIVERSITY, DEPT MATH SCI, LAS CRUCES, NM 88003

Visiting positions and possible tenure-track, assistant professor positions in pure and applied mathematics, numerical analysis, statistics, computer vision. Start August 24, 1987. Salary competitive. Ph.D. (or equivalent) and strong commitment to teaching and research essential. Applications are kept on file through hiring period and positions filled as openings occur. Send vita and arrange for three reference letters to be sent to Carol L. Walker, Head, Department of Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003. An Equal Opportunity/Affirmative Action Employer.

NEW COLLEGE OF USF

Tenure-earning position at assistant professor level anticipated for Fall, 1987. Ph.D. in Mathematics or Applied Mathematics, commitment to excellence in teaching and scholarship required. New College is a small, highly selective liberal arts college with a faculty/student ratio of 1:8, recently ranked eighth in U. S. in proportion of graduates successfully completing Ph.D. (Chron. Higher Educ., 8/7/85). The program stresses student independent study and research, and close student-faculty interaction. Send application with résumé, three letters of reference, and statement on teaching philosophy and research interests to Prof. Soo Bong Chae, Division of Natural Sciences, New College of USF, Sarasota, FL 34243-2197. Deadline for applications is 2/1/87. EO/AA employer.

POSITIONS AVAILABLE

DARTMOUTH COLLEGE
John Wesley Young Research Instructorship

The John Wesley Young Research Instructorship is a two year post-doctoral appointment for promising new or recent PhD's whose research interests overlap with those of a department member. Current departmental interests include certain areas in algebra, algebraic number theory, analysis, algebraic geometry, combinatorics, computer science, differential geometry, logic and set theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's specialty and include elementary, advanced and (at instructor's option) graduate courses. Nine-month salary of $26,000 supplemented by research stipend of $3000 for instructors in residence for two months in summer. Send letter of application, résumé, graduate transcript, thesis abstract (and description of other research activities and interests if appropriate), and 3 or preferably 4 letters of recommendation to Recruiting Committee Chair, Department of Math and CS, Bradley Hall, Hanover, NH, 03755. Applications received by Jan. 31 receive first consideration. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

DARTMOUTH COLLEGE
Assistant Professor of Mathematics

The Department of Mathematics and Computer Science expects to have a three-year tenure-track assistant professorship available for fall of 1987. New PhD's must show exceptional promise in teaching and research. More advanced candidates should also have a strong research program and a reputation for excellent work. Tenure would normally be considered in the sixth year of the appointment, but it may be possible to arrange somewhat earlier tenure consideration for candidates with an exceptional postdoctoral record. Research in algebra (including algebraic geometry and algebraic number theory) is of most interest, followed by combinatorics, probability and topology; applications are welcome in all fields. Assistant professors teach four ten-week courses spread over two or three quarters and may supervise graduate students. Send letter of application, statement of research accomplishments and plans, graduate transcript, résumé and four letters of recommendation to Recruiting Committee Chair, Department of Math and CS, Bradley Hall, Hanover, NH 03755. Applications received by Jan. 31 receive first consideration. Dartmouth College is committed to affirmative action and strongly encourages women and minorities to apply.

Department of Mathematics
University of Alberta

Applications are invited for one tenure-track position at the Assistant Professor level starting July 1, 1987. Requirements are a Ph.D. and proven ability or demonstrated potential for research and teaching. Current salary range is $31,612–$45,340 (Canadian) per annum depending upon qualifications. Send vitae and arrange for three letters of reference to be sent to Professor H. I. Freedman, Acting Chairman, Department of Mathematics, University of Alberta, Edmonton, Canada T6G 2G1. The University of Alberta is an equal opportunity employer, but in accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents. Closing date for applications is January 31, 1987. Please refer to File AMD6 when responding to this advertisement.

Mathematics Department Chairperson
Department of Mathematics
Illinois State University

The Department of Mathematics at Illinois State University invites applications for the position of Chairperson. The appointment will be made at the rank of Professor. The salary is competitive. Duties will begin on or about July 1, 1987.

Qualifications–Applicants must have a Ph.D. in Mathematics or Mathematics Education and a solid record of achievement in research, teaching, and leadership. They must have demonstrated effective administrative skills and a strong commitment to mathematics, applied mathematics, statistics, and mathematics education. Experience with graduate programs is desirable.

The Department–The ISU Department of Mathematics has 42 full-time faculty positions and offers undergraduate, masters, and Doctor of Arts programs, with opportunities in both mathematics and mathematics education. A Ph.D. in Mathematics Education is currently being developed. Current faculty research interests include analysis, combinatorics, graph theory, number theory, statistics, and various areas of mathematics education. The department serves over 4000 students each semester.

Application Procedures–To ensure consideration applicants should send, before February 15, 1987, a letter of application, a complete vita, a transcript, and names and addresses of at least 3 references to: Mathematics Chair Search Committee; c/o Professor Larry Alferink, Department of Psychology; Illinois State University; Normal, Illinois; 61761.

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Department of Mathematics
University of Alberta

Applications are invited for one tenure-track position in Optimization and Control starting July 1, 1987. Requirements are a Ph.D. and proven ability or demonstrated potential for research and teaching. Current salary range is from $31,612 (Canadian) per annum depending upon qualifications. Send vitae and arrange for three letters of reference to be sent to Professor H. I. Freedman, Acting Chairman, Department of Mathematics, University of Alberta, Edmonton, Canada T6G 2G1. The University of Alberta is an equal opportunity employer, but in accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents. Closing date for applications is January 31, 1987. Please refer to File AMD5 when responding to this advertisement.

Department of Mathematics
University of Alberta

Applications are invited for one tenure-track position in Partial Differential Equations starting July 1, 1987. Requirements are a Ph.D. and proven ability or demonstrated potential for research and teaching. Current salary range is from $31,612 (Canadian) per annum depending upon qualifications. Send vitae and arrange for three letters of reference to be sent to Professor H. I. Freedman, Acting Chairman, Department of Mathematics, University of Alberta, Edmonton, Canada T6G 2G1. The University of Alberta is an equal opportunity employer, but in accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents. Closing date for applications is January 31, 1987. Please refer to File AMD3 when responding to this advertisement.

POSITIONS AVAILABLE

DEPARTMENT OF MATHEMATICS
University of Connecticut

Applications are invited for anticipated tenure track and visiting positions in both pure and applied mathematics. Applicants should have significant research promise and evidence of good teaching ability. Salary and rank will be competitive and commensurate with qualifications.

Send resume and three letters of reference by January 15, 1987 to Professor J. Tollefson, Head, Department of Mathematics, U-9, University of Connecticut, Storrs, CT 06268.

EEO/AA employer

UNIVERSITY OF SOUTH FLORIDA
Department of Mathematics

Tenure-track teaching and research positions are available beginning August 1987. Applicants must possess a Ph.D. degree. Applicants specializing in Approximation Theory, Computer Science, Control Theory, Differential Equations, Logic, Numerical Analysis, Probability, or Statistics are preferred. Rank and salary will depend on credentials. To apply send curriculum vitae and have three letters of recommendation sent to Kenneth L. Pothoven, Chairman, Tampa, FL 33620-5700. Application Deadline: Feb 10, 1987. The University of South Florida is an equal opportunity employer.

UNIVERSITY OF HAWAII
DEPARTMENT OF MATHEMATICS

Possible positions in mathematics, both visiting and tenure track. Rank open. Ph.D. or equivalent required. To begin approximately 8/1/87. Strong commitment to teaching and research required. Salary range for assistant professors $1894-2804; salaries for full professors range up to $4317. Teaching load is 6 hours per semester. To apply write to Professor Ronald Brown, Chairman, Department of Mathematics, University of Hawaii at Manoa, 2565 The Mall, Keller 401A, Honolulu, Hawaii 96822. Send a curriculum vitae. Have three references sent directly. To be guaranteed full consideration an application should be completed by 1/15/87. The University of Hawaii is an affirmative action/equal opportunity employer.

UNIVERSITY OF MISSOURI-KANSAS CITY,
MATH DEPARTMENT,
5100 ROCKHILL ROAD,
KANSAS CITY, MO 64110

A tenure track Assistant Professorship will be available for Fall 1987. Applicants should have completed the Ph.D. by the time of employment, be able to teach effectively at the undergraduate and graduate level, and show promise of developing a research career which will contribute to the department's doctoral program. Applicants from all areas will be considered; preference given to combinatorics, statistics, and complex analysis. A letter of application, vita, and three letters of recommendation should be sent to Professor Phillip Barker, Chair. It is anticipated interested applicants can be interviewed or receive information at the 1987 AMS Annual Meeting in San Antonio.

The University of Missouri is an EO/AA employer.

Syracuse University invites applications for several anticipated tenure-track positions at the rank of assistant or associate professor. Excellence in teaching and research is required. Candidates in research areas currently represented here will have priority. One position is in the area of numerical analysis and at the rank of assistant professor. For the others, preference will be given in areas related to nonlinear pde's, algebra, or discrete mathematics. Applicants should send a curriculum vitae and have three letters of reference (and a transcript if recent Ph.D.) sent to L. J. Lardy, Chairman, Department of Mathematics, Syracuse University, Syracuse, New York 13244-1150. Syracuse University is an AA/EEO Employer.

Tenure-track, possibly senior, positions anticipated to begin August 15, 1987. Outstanding research record and/or proven research potential and teaching excellence required. Preferred areas: statistics and numerical methods, but candidates in areas of global analysis, dynamical systems, control theory, probability and functional analysis will also be considered for junior positions. Women and minority groups candidates are especially encouraged to apply. Visiting positions most likely in the area of applications of probability and graph theory to chemistry. Send vita plus three letters of recommendations to professor W. A. Woyczynski, Chairman, Department of Mathematics and Statistics, Case Western Reserve University, Cleveland, OH 44106.

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EXCHANGE WANTED

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Proceedings of the Nineteenth Nordic Congress of Mathematicians, University of Iceland, August 13-17,1984

Detailed advertisement with list of contents in the January 1986 Notices, p. 181. Send order and payment ($20) to: Icelandic Mathematical Society, Science Institute, Dunhaga 3, IS-107 Reykjavik, Iceland.

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(2) The Whyburn Research Instructorship, a two year appointment with reduced teaching load starting Sept. 1, 1987. Deadline for receipt of applications including three letters of reference: Feb. 1, 1987.

Applications should be mailed to:

David C. Brydges
Department of Mathematics
Mathematics-Astronomy Building, Cabell Drive
University of Virginia
Charlottesville, Virginia 22903

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DIVISION OF MATHEMATICAL SCIENCES

The Directorate for Mathematical and Physical Science is seeking qualified applicants for position of Director, Division of Mathematical Sciences (DMS). The Division is responsible for funding research in areas of Algebra and Number Theory, Applied Mathematics, Classical Analysis, Modern Analysis, Statistics and Probability, Topology, Foundations, Geometric Analysis and Special Projects. Appointment to this Senior Executive Service position may be on a career or a one- to three-year limited term basis with a salary currently ranging from $61,296 (ES-1) to $68,700 (ES-4). Alternatively, assignment may be made under the provisions of the Intergovernmental Personnel Act.

Applicants must have a Ph.D. or equivalent professional experience or a combination of education and equivalent experience in the mathematical sciences or related field; substantial research contributions and strong evidence of scholarship in the mathematical sciences, including publication of research; demonstrated familiarity with relevant academic community and recognized professional standing in the scientific/engineering community; and supervision and management of professional and support staff.

Applicants should contact Margaret Cademartori on (202) 357-7601 (hearing impaired individuals may call TDD (202) 357-7492) to request Announcement EP 86-9 (career appointment), EP 86-19 (limited term appointment), or EP 86-29 (IPA) for complete qualification requirements and application procedures. Applications must be received by January 9, 1987.

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ICM-86 SOUVENIRS

Many participants at ICM-86 took the opportunity to purchase mementos of the occasion while attending the Congress in Berkeley. For those of you who were unable to attend ICM-86 or who wish to make additional purchases, the following commemorative items are being offered for sale by mail:

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THE UNIVERSITY OF FLORIDA
DEPARTMENT OF MATHEMATICS

The Department of Mathematics is beginning a five year program to fill over 20 new tenure track faculty positions with mathematicians of exceptional caliber. At least one third of these positions will be senior positions.

The Department invites applications for six tenure track positions beginning in Fall, 1987, at least two of which will be filled with senior appointments. Senior candidates chosen by the department will be given a role in the selection of this year's candidates for junior positions. The Department is especially interested this year in attracting candidates in the fields of Differential Geometry (including Dynamical Systems); Mathematical Algorithms and Complexity Theory; Analysis and Probability (particularly Complex Variables and Stochastic Differential Equations). Candidates should have strong research potential, an interest in teaching and at least two years of postdoctoral experience. Rank and salary will be commensurate with experience and achievements. Candidates should forward a resume (including a list of publications) and should arrange for at least three letters of reference to be sent to:

Gerard G. Emch, Chairman
Department of Mathematics
201 Walker Hall
University of Florida
Gainesville, Florida 32611

All applications for the academic year 1987–1988 must be complete by January 15, 1987. The University of Florida is an *equal opportunity employer.*

Math from Princeton

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ASSISTANT PROFESSORSHIPS

University of California, Berkeley
Department of Mathematics
Berkeley, CA 94720

We invite applications for one or more positions effective July 1, 1987, at the tenure-track Assistant Professor level, subject to budgetary approval, in the areas of algebra, analysis, applied mathematics, foundations, or geometry and topology. Applicants are expected to have demonstrated outstanding research potential, normally including major contributions beyond the doctoral dissertation. Send by January 15, 1987 a curriculum vitae, list of publications, and a few selected reprints or preprints. Ask three people to send letters of recommendation to Marc A. Rieffel, Vice Chair for Faculty Affairs, at the above address. The University of California is an Equal Opportunity, Affirmative Action Employer.

TENURED POSITION

University of California, Berkeley
Department of Mathematics
Berkeley, CA 94720

We invite applications for one or more positions effective July 1, 1987, at tenure level (Associate or full Professor), subject to budgetary approval, in the areas of algebra, analysis, applied mathematics, foundations, or geometry and topology. Demonstrated leadership in research is expected of applicants. Send by January 15, 1987 a curriculum vitae, list of publications, a few selected reprints or preprints, and the names of three references, to Marc A. Rieffel, Vice Chair for Faculty Affairs, at the above address. The University of California is an Equal Opportunity, Affirmative Action Employer.

TEMPORARY POSTDOCTORAL POSITIONS

University of California, Berkeley
Department of Mathematics
Berkeley, CA 94720

Several temporary positions beginning in Fall 1987 are anticipated for new and recent Ph.D.'s of any age, in the fields of algebra, analysis, applied mathematics, foundations, or geometry and topology. 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 some preference. Send by January 15, 1987 a resume, and reprints, preprints, and/or a dissertation abstract. Ask three people to send letters of recommendation to Marc A. Rieffel, Vice Chair for Faculty Affairs, at the above address. The University of California is an Equal Opportunity, Affirmative Action Employer.

MATHEMATICS

STATE UNIVERSITY OF NEW YORK AT BUFFALO

The Department of Mathematics anticipates the appointment of at least one tenured or tenure-track faculty member beginning September 1, 1987. Salary will be competitive. Outstanding applicants in all fields of mathematics are encouraged to apply. We seek applicants with excellent research accomplishments/potential and a strong commitment to teaching.

Applicants should send any supporting information and have four letters of recommendation sent to:

Dr. Jonathan Bell
Search Committee Chairman
Department of Mathematics
SUNY/Buffalo
106 Diefendorf Hall
Buffalo, New York 14214

The deadline for applications is December 1, 1986. Late applications will be considered until positions are filled.

SUNY/Buffalo is an Equal Opportunity/ Affirmative Action Employer. We are interested in identifying prospective minority and women candidates. No person, in whatever relationship with the State University of New York at Buffalo, shall be subject to discrimination on the basis of age, creed, color, handicap, national origin, race, religion, sex, martial or veteran status.

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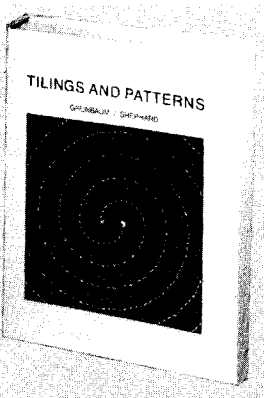

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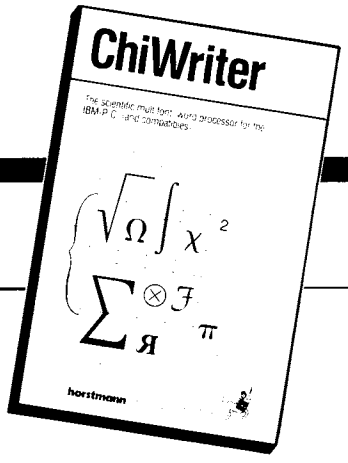

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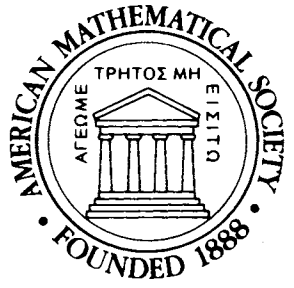

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D. J. Britten, F. W. Lemire, and R. V. Moody, Editors

This book focuses on some recent advances in the theory of semisimple Lie algebras and some direct outgrowths of that theory. Of particular interest are notes for several courses presented at this 1984 meeting: an important survey article by R. Block and R. Wilson on restricted simple Lie algebras, a survey of universal enveloping algebras of semisimple Lie algebras by W. Bohro, a course on Kac-Moody Lie algebras by I. G. Macdonald, and a course on formal groups by M. Hazewinkel. Because of the expository surveys and courses, the book should be especially useful to graduate students in Lie theory, as well as to researchers in the field.

ISBN 0-8218-6009-7, LC 85-26818, ISSN 0731-1036
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I. Hambleton and C. R. Riehm, Editors

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Members of the Society who move or who change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the *Combined Membership List*). In addition, the AMS maintains records of members' honors, awards, and information on Society service. Information of the latter kind appears regularly in *Notices*.

When changing their addresses, members are urged to cooperate by supplying the information requested below. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed, or will change within the next two or three months, please place the peel-off label from the back cover (which contains your name, member code, and address) in the rectangle provided below (or on a copy of this page), supply any other information appropriate for the AMS records, and mail to the address given below.

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EMPLOYMENT INFORMATION IN THE MATHEMATICAL SCIENCES

The American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics publish *Employment Information in the Mathematical Sciences* six times a year. The following resolution was passed on October 25, 1974, by the Council of the American Mathematical Society: "The Council of the AMS adopts principles that all positions in the mathematical sciences shall insofar as practicable be advertised, and that the standard place for the advertisements to appear is the publication *Employment Information*." A similar resolution was subsequently approved by the Board of Governors of the Mathematical Association of America.

The November, January, March, May, and August issues contain listings of open positions, information for which has been provided by heads of mathematics departments of colleges and universities in the United States, Canada, and overseas. In addition, these issues contain descriptions of open positions within government, industrial, and other nonacademic areas. The December issue contains résumés of job applicants who will be participating in the Employment Register at the January Annual Meeting.

Subscription rates include first-class delivery in North America and airmail delivery elsewhere. The 1987 subscription starts with the November 1986 issue and ends with the August 1987 issue. All subscribers receive all six issues regardless of when the order is received.

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January 21-24, 1987

MUST BE RECEIVED IN PROVIDENCE NO LATER THAN NOVEMBER 15, 1986

Please complete this form and return it with your payment to
Mathematics Meetings Housing Bureau
P.O. Box 6887, Providence, Rhode Island 02940 - Telephone: 401-272-9500, Ext. 239

DEADLINES: Preregistration: November 15, 1986.
Changes/Cancellations: Before January 12, 1987, 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 assigned.
Refunds: 50% of preregistration fee(s) for the AMS Short Course or the Joint Meetings will be refunded in Providence on or before January 16, 1987. After this date, there will be no refunds.

	REGISTRATION FEES	
	Preregistration by mail by 11/15	At Meeting
JOINT MATHEMATICS MEETINGS		
Member of AMS, ASL, MAA, NCTM	$59	$77
Nonmember	$90	$117
* Student, Unemployed, or Emeritus	$16	$21
AMS SHORT COURSE		
Member/Nonmember	$35	$45
* Student or Unemployed	$10	$15
EMPLOYMENT REGISTER - Employer fee	$75	$100
- Applicant fee	$15	$20
- Posting fee for job descriptions for noninterviewing employers	$10	$15

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

* All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned from their latest position. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and is retired on account of age from his or her latest position.

PREREGISTRATION SECTION: Please check the function(s) for which you are preregistering:
Joint Meetings [ ] AMS Short Course [ ] Employer [ ] Applicant [ ] Posting [ ]
(January 20-22)

1) _____ Nickname for badge_____
(Please print) Surname First Middle (optional)

2) _____
(Mailing address)

_____

3) Employing institution_____ Emeritus member [ ] Unemployed [ ]

4) I am a student at_____ (5) Accompanied by spouse_____; number of children_____

6) 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 [ ]

7) Joint Meetings fee $_____ (8) AMS Short Course fee $_____ (9) Employer fee $_____

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Credit card type:_____; Card number:_____; Expiration date:_____

Telephone:_____ _____
Signature (name as it appears on credit card)

[ ] PLEASE CHECK HERE IF YOU WILL NOT REQUIRE A ROOM.

Please be sure to complete the section on next page if you will require hotel accommodations.

For office use only:

Codes:	Options:	Hotel:	Room type:
Dates:		Amount paid:	
Special remarks:			

PREREGISTRATION/HOUSING FORM, SAN ANTONIO, TEXAS

JANUARY 1987

HOUSING SECTION:

Please rank hotels in order of preference by writing 1, 2, 3, in the 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 available rate. If not all hotels are ranked, and all rooms have been filled at the ranked hotels, the assignment will be made at an unranked hotel with the next available rate. Rates listed below are subject to 11% hotel/motel occupancy tax.

GUARANTEE REQUIREMENTS: $50 by check, VISA, or MasterCard credit cards. No other credit cards will be accepted. PLEASE SUPPLY THIS INFORMATION ON THE REVERSE together with mailing address for confirmation of room reservation.

Order of choice	Numbers in parentheses indicate location on map.	Single	Double	Twin double	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suite Information
	San Antonio Marriott (1) (Headquarters Hotel)	$60	$60	$60	$66	$66	$70	$70	$125 - $300
	The Crockett Hotel (2)	$54	$54	$54	$59	N/A	$59	N/A	$150
	Hilton Palacio del Rio (3)	$60	$60	$60	$66	$66	$70	$70	On request
	Holiday Inn Downtown-Market Square (4)	$47	$47	$47	$47	$47	$47	$47	N/A
	Hyatt Regency San Antonio (5)	$62	$68	$68	$75	$90	$75	$90	$150 - $411
	La Mansion del Rio Hotel (6)	$60	$70	$70	$80	$80	$80	$80	On request
	La Quinta Convention Center Motor Inn (7)	$46	$56	$56	$61	$61	$66	$66	N/A
	La Quinta Market Square Motor Inn (8)	$37	$45	$45	$49	N/A	$49	N/A	N/A
	TraveLodge on the River (9)	$43	$46	$46	$49	$49	$52	$52	$90

I will arrive on (date)_____at_____a.m./p.m., and depart on (date)_____at_____a.m./p.m.

List other room occupants:

FULL NAME	ARRIVAL DATE	DEPARTURE DATE

1024

MAA MINICOURSE PREREGISTRATION FORM, SAN ANTONIO, TEXAS

Please complete this form and return it to

Mr. John Gilliland
Mathematical Association of America
1529 Eighteenth Street, NW, Washington, DC 20036
Telephone: 202-387-5200

DEADLINE: Preregistration deadline for Minicourses: November 15, 1986 (Send form to address above.)

CANCELLATIONS: 50% of Minicourse fees will be refunded in Washington for cancellations received on or before January 12, 1987. No refunds will be made after this date.

NOTE: All Minicourse registration fees paid to MAA by professional mathematicians are tax deductible.

IMPORTANT: Please be sure to send a separate Joint Meetings preregistration form and fee to the Mathematics Meetings Housing Bureau, PO Box 6887, Providence, RI 02940. Preregistration for the Joint Meetings is a requirement in order to participate in the MAA Minicourses.

[ ] I plan on preregistering for the Joint Meetings only in order to attend the MAA Minicourse(s) indicated below. It is my understanding that, should the course(s) of my choice be filled, full refund of the Joint Meetings preregistration fee will be made.

MINICOURSE PREREGISTRATION

1) _____
(Please print) Surname First Middle

2) _____
Mailing address for confirmation of Minicourse(s)

_____

3) Employing institution_____

4) Please enroll me in the following Minicourse(s). It is my understanding that an invoice will be sent to me if I have been assigned a place in the course(s) chosen.

_____
(Signature)

No. MINICOURSES: Participants are limited to two Minicourses each.

1 A microcomputer linear algebra course using LIN-KIT (Howard Anton)

2 Introduction to computer graphics (Joan P. Wyzkoski, Fairfield University)

3 The teaching of applied mathematics (Gilbert Strang, Massachusetts Institute of Technology)

4 Interesting applications of elementary mathematics (JoAnne S. Growney, Bloomsburg University)

5 Discrete mathematics using difference equations (James T. Sandefur, Jr., Georgetown University)

6 Using microcomputer software in teaching calculus (David A. Smith, Benedict College, and David P. Kraines, Duke University)

NOTE: There is no Minicourse #7.

8 Computer simulation of discrete systems (Zaven A. Karian, Denison University)

9 Recurrence relations (Margaret Barry Cozzens, Northeastern University)

10 Integrating history into undergraduate mathematics courses (Judith V. Grabiner, Pitzer College)

11 Teaching mathematical modeling (Maurice D. Weir, Naval Postgraduate School, and Frank R. Giordano, US Military Academy)

12 True BASIC in freshman calculus (James F. Hurley, University of Connecticut)

13 For all practical purposes (Solomon A. Garfunkel, COMAP, Inc.)

14 Applications of discrete mathematics (Fred S. Roberts, Rutgers University)

15 Constructing placement examinations (John W. Kenelly, Clemson University)

First choice: [ ] Second choice: [ ]

COMBINATORIAL METHODS IN TOPOLOGY AND ALGEBRAIC GEOMETRY

John R. Harper and Richard Mandelbaum, Editors

This collection marks the recent resurgence of interest in combinatorial methods, resulting from their deep and diverse applications both in topology and algebraic geometry. Nearly thirty mathematicians met at the University of Rochester in 1982 to survey several of the areas where combinatorial methods are proving especially fruitful: topology and combinatorial group theory, knot theory, 3-manifolds, homotopy theory and infinite dimensional topology, and four manifolds and algebraic surfaces. This material is accessible to advanced graduate students with a general course in algebraic topology along with some work in combinatorial group theory and geometric topology, as well as to established mathematicians with interests in these areas. For both student and professional mathematicians, the book provides practical suggestions for research directions still to be explored, as well as the aesthetic pleasures of seeing the interplay between algebra and topology which is characteristic of this field.

In several areas the book contains the first general exposition to be published on the subject at hand. In topology, for example, the editors have included M. Cohen, W. Metzler and K. Sauerman's article on "Collapses of $K \times I$ and group presentations" and Metzler's "On the Andrews-Curtis-Conjecture and related problems." In addition, J. M. Montesino has provided summary articles on both 3- and 4-manifolds.

1980 *Mathematics Subject Classifications*: 14Jxx, 20Fxx, 55Pxx, 55Sxx, 57Mxx, and others.
ISBN 0-8218-5039-3, LC 85-11244
ISSN 0271-4132
376 pages (softcover), October 1985
List price $34, Institutional member $27, Individual member $20
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Shipping/Handling: 1st book $2, each add'l $1, $25 max. By air, 1st book $5, each add'l $3, $100 max. Prepayment required. Order from AMS, P.O. Box 1571, Annex Station, Providence, RI 02901-9930, or call 800-556-7774 to use VISA or MasterCard.

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER

Instructions for Applicant's Form on facing page

The form. Applicants' forms submitted for the Employment Register will be photographically reproduced in the December 1986 issue of *Employment Information in the Mathematical Sciences*. Résumés of those attending will be posted at the meeting.

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, 1986** in order to appear in the special issue of *EIMS*, and must be accompanied by the Preregistration/Housing Form printed in this issue, if attending the meeting. **See the Meeting Announcement in the October issue of *Notices* for information. Forms received past the deadline or not completed 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

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER

APPLICANT FORM JANUARY 21-23, 1987 SAN ANTONIO, TEXAS

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 ☐
Thurs. AM 9:30-11:45	Thurs. PM 1:15-5:00	Fri. AM 9:30-11:45	Fri. PM 1:15-5:00

I do not plan to attend the Winter Meeting ☐

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 (be sure to complete) 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 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 San Antonio meeting announcement.)**

EMPLOYER FORM Institution _____ Dept. _____

Name of Interviewer(s) 1. _____ 2. _____

3. _____ 4. _____

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 _____ F Specialties Sought _____

Ⓖ Degree Preferred _____ Ⓗ Degree Accepted _____ Ⓘ Duties _____ Ⓙ Experience _____ Ⓚ Citizenship Restriction _____

Ⓛ Available for Interviews **Session 1 ( ) Thurs. AM, 9:30-11:45** **Session 2 ( ) Thurs. PM, 1:15-5:00** **Session 3 ( ) Fri. AM, 9:30-11:45** **Session 4 ( )* Fri. PM, 1:15-5:00**

Ⓜ Number of Interviewers: _____ **Interviewers** _____ **Interviewers** _____ **Interviewers** _____ **Interviewers**

Institution, City, State, Ⓐ Title of position, Ⓑ No., Ⓒ Start mo. / yr.

Ⓓ, Ⓔ, Ⓕ Specialties sought, Ⓖ, Ⓗ, Ⓘ Duties, Ⓙ Experience, Ⓚ, Ⓛ Sessions

NOTES: Ⓐ Inst, Lect, Asst Prof, Asso Prof, Prof, Dean, Open, MTS (Member Technical Staff), OPAN (Operations Analyst), PREN (Project Engineer), RESC (Research Scientist); Ⓒ Date 01/87, 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.

AMERICAN MATHEMATICAL SOCIETY

Application for Membership 1987

Date ..... 19.....

Please read the reverse side of this form to determine what membership category you are eligible for. Then fill out this application and return it as soon as possible. Your name will be added to our mailing lists upon our receipt of your completed application, and payment for member dues.

Subscriptions to the Notices *and the* Bulletin *(New Series) are included as part of your membership.*

.....
Family Name *First* *Middle*

Please indicate below the way your name should appear in the Combined Membership List.

.....
Family Name *First* *Middle or Initial*

Place of Birth .....
City *State* *Zip/Country*

Date of Birth .....
Day *Month* *Year*

If formerly a member of AMS, please indicate dates .....

Check here if you are now a member of either MAA or SIAM ○

Degrees, with institutions and dates .....

.....

.....

Present position .....

Firm or institution .....

.....
City *State* *Zip/Country*

Fields of Interest *(choose five from the list at right)*

....

Address for all mail

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Signature

Prepayment Methods and Mailing Addresses

Send checks, money orders, UNESCO coupons to American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571.

To use VISA or MasterCard, fill in information requested and mail to American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

For Foreign Bank Transfers: The name and address of the AMS bank is Rhode Island Hospital Trust National Bank, Account #000-753-111, One Hospital Trust Plaza, Providence, RI 02903, U.S.A.

VISA ○ *MasterCard* ○ ....
Account number *Expiration date*

Fields of Interest

If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings of the 1980 Mathematics Subject Classification below. Select no more than five category numbers and fill in the numbers where indicated on the left. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

00 General
01 History and biography
03 Mathematical logic and foundations
04 Set theory
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General mathematical systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra; matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 K-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
39 Finite differences and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control; optimization
51 Geometry
52 Convex sets and related geometric topics
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
73 Mechanics of solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum mechanics
82 Statistical physics, structure of matter
83 Relativity
85 Astronomy and astrophysics
86 Geophysics
90 Economics, operations research, programming, games
92 Biology and behavioral sciences
93 Systems theory; control
94 Information and communication, circuits

M7NO

Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

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1987 Dues Schedule

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Reciprocity member (please verify)[3]	○ $42	○ $64	○ $84
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I am a full-time student at .....

..... *currently working toward a degree.*

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3 Reciprocity Membership Verification (sign below) *I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.*

Reciprocating Societies

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- ○ Calcutta Mathematical Society
- ○ Dansk Matematisk Forening
- ○ Deutsche Mathematiker-Vereinigung e.V.
- ○ Edinburgh Mathematical Society
- ○ Gesellschaft für Angewandte Mathematik und Mechanik
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