

Math Times

University of Illinois at Urbana-Champaign

Spring 1994

Letter from the Chair

Dear Colleague,

This has been a busy time for members of the department. In addition to the dozens of seminars that meet each week, the teaching of undergraduate and graduate students, the visitors who come to inform us both informally and formally at colloquia and seminars of their mathematical work, and the invitations our faculty members receive from colleagues elsewhere to talk about their research, this winter the members of the executive committee read the applications from each of the more than 650 young mathematicians who replied to our job advertisement. Most of them were from outstanding people, many of whom already have important publications.

The committee members had a difficult task in deciding which ones to invite for interviews. In January and February, 10 job applicants

were invited to come and lecture to members of the department on their research.

I am pleased to announce that four new mathematicians have accepted and will be joining our faculty, two this fall, two next year. All four have had a number of graduate and postdoctoral awards and fellowships. **Nick B. Firoozye** and **Randy McCarthy** will come this August and **Kequan Ding** and **Robert Jerrard** will start in fall 1995.

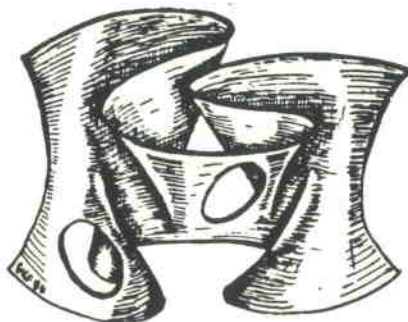
Also coming to the department this August will be **Douglas Bowman** who was

hired a year ago and has been a postdoctoral fellow at Pennsylvania State University, supported by a National Science Foundation fellowship.

I am also pleased that one of our graduates **David Blackwell** will receive an Alumni Achievement Award at commencement ceremonies in May. See Page 3 for a writeup on Professor Blackwell.

We enjoy hearing from any former students or friends of the department. Keep on sending us your news.

Jerry Janusz



A mathematician's work is mostly a tangle of guesswork, analogy, wishful thinking and frustration, and proof, far from being the core of discovery, is more often than not a way of making sure that our minds are not playing tricks.

Gian-Carlo Rota

The Root of the Matter by Joe Rotman

A year ago my (then 11 year old) daughter Ella asked me why square roots are called roots; she saw no connection with plants. Neither did I. I contacted a British historian of mathematics, who traced the English *root* to the Latin *radix* to the Arabic *jidhr* in the 9th century. He quoted the historian D.E. Smith who said that the Arabs thought that squares "grew out of" roots. This didn't sound reasonable to me then, but I was happy to see the word traced back more than a thousand years.

Several months ago, I was reading a new biography of Elie Cartan, by Akivis and Rosenblat. When the authors were explaining Cartan's thesis (the classification of simple complex Lie algebras), they began by describing root systems. Moreover they thought it would be interesting to go into the etymology of *root*, and they traced the Arabic *jidhr* to the earlier Sanskrit *pada*.

I surmise that Akivis and Rosenblat could tell us more, but I suggest that the following guess looks reasonable. Just as we call the bottom side of a triangle its base, let us also call the bottom side of a square its base. A natural question the Greeks asked was: Given a square of Area A , what is the length of its base? The answer,

of course, is $a = \sqrt{A}$; thus if we were inventing a word for \sqrt{A} , we might call it the *base* of A .

Through about the fourth and fifth centuries, most mathematics was written in Greek, but India had become a center of mathematics in the fifth and sixth centuries, and important mathematical texts were also written in Sanskrit. The Sanskrit term for \sqrt{A} was *pada*. Both Sanskrit and Greek are Indo-European languages, and the Sanskrit word *pada* is a cognate of the Greek word $\pi\omicron\delta\omicron\varsigma$; both mean foot or base in the sense of a pillar or, as above, the bottom of a square. But, in both languages, there is a secondary meaning for these words: the root of a plant. In translating the Sanskrit *pada* into the Arabic *jidhr* (Arabic is not an Indo-European language) Arab mathematicians chose the latter meaning, and the translation has been handed down to us through the centuries. The usage became general in Arabic writings, and many European translations from Arabic into Latin used the word *radix*, from which the English *root* derives. The notation for square root of 2 was r_2 , which evolved into $\sqrt{2}$.

This suggestion is supported by the fact that in Europe from the twelfth through the sixteenth centuries, there was a

competing term and notation for a square root (indeed in those days when notation was being invented, it was a common occurrence to have several competing notations). Several translators from the Greek and several from Arabic used the Latin word *latus* (side of a square) and denoted $\sqrt{2}$ by l_2 ; eventually r_2 won out, probably because of the invention of logarithms, for $\log 2$ was often written as l_2 .

The passage from square root to the root of a general quadratic equation is natural enough as is the passage to roots of cubic or higher degree equations. Thus, as pleasant as it would be, there seems to be no botanical connection with roots of equations.

What happens most of the time is nothing. You just can't have ideas often... With any luck, I'll see something.

John Conway

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Editor	Margot Jerrard
Photographs	Hiram Paley
Calligraphy	Pat Martin
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Blackwell to be Honored

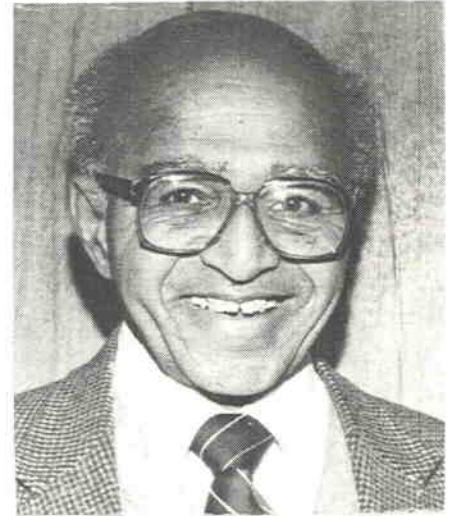
Dr. David Blackwell, emeritus professor of mathematics and statistics at the University of California at Berkeley, will be presented with an Alumni Achievement Award at the university commencement ceremonies in the Assembly Hall, May 15.

This award is for outstanding achievement and was established in 1956. It is the highest honor the U. of I. Alumni Association can bestow. Portraits of the awardees are permanently displayed in the Illini Union.

Dr. Blackwell, a native of Centralia where he attended public schools, came to the university in 1935. He received three degrees here, his A.B. in 1938, his A.M. in 1939 and his Ph.D. in 1941. He wrote his thesis under Emeritus Professor J.L. Doob.

Dr. Blackwell has been a pioneer in statistical decision theory and is an expert on Bayesian statistics, probability and dynamic programming, as well as information theory. He is a member of the National Academy of Sciences and the American Academy of Arts and Sciences and has received twelve honorary doctorates, including one from the University. When he received a doctorate from Harvard the citation said, "His lucid mind has emphasized new ways of describing old concepts."

Among his other awards are the Von Neumann Theory Prize, fellowship in the Institute of Mathematical Statistics and honorary fellowship in the Royal Statistical Society. He is a past president of the International Association for Statistics in the Physical



David Blackwell

Sciences and of the Bernoulli Society for Mathematical Statistics and Probability. He will be introduced at the Alumni Association's annual awards luncheon on May 14 in the Illini Union and will be a guest at dinner that evening.

Effervescent Mathematics

In the early 1980s Professor Eberhard Becker of the University of Dortmund in Germany proved that, for every positive integer, the rational function $(1+t^2)/(2+t^2)$ can be written as a sum of $2k$ -th powers of rational functions. His proof was abstract, and he offered a bottle of champagne

to anyone who could construct an explicit set of formulas.

Bruce Reznick presented a 20 minute talk at a special session on Quadratic Forms and Division Algebras at the Joint Meetings in Cincinnati last January, and for this was awarded the bottle of champagne. Professor Victoria

Powers of Emory University, a collaborator of Professor Becker, made the presentation. The explicit formulas, which fit on a single sheet of paper, are available from Reznick, but the champagne is all gone.

Faculty Notes

In December **Bruce Berndt** gave two lectures at Simon Fraser University in British Columbia. He was the mathematics department's Distinguished Lecturer for the fall semester. *Ramanujan's Notebooks, Part 1V*, by Bruce Berndt was published by Springer-Verlag also in December.

Daniel Grayson gave a talk "Weight Filtration of Algebraic K-Theory via Commuting Automorphisms" at a conference on Algebraic K-Theory and Number Theory at the Fields Institute in Waterloo, Ontario in March.

Lee Rubel has been invited to Israel in May where he will participate in a function theory conference in Bar-Ilan University outside Tel Aviv. He will take part in a seminar and colloquium at the Technion in Haifa and will give lectures at other Israeli universities, among them Hebrew University in Jerusalem and Tel Aviv University.

Leon McCulloh gave an invited hour talk at the workshop on Galois Module Structure held at the Fields Institute in Waterloo, Ontario, February 14 to 18. His paper was titled "Realizable Galois

Module Classes for Nonabelian Extensions."

In May **Gaisi Takeuti** is going to Prague to work on a United States-Czech joint project on Bounded Arithmetic and Complexity.

In Japan **Philippe Tondeur** recently gave four lectures and a colloquium at Keio University in Yokohama, then participated in two workshops on foliations at Chuo University, Tokyo, and the Tokyo Institute of Technology. He also went to Korea where he gave two lectures at Yonsei University in Seoul.

Julian Palmore gave three talks on verification and validation in distributed interactive simulations at the 10th workshop on Standards for the Interoperability of Defense Simulations in March in Orlando FL. In February he gave an hour talk at the Environmental Effects in Distributive Interactive Simulation (E2DIS) project on verification and validation of DIS/E2DIS exercises at New Mexico State University.

Among his other activities, he took part in an E2DIS architecture meeting in Huntsville AL at the U.S. Army's Redstone Arsenal and gave a talk, as well

as chairing a session at the Object Oriented Simulation Symposium at the Society for Computer Simulation Western Multiconference in Tempe AZ.

Palmore, who is a member of the senior advisory group of the Military Operations Research Society, will chair a session on distributive interactive simulation at an upcoming MORS workshop in Albuquerque in September.

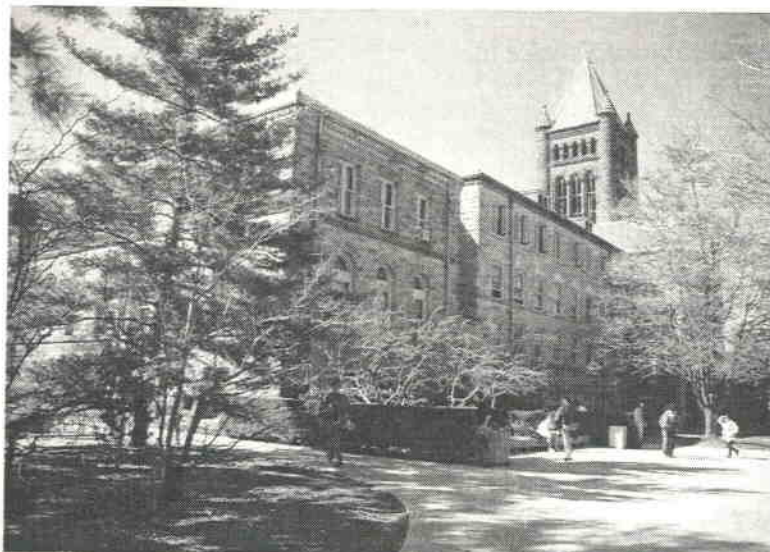
So it is appropriate to note here, not just in passing, that the world of mathematics provides the rest of us with the best and most exemplary of all models for the internationality, transnationality of science. The mathematicians have been talking to each other for centuries, over great distances, back and forth across the borders of every nation-state, giving away their information and always getting back more, trading human thought on a global scale. If we are looking about for new ways to enhance the apparatus of international collaboration in basic science, we would do well to examine how the mathematicians went about the business.

Lewis Thomas, *The Fragile Species*

Sloan Fellow

Nigel Boston, who came to the department in 1990 as an assistant professor, has been awarded a Sloan Research Fellowship. These fellowships were established in 1955 to support young scientists who show outstanding promise of making a fundamental contribution to new knowledge. The awards are for two years and may be used for any activity directly related to the Fellow's research, such as equipment, technical assistance, or professional travel. Candidates cannot apply for these fellowships but must be nominated by senior scholars.

Boston, a native of the United Kingdom, received his B.A. and M.A. from Cambridge University and, in 1983, a Certificate of Advanced Study in Mathematics. He then went to Harvard where in 1987 he was awarded a Ph.D. He spent the following year at the I.H.E.S. in France and in 1988 went to the University of California at Berkeley as a Morey Assistant Professor, before coming to UIUC in 1990. From January through June 1993 he was at the Isaac Newton Institute in Cambridge, England.



Altgeld Hall from the Southeast

Number Theory Conference

The 1994 Illinois Number Theory Conference, organized by mathematics professors **Bruce Berndt, Harold Diamond and Adolf**

His research interests are algebraic number theory, group theory and arithmetic geometry. Among the universities at which he has given invited lectures in the current academic year are the University of Southern California, Amherst College and the University of Arizona.

Hildebrand, was held April 8 and 9 at the UIUC campus.

Professor Roger Baker of Brigham Young University, Professor Basil Gordon of UCLA, Jeffrey Lagarias of AT & T's Bell Laboratory and Janos Pintz of the Hungarian Academy of Science and of Brigham Young University were invited to give 50 minute talks on their research. In addition there were 18 shorter talks.

The conference was very well attended; it attracted about sixty number theorists from the United States and abroad.

Library News

A Guide to Library Service in Mathematics: the Non-Trivial Mathematics Librarian, edited and written by department librarian Nancy Anderson, has recently been published. The book is dedicated to Emeritus Professor Felix Albrecht who is chairman of the library committee and, as the inscription says, has been a friend and mentor.

Co-edited with geology librarian Lois Pausch, this guide is designed for the librarian or information specialist who provides access to library resources for mathematicians and is written for the new librarian who does not have a background in mathematics. The editors write that they hope it will help the librarian to overcome any "math anxiety", and respond creatively and effectively to the user.

With her co-editor, Anderson has written one of the first chapters which covers most aspects of mathematics librarianship at a research university. Other writers discuss reference materials for librarians in mathematics libraries in public or government libraries. Final chapters by Anderson cover contemporary books and journals which are of interest to mathematicians.

Notices

Steven Bank 1939-1994

Professor Steven Bank died on April 10 in Urbana. He was 55. Survivors include his wife Connie and son, Seth.

A native of New York City, he was educated at Columbia University where he received his A.B. in 1959 and his Ph.D. in 1964. He came to our department in 1964, attaining the rank of associate professor in 1968 and professor in 1971.

Professor Bank's research concerned Nevanlinna theory and differential equations in the complex domain, a classical branch of analysis to which he made numerous important contributions. His research was characterized by analytical power and careful estimation.

He published 85 papers, many in international journals, and was active in mathematical research even during his illness. Among the numerous talks he was invited to give were several at Oberwolfach, Germany, in Finland and in Japan.

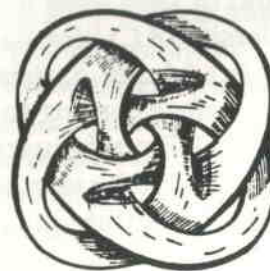
He was active in the affairs of the mathematics department and the LAS College. He was admired by his students and colleagues for his high standards in teaching and research.

Lucretia Levy 1904-1994

Lucretia Levy died February 4, 1994, in Sun City, Arizona. Born in the Oklahoma territory in 1904, she received a master's degree from the University of Kansas in 1923, then came to Urbana to continue her studies in mathematics at the UI. Here she met and married professor Harry Levy in 1928.

From 1946 to 1965 she was an instructor in the department. She and her husband were the authors of a book on analytic geometry. From the inception of the *Illinois Journal of Mathematics* in 1956 until she retired in 1974 she was the journal's technical editor.

Memorial contributions may be made to the Cousteau Society, the Birchwood School Foundation in Tofte, Minnesota, or the University YMCA in Champaign.



Raoul Bott is Cairns Lecturer

Professor **Raoul Bott** of Harvard University delivered the tenth **Stewart S. Cairns Memorial Lectures** in Altgeld Hall on March 16, 17, and 18 on the topic, *Invariants of Manifolds*, beginning with a lecture entitled "Remembrance of Things Past." The lecture series honors the memory of Stewart S. Cairns, professor of mathematics at UIUC from 1948 until he retired in 1972. The Cairns family established the fund to endow a series of public lectures by outstanding mathematicians to honor the memory of Professor Cairns whose research was primarily in topology.

Professor Bott was appointed to the Harvard faculty in 1959 where he is the William Caspar

Graustein Professor of Mathematics, and has had numerous visiting appointments. He is a member of the National Academy of Sciences, received a National Medal of Science in 1987 and has been awarded a Sloan Fellowship, a Guggenheim Fellowship, an Oswald Veblen prize and the Leroy P. Steele Prize Career Award. From 1965 to 1985 he served as editor of *Topology* and was an editor of the *American Journal of Mathematics* from 1968 to 1971. Elected Vice-President of the American Mathematical Society in 1975, he has been an active member of the society, serving on the executive committee of the council as well on many other committees.

Alumni News

David Page, who received his M.A. in mathematics from UIUC in 1950 and who is now a professor at UIC, has developed an interactive program, *Maneuvers in Mathematics*, which brings algebra and geometry into two elementary school classrooms in Chicago. Teachers and principals say the results are exciting.

Annette Sinclair (1949, Ketchum), who before her retirement was a mathematics professor at Purdue, has published the book *A Look at Calculus for Many*. The book is intended to be an easy-to-understand guide for the use of calculus in problem solving.

Putnam Test

Twelve of our students entered the the 54th annual W. L. Putnam Mathematical Competition. The six hour examination, which consists of twelve extremely challenging problems, is open to undergraduate students in the United States and Canada.

Of the 2,356 contestants from 408 colleges who competed, UIUC student **Patrick Keenan**, a sophomore from McHenry, placed 109th. Patrick is a first year student but has sophomore standing because of the many credit hours he received for proficiency exams he took and for work he did in high school.

Five of the UIUC competitors ranked among the top 250 students. Professors **Harold Diamond** and **Aimo Hinkkanen** coached the contestants and entered a team of three students. The UIUC Team ranked 25th out of 291 teams in the competition.

*For he by geometric scale
Could take the size of pots of ale,
And wisely tell the hour o'th' day
The clock doth strike, by algebra.*

Samuel Butler

Job Descriptions Wanted

The graduate and undergraduate advisers are often asked by students completing their degrees in mathematics about career opportunities open to them. It would be a big help, particularly this year when the job market is not too good, to have specific examples of positions that our graduates hold in industry, business, or government.

If you are employed in a

position that makes use of your mathematical training, or if you know of employers who have hired graduates of mathematics programs, please send this information to:

Professor Elliot Weinberg
Department of Mathematics
University of Illinois
1409 W. Green Street
Urbana IL 61801
email:Weinberg@math.uiuc.edu

With the end of the cold war, jobs in mathematics and the physical sciences have sharply dwindled in the United States, spoiling the lifelong dreams of some students, throwing professionals out of work and possibly dulling the cutting edge of research itself....Some scientists say the lack of jobs and declining national support...have begun to sap the vigor of American research.

NY Times, February 20, 1994

DEPT. OF MATHEMATICS
UNIVERSITY OF ILLINOIS
1409 W. GREEN ST.
URBANA, IL 61801

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