

Perspectives in Mathematics

UK Department of mathematics, Summer 2001

Letter from the chair.

Greetings to alumni and friends of the UK Mathematics Department! As a first-year chair I have appreciated the opportunity to become better acquainted with the faculty, students, and alumni of our department and I've been impressed both by the dedication of the faculty and the support of our alumni.

Our department continues to respond to the challenges and opportunities of a changing academic environment and job market. This year we instituted a new degree program, the Master of Science in Applied Mathematics, intended for students pursuing careers in business, industry, or government service. We have also initiated a joint undergraduate degree program in Mathematical Economics in cooperation with the College of Business and Economics.

At the end of this year, **Mike Freeman** will retire after thirty-one years of service at the University. Most recently, Mike pioneered UK's MathExcel program to help minority and disadvantaged students succeed in Calculus and helped foster similar programs at UK and around the nation. We celebrated Mike's achievements in a Conference on Excel Programs in the Mathematics and Sciences this past April, where University of Texas at Austin professor Uri Treisman gave a keynote address.

Emeritus Professor **Clasine van Winter** passed away this fall and directed that her collection of over 400 volumes in Mathematics and Physics be sold and the proceeds donated to the departments of Mathematics and Physics and Astronomy. The chairs of the two departments determined that an endowed lectureship should be established in her memory. Professor Elliot Lieb, a senior mathematical physicist at Princeton University and member of the National Academy of Sciences, will give the first van Winter lecture in Mathematical Physics on Tuesday, September 11, 2001.

Alumni gifts continue to play an important role in enhancing our teaching and research programs. Professor Richard Stanley of M.I.T. gave the first Hayden-Howard endowed lecture in Mathematics this fall, and Professor L. Craig Evans of the University of California at Berkeley will give the second Hayden-Howard lecture next spring in conjunction with the Midwest Partial Differential Equations conference. Fugate-Wells quality achievement fellowships help us to attract outstanding graduate students by supplementing our teaching assistantships. A complete list of alumni-supported development funds may be found on our department's web page at <http://www.ms.uky.edu/~math/Alumni/development.html>

I enjoyed meeting a number of graduate alumni at the New Orleans meeting of the American Mathematical Society, where nearly fifty alumni gathered for dinner on Thursday, January 11. Alumni of many years joined recent masters' and doctoral graduates in an enjoyable evening's dining in New Orleans' French Quarter. We will

continue the tradition of Thursday evening dinners at coming joint meetings of the AMS and MAA—please contact **Joy Williams Lind** (Joy.Williams@Level3.com) for further information!

Peter Perry
chair@ms.uky.edu
Insert picture here.



Caption: Wendy Weber, Joy Williams and Chris Bullock at the annual meeting of the AMS in Washington D.C.

Activities in the department

KYMAA meeting and MathExcel conference. The annual meeting of the Kentucky section of the Mathematical Association of America took place at the University of Kentucky on April 6-7, 2001. The meeting featured a workshop on Mathclass.org by **Paul Eakin, Carl Eberhart** and **Ken Kubota**. Mathclass.org is a tool for delivering mathematics instruction over the web. It is currently used in all of the department's Elementary Calculus classes (MA123) and in the Kentucky Early Mathematics Testing Program, which is described below. The evening address was given by Edward Barbeau of the University of Toronto who presented a talk that included some of the pitfalls of setting problems for the Putnam competition and similar contests.

In conjunction with the KYMAA meeting, the department hosted a MathExcel celebration. The keynote lecture at the MathExcel conference was given by Uri Treisman of the University of Texas at Austin. Uri designed the Excel model to support high achievement among minority students at the University of California at Berkeley. The conference brought together leaders of Excel programs from Kentucky, Oregon, Nebraska and Illinois. Kentucky graduate and former MathExcel workshop leader, **Wendy Weber** was one of the presenters at the conference.

Kentucky Early Mathematics Testing Program. The implementation of the Kentucky Early Mathematics Testing Program continues with the work of **Paul Eakin, Carl Eberhardt** and **Ken Kubota** at the University of Kentucky. This program, which was initiated by colleagues at Northern Kentucky University, provides high school students with a chance to determine if they are on track for college-level mathematics during their junior year and then correct deficiencies during high school, if necessary. Over 3000 students have taken the test during preliminary testing this year. The test is on the web at <http://www.mathclass.org>.

Hayden Howard Lecture. On March 6th the inaugural Hayden-Howard Lecture was given by Richard Stanley, the Norman Levinson Professor of Applied Mathematics at Massachusetts Institute of Technology. His talk, entitled "Polynomials with Real Zeros," was well-received by a packed audience of undergraduates, graduate students and faculty at UK and the surrounding mathematics community. The question of whether a polynomial has real roots or not is generally a part of mathematical analysis. Starting with Rolle's theorem, Stanley considered polynomials that naturally occur in combinatorics, graph theory and probability. The transparencies from the talk are available at www-math.mit.edu/~rstan/trans.html

The Hayden-Howard lecture series is supported by a generous contribution to the Department of Mathematics at the University of Kentucky. It was established to honor professors **Thomas Hayden** and **Henry Howard**. The lecture series will bring a distinguished mathematician to campus each year.

The next Hayden-Howard lecture is tentatively scheduled for Tuesday, 19 March 2002. The speaker will be L. Craig Evans of the University of California at Berkeley. Craig is a former member of the Department of Mathematics at Kentucky.

Faculty News

Great teacher award. **Brauch Fugate** received the great teacher award from the Kentucky section of Mathematical Association of America at their annual meeting in the spring of 2001. Brauch has been at UK since 1964. He served as Director of Undergraduate Studies from 1974-1978. From 1989 to 1999 he led the department's graduate program. Under Brauch's leadership, the graduate program thrived as evidenced by over sixty students who earned doctoral degrees while Brauch was Director of Graduate studies.

University Research Professor. **Chi-sing Man** has been named University Research Professor for 2001-2002 academic year. This award was given in recognition of Chi-Sing's active research program. Chi-Sing's current area of interest is the study of mechanical properties of textured materials.

New faculty. The department hired **Michel Jabbour** who will begin as an Assistant Professor in the fall of 2001. Michel received his Ph.D. in Applied Mechanics from the California Institute of Technology in 1999. He has spent two years at Carnegie-Mellon

University in Pittsburgh, Pennsylvania working with Morton Gurtin. Michel's research is centered around developing a mathematical description of materials that are being deposited in thin films.

Li Promoted. **Ren-cang Li** was promoted to Associate Professor in the spring of 2001. Ren-Cang's appointment at Kentucky began in the fall of 1995, though he spent his first year on leave at Oak Ridge National Laboratory in Tennessee. Ren-Cang received an National Science Foundation Career award in 1999. He is currently on leave working for Hewlett-Packard in California.

Thirty-one years of service. **Michael Freeman** retired after thirty-one years at Kentucky. Michael received his Ph.D. under the supervision of Errett Bishop at the University of California in Berkeley in 1965. He held positions at Brandeis University and Rice University before coming to Kentucky in 1970. At Kentucky, he supervised one Ph.D. student, **Gary Harris** who is now at Texas Tech University. Since 1990, Mike has led the MathExcel program at Kentucky.

Resignations. This year, two faculty members have resigned from the department and taken jobs elsewhere. The department wishes them well in their positions.

Kristina Vuškovic resigned this year to take a position in England. Kristina came to Kentucky in August of 1996 after a post-doctoral position at the University of Waterloo. While at Kentucky she was a valuable member of the department's discrete mathematics program. With Jon Lee and Carl Lee, she helped to organize the CBMS conference in the summer of 1999 that featured ten lectures by Gérard Cornuéjols of Carnegie Mellon University.

Jon Lee resigned to take a position at IBM's Thomas J. Watson research center in New York. Jon received his Ph.D. from Cornell University in 1986 and came to Kentucky from Yale University in the fall of 1993. Jon was promoted to full professor in 1999. While at Kentucky, Jon was a leading contributor to the Department's graduate program. Most notably, he directed five Ph.D. dissertations.

Faculty Profile: Carl Lee

Carl Lee's mathematical work is centered around polyhedra. Most of us are familiar with classical shapes such as the five Platonic solids, but higher-dimensional polyhedra are of interest as well, and continue to be the source of both research and recreational activity.

This year, Carl taught a small seminar-style course on polyhedra in the College of Arts and Sciences Freshman Discovery Seminar program. Students worked through an introduction to polyhedra concentrating in particular on regular and semi-regular solids. The course was designed around collaborative group work, and there was an emphasis on building both physical and virtual models-some of the results can be seen in the course gallery, www.ms.uky.edu/~lee/as153/images.html. For example, **Jay Begley** constructed

a beautiful stained-glass icosahedron, and **Max Brown** created a spectacular stellated polyhedron using a ray-tracing program.

Carl's interest in polyhedra has several motivations.

1. Their intrinsically interesting properties, (*e.g.*, symmetry of the Platonic and Archimedean solids, and regular polyhedra in higher dimensions), combinatorial properties (*e.g.*, Euler's relation $V-E+F=2$ relating the number of vertices, edges and faces for three-dimensional polyhedra and extensions to higher dimensions, paths in the graph determined by a polyhedron's edges), and metrical properties (*e.g.*, formulas for volume, numbers of interior lattice points, rigidity, triangulations).
2. The tools from other areas of mathematics that can be brought to bear on problems on polyhedra, such as commutative algebra, algebraic geometry, enumerative combinatorics, and linear algebra. Some very striking combinatorial results, for example, so far admit no purely combinatorial proof, but require an algebraic perspective.
3. The applications of polyhedra to other areas of mathematics, such as linear programming, combinatorial optimization, computational geometry, algebraic geometry, and convexity. For example, in combinatorial optimization one often wishes to optimize a linear functional over a finite (usually large) set of points. Frequently one can approach such problems by taking the convex hull of these points, considering an alternate representation of this polyhedron as an intersection of half-spaces, and exploiting its combinatorial/geometric structure to develop efficient algorithms.

One area of current interest is counting the number of faces of a polyhedron. Face-counting problems begin with Euler's relation $V-E+F=2$ for convex, 3-dimensional polyhedra. For example, a dodecahedron has $V=20$ vertices, $E=30$ edges, and $F=12$ faces (all pentagons), and indeed $20-30+12=2$. The soccer ball (which combinatorially is a "truncated icosahedron") has 60 vertices, 90 edges, and 32 faces (12 pentagons and 20 hexagons). Here is a puzzle to try: Show that any polyhedron made up entirely of hexagons and pentagons, with exactly three meeting at each vertex, must have exactly 12 pentagons. Carl is interested in properties of numbers of faces of polyhedra in higher dimensions, and already for four-dimensional polyhedra there are some tough unsolved problems. We know that there is an analogue of Euler's relation for four-dimensional polyhedra, but cannot yet characterize which combinations of numbers of faces of different dimensions such polyhedra can possess.

News from the graduate program.

Nine Ph.D.'s awarded. The following students have received their Ph.D. degree in mathematics during the past year. The degree recipients are listed with their advisor and thesis area in parentheses.

Theresa Contenza (Carl Lee, Combinatorics) is now teaching at Montevallo University in Montevallo, Alabama.

David Dempsey (Ed Enochs, Algebra) is teaching in the Mathematics, Computing and Information Science Department at Jacksonville State University in Jacksonville, Alabama.

Jody Fast (Serge Ochanine, Algebraic topology) is a Visiting Assistant Professor at Colgate University for the 2000-2001 academic year.

Connie Fournelle (Carl Lee, Combinatorics) has taken a job with Alphatech near Boston, Massachusetts. Alphatech is a research and consulting firm, which applies mathematics to a variety of problems for its clients.

Jonathan Hu (Craig Douglas and Tom Hayden, Numerical analysis) holds a post-doctoral position in the Computational Mathematics and Algorithms Department at Sandia National Labs.

Thomas Kowalski (Zhaojun Bai, Numerical analysis) completed his degree in the summer of 2000. He has been working at MSC Software for several years.

Makhmud Sagandykov (Ed Enochs, Algebra) is working as an actuarial analyst at SAFECO Insurance Co. in Indianapolis, Indiana.

Sharon Sullivan (David Leep, Algebra) will be an assistant professor at Catawba College in Salisbury, North Carolina beginning in the fall of 2001.

Julia Varbalow (Ed Enochs, Algebra) completed her degree in the fall of 2000.

Masters degrees awarded. The department awarded six Masters degrees over the past year. **Anne Cavagnaro, Marcie Davis, Steve Elliott, Beth Irwin, David Pettit, and Janie Stewart.**

News from the undergraduate program

Bachelor's degrees awarded during the 2000-2001 academic year. The following students received Bachelor's degrees from the department of Mathematics during the 2000-2001 academic year. **Brittany Carter, Lydia Elaine Conaway, John Bernard Eifler, Jr., Eskandar El-Hayek, Jung-sook Kim, Jon Ben Leach, II, James Adam Markham, Izumi Matsui, Marcus Charles Mitchell, Jamen Mohan, DeLisa Michelle Nelson, Wayne Wesley Punnet, Kenneth Dale Sebesta, Ayse A. Semizoglu, Brett Alan Strassner, Elwood Waddell, Mark Wurth and Andrea M. Zawadzki.** Of these students, Elwood Waddell, John Bernard Eifler, Jr., Marcus Charles Mitchell and Kenneth Dale Sebesta are graduating with honors.

Sallie E. Pence award. **Michael Haake** received the Sallie E. Pence award, which is given to outstanding math majors who plan to pursue a career in teaching.

Carolyn Bunyan awards. **Wesley Mayes** and **Carrie Minnick** received the Carolyn Bunyan scholarship for undergraduate mathematics majors. Wesley is a sophomore from Eastern Kentucky who is plans to go to dental school. Carrie is a junior and is interested in pursuing a career as an actuary.

A problem to keep you busy. This year, a small group of students have been meeting regularly to work on recreational mathematics problems. Below is one of the problems from the past year.

Two mathematicians are out for a walk. Mathematician A says, "I have three children and the product of their ages is 36." Mathematician B responds, "That is not enough information to determine their ages." Mathematician A adds, "The sum of their ages is that house number over there." Mathematician B says, "That is still not enough information." They change the subject and start discussing their children's soccer games for the weekend. Mathematician A says that her oldest child has two soccer games on Saturday. Then, Mathematician B exclaims, "Now I know their ages." What are the ages of Mathematician A's children and how did Mathematician B determine their ages?

News from Alumni

Please send notes for this section to Russell Brown, Department of Mathematics, University of Kentucky, Lexington, KY 40506-0027 or to rbrown@uky.edu

Charlotte Rieth née **Antonelli**, M.A. 1998 is working for Catalina Marketing Corporation in Tampa, Florida.

Cindy Aossey, Ph.D. 2000, and **Craig Aossey** are pleased announce the birth of Daniel Craig Aossey on 25 October 2000.

Richard Belshoff, Ph.D. 1989, was promoted to full professor at Southwest Missouri State University in July of 2000.

Anne Cavagnaro, M.A. 2001, will be teaching at Columbia College in the Yosemite Community College district in California beginning in the fall of 2001.

Theresa Contenza, Ph.D. 2001, spoke in the special session on polytopes at the regional A.M.S. meeting in Lawrence, Kansas in April of 2001.

Evelyn Christensen, M.A. 1973, teaches at Meadowthorpe Elementary in Lexington. Her book *Coin-Clue Puzzles* was published this past year by Cuisenaire. A set of logic puzzles for ages 8 to adult, it's similar to her first book *Clip-Clue Puzzles* but uses coins instead of paper clips. A third book in the set will be out soon.

Benny Johnson, Bachelors in chemistry and mathematics 1989, returned to the university in the fall of 2000 to speak to the Chemistry department about computer assisted instruction.

Overtoun Jenda, Ph.D. 1981, was named Associate Dean for Minority Programs and Special Academic Projects at Auburn University Associate Dean for Minority Programs in July of 2000.

Jay Rao, M.S.O.R. 1989, was promoted to Associate Professor with tenure in the Management Division at Babson College in Babson Park, Maryland.

Thaddeus Tarpey, B.S. 1983, was promoted to Associate Professor in the Department of Mathematics and Statistics at Wright State University in Dayton, Ohio. Thaddeus obtained his PhD from Indiana University in 1992 and did postdoctoral work at the National Institute of Standards and Technology in Boulder, Colorado before coming to Wright State University.

Darcy Thompson, B.A. 1998 in Math and English, visited campus in January of 2001 to recruit math and science teachers for Teach for America. Darcy has spent two years with Teach for America working in Helena, Arkansas.

Wendy Weber, Ph.D. 1999, gave a presentation in April of 2001 in the special session on polytopes at the regional A.M.S. meeting in Lawrence, Kansas.

Pamela Williams, B.S. 1991, Nathaniel Dean and Cassandra M. McNeal have edited a volume titled *African Americans in Mathematics II. Proceedings of the 4th Conference for African-American Researchers in the Mathematical Sciences*.

Naveed Zaman, Ph.D. 2000, is teaching at West Virginia State College in Institute, West Virginia.

David Zimmerman is finishing graduate studies and will work at Caterpillar Logistics in Peoria, Illinois.