Autumn 2002, Vol. 11

Mathematics

Newsletter of the Department of Mathematics at the University of Washington

A MESSAGE FROM THE ACTING CHAIR

Ron Irving assumed the position of Divisional Dean for the Natural Sciences after serving a year as chair of our department. I am serving as acting chair for a year while we search for a chair. The twelve months since our last newsletter have brought many exciting developments to our department. While we are concerned about the effects of the current economic outlook for our State, we hope to maintain and build upon our successes in the coming years. I would like to take this opportunity to highlight some of the exciting work we are engaged in, from undergraduate education to mathematical research.

We have revised our pre-calculus and calculus courses in recent years. We are currently in the second year of a three-year reform of our calculus sequence for science and engineering. The changes include reduction of class size, longer quiz sections, and use of worksheets. You will read in the adjoining column about Ryan Card, Ernie Esser, and Jeff Giansiracusa's success. Ryan joined our PhD program this September, supported in part by an ARCS Fellowship. Ernie and Jeff, currently in their final year as undergraduates, are also applying to graduate schools in mathematics. Our graduate students go on to rewarding careers in academia or industry upon completing their degrees. For the second year in a row, one of our students was awarded a National Science Foundation Postdoctoral Fellowship, perhaps the most prestigious postdoctoral fellowship in mathematics, upon completing his PhD.

The awards received by our faculty within the past year included Sloan Research Fellowships awarded to Sándor Kovács and Yu Yuan, making us the only department, in any field, to receive two Sloan Fellowships last year. In addition to the usual research activity of our department, several faculty members are organizing research programs this year. For example, Gunther Uhlmann is the coordinator of the Pacific Institute for the Mathematical Sciences (PIMS) thematic year in Inverse Problems and Applications. This program includes five week-long workshops in Santiago, Banff, Calgary, UBC, and UW. Doug Lind is organizing a Concentration Year in Dynamics, with most of the activity planned for the spring and summer of 2003. The 23rd Seminar on Stochastic Processes will be held at UW in March, 2003, with Chris Burdzy and Zhenqing Chen as organizers. The newsletter will report in greater detail on some of these activities; you will find additional information on our web site.

We hope that you, our community of students, parents, alumni and friends, will remain involved in the department and attend the events, such as the recent lecture by Stephen Wolfram, we will be organizing in the coming months. I invite each of you to tell us which aspects of the department's activities most interest you, to help us in our efforts to include you in our activities.

-Selim Tuncel

MATH MODELING CONTEST

Three University of Washington undergraduates have earned a place among the world's college math elite with a win in an international mathematics modeling competition.

Ryan Card, Jeffrey Giansiracusa and Ernie Esser won an outstanding ranking–the highest commendation–in the 18th Mathematical Contest in Modeling, an annual worldwide competition sponsored by the Consortium for Mathematics and its Applications. The UW students were one of four teams, among a total of 279 competing in their category, to merit an Outstanding ranking for their solution to a complex math problem. In addition, the UW team's 21-page solution was selected from the four to receive the annual SIAM award from the Society for Industrial and Applied Mathematics. The students each received a $500 cash prize and had their expenses paid to attend the 50th annual meeting of SIAM; there they presented their paper and received their award.

The contest began on Feb. 7th, when officials posted two problems to the Web. The 522 participating teams from the United States and ten other countries had four days to pick one and devise a solution. They were allowed to refer to Web and library sources, but could not consult with another person. Participants didn't get a lot of sleep. This was the second year this team participated. Last year they (and their advisor) misread the contest starting time and ended up starting a day late. So maybe this year they had the advantage of being prepared for a three-day contest when in fact they had four full days to work on it. The winning paper was a solution of a problem involving an algorithm to prevent a decorative water fountain from spraying observers in windy weather. A copy of the paper and other links can be found at:

http://www.math.washington.edu/~morrow/mcm/mcm.html.

Three other teams from the UW participated. The other team from Mathematics consisting of Mark Blunk, Sam Coskey, and Erik Curre, also did very well, receiving the Meritorious designation, which is just below the outstanding ranking. All of these students except for Ryan Card will still be undergraduates in 2002-03 and we hope for another outstanding performance.

SIMUW: SUMMER INSTITUTE FOR MATHEMATICS AT THE UNIVERSITY OF WASHINGTON

In June, 2002, the department received a substantial anonymous gift from a generous couple that will provide two years of funding for a new program, the Summer Institute for Mathematics at the University of Washington, or SIMUW. This program is intended for talented high school students from Washington, Oregon, and British Columbia and will bring twenty-four of them to campus for six summer weeks to study mathematics with faculty, special lecturers, graduate students, and undergraduate counselors. A program proposal, developed by Ron Irving and Jim Morrow last winter, was presented to the donors and received with enthusiasm. Thanks to the gift, students will be able to participate at no cost. Instruction, room, board, and social activities are all covered.

Within the typical high school curriculum, a student has limited opportunities to acquire a full appreciation of the nature of mathematics: its wide-ranging content, the intrinsic beauty of its ideas, the nature of mathematical argument and proof, and the surprising power of mathematics within the sciences and beyond. Getting a glimpse of the depth and beauty of mathematics can be a transforming experience for a student, whatever interests the student may intend to pursue in the future. SIMUW is intended to provide talented, enthusiastic students with just such a glimpse. The mathematical topics studied are accessible, yet of sufficient sophistication to be challenging, allowing students to participate in the experience of mathematical inquiry and be immersed in the world of mathematics.

The first SIMUW program will run for six weeks in the summer of 2003, from June 22nd to August 3rd. The co-directors of the program are Ron Irving, Sándor Kovács, and Jim Morrow. Four departmental faculty members will serve as instructors –Tim Chartier, David Collingwood, Sándor Kovács, and Virginia Warfield. In addition, Henry Cohn, an affiliate assistant professor in the department and a member of the Theory Group at Microsoft Research, will serve as an instructor, as will Robert Pollack, a postdoctoral department member last year who is now at the University of Chicago. Each instructor will work with the students for two weeks, helping the students attack a variety of stimulating but elementary problems. The instructors will lecture to a limited extent, in order to provide necessary background, but the emphasis will be on giving the students the opportunity to tackle hard mathematical problems in collaboration with the staff.

One weekday of each week there will be a special program featuring a speaker from the campus or the region who will discuss the role mathematics plays in his or her work. The lecture will serve simultaneously to provide the students with a break from their work during the rest of the week and to open vistas on subjects that lie ahead. Ten such guests are scheduled at this time, including Judith Arms, Pat Averbeck, Eric Babson, Tatiana Toro, and Gunther Uhlmann from the department. Also featured are Tom Daniel from Biology, Nathan Kutz from Applied Mathematics, Richard Ladner from Computer Science and Engineering, Kristin Lauter from Microsoft Research, and Brian Marcus, the chair of the mathematics department at the University of British Columbia.

More information on SIMUW can be found at the website http://www.math.washington.edu/~simuw/index.html.

PROMOTIONS

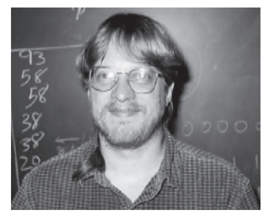
Steffen Rohde

Tatiana Toro

During the academic year 2001-2002, the Department promoted Steffen Rohde and Tatiana Toro from Associate Professor to Professor. Professor Rohde works in complex analysis. Professor Toro works in analysis and geometric measure theory.

The Department promoted Sándor Kovács and John Palmieri from Assistant Professor to Associate Professor. Professor Kovács works in algebraic geometry and Professor Palmieri works in algebraic topology and representation theory.

Sándor Kovács



John Palmieri

NEW FACULTY

This year the Department welcomes three new faculty members.

Lisa Korf (Assistant Professor) PhD University of California, Davis, 1998. Professor Korf's subject is stochastic optimization.

Sara Billey (Associate Professor-on leave this year), PhD University of California, San Diego, 1994. Professor Billey's mathematical work is in the subject of algebraic combinatorics, Lie theory, and computational algebraic geometry.

Manfred Einsiedler (Acting Assistant Professor), PhD Vienna University, 1999. Professor Einsiedler works on dynamical systems and higher dimensional dynamics.

Lisa Korf

Sara Billey

Manfred Einsiedler

CALCULUS REFORM

In the fall of 1997, Doug Lind, then Chair of the Mathematics Department, formed an Ad Hoc Committee on Calculus to review our science and engineering freshman calculus course, Math 124/5/6. The committee presented a report to the department in the spring of 1998, which ultimately led to a Tools for Transformation (TFT) “calculus reform” proposal funded for a three-year period by the Office of Undergraduate Education. The academic year 2001-2002 was the first year of implementation. A new version of Math 124 was introduced in Autumn 2001, followed in Winter 2002 by a new version of Math 125.

Our “calculus reform” involves several components, which include:

-Lecture classes of 81 students, a reduction from the previous size of 160 students.

-TA section classes of size 27 students, a reduction form the previous size of 40 students.

-Introduction of one 80-minute TA section per week combined with one usual 50-minute TA section; in the past, both TA sections were 50 minutes in length.

-We use a standard textbook that thoroughly covers the basic mechanics of calculus; we then supplement the text with departmentally produced materials. Some of the materials augment the textbook homework, while other materials (worksheets) are designed specifically for the 80-minute TA sections.

-Students will take their two hour-long midterm exams during the 80-minute TA sections in an effort to eliminate time pressure problems.

-Course materials are conveniently archived using the World Wide Web, which is an asset for both students and instructors. The web addresses for Math 124/5 are:

http://www.math.washington.edu/~m124/
http://www.math.washington.edu/~m125/

We are very pleased to report that our first-year reform effort has been a success on several fronts. A full detailed report of our findings may be obtained online at:

http://www.math.washington.edu/~m124/Reports/report_summer2002.html

Overall we found that student and collegial assessments indicate that most components of the courses worked well. Our student feedback was gathered on several fronts: student course evaluations (given at the end of the term), supplementary questions aimed at specific components of the reformed courses and extensive mid-quarter discussions facilitated by CIDR (the Center for Instructional Development and Research). In total, 34 calculus classes involving approximately 2,500 students participated in these surveys; a full discussion of this data is contained in the above report. Our instructor feedback was gathered through weekly meetings between the course coordinators and all instructors for the course, including additional surveys and meetings with graduate student teaching assistants. Of course, as with any reform effort, a few components were identified as needing further adjustment or assessment and this will be the main focus of year-two of our calculus reform effort. Professor David Collingwood is serving as coordinator of the calculus reform project.

Our model for curricular reform involves extensive on-going input from students, faculty, graduate teaching assistants and CIDR facilitators. We believe the end result is a revised course which engages the students and instructors in a satisfying learning and teaching experience. We intend to maintain the positive trajectory of student satisfaction during the coming academic year. Ultimately, after the end of our three-year TFT grant, we will pursue permanent funding of our calculus reform through the College of Arts and Sciences.

Dave Collingwood

IRVING TAKES NEW POSITION

After serving for one year as chair of the department, Ron Irving became Divisional Dean for the Natural Sciences in the College of Arts and Sciences on July 1, 2002. In this position, Ron oversees the science departments in the College, from Astronomy through Mathematics to Zoology. Ron also works jointly with the Dean of the College, David Hodge, and the other divisional deans on budgetary, curricular, development, and policy matters of the College. Ron came to the department in 1980. While continuing to teach and pursue his research interests in ring theory and representation theory, Ron began to assume a range of departmental administrative duties during the 1990’s. He received a UW Distinguished Teaching Award in 2001, just before becoming chair. As divisional dean, Ron is already enjoying the opportunity to learn more about the exciting research being done in the sciences at UW. He continues to participate in some departmental activities, such as the development of SIMUW, the new summer program for talented high school students discussed elsewhere in the newsletter.

Mathematics

This newsletter is published annually for alumni and friends of Mathematics at the University of Washington.

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GRADUATE STUDENTS RECOGNIZED IN THE THIRD ANNUAL GRADUATE AWARDS CEREMONY

The third annual Graduate Awards Ceremony, honoring outstanding graduate students in mathematics who received awards and fellowships during the past year, was held in the Mathematics Department lounge on October 31, 2002. Two Excellence in Teaching and four Academic Excellence awards were presented. Each award includes a $1,000 supplementary academic stipend.

Mathematics students also received a number of fellowships and other awards, including seven VIGRE (Vertical Integration Grants for Research and Education) fellowships, two GK-12 Fellowships, four Graduate School Merit Awards, a Graduate Opportunity Fellowship, two ARCS (Achievement Rewards for College Scientists) fellowships, a McFarlan fellowship, and two Microsoft Scholar Awards.

Excellence in Teaching awards recognize Teaching Assistants for outstanding teaching performance in undergraduate mathematics courses. This year's awardees are Dylan Helliwell, a fifth year student studying differential geometry and Kris Kissel, a third year student studying geometric measure theory. The TA Advisory committee selects awardees based on both student and faculty comments.

Dylan Helliwell

Kris Kissel

Academic Excellence Awards recognize outstanding performance in both core graduate mathematics courses and the PhD qualifying exams. This year's awards were funded by endowments created by Carl B. Allendoerfer and Z. William Birnbaum, both former faculty members. Professor Allendoerfer served as Department chair from 1951 to 1962. Professor Birnbaum is widely recognized for his contributions to probability and statistics. Allendoerfer awards were presented to Eric Bahuaud, a second year student studying differential geometry and partial differential equations; Anton Dochterman, a second year student studying algebra, topology and combinatorics; and Jeremy Walthers, a second year student

Eric Bahuaud

Anton Dochtermann

Jeremy Walthers

Ilgar Eroglu

studying algebraic invariants. Ilgar Eroglu, a second year student studying complex analysis received a Birnbaum award.

VIGRE awards are funded by a joint grant to the UW departments of Applied Mathematics, Mathematics and Statistics from the VIGRE program of the National Science Foundation. Each award provides fellowship support, without teaching duties, during two academic quarters and the summer. This year's VIGRE fellows in the Department of Mathematics are: Matthew Blair, a second year student, studying hyperbolic partial differential equations; Anne Garrison, a first year student from Santa Clara University; Robert Hladky, a fourth year student studying complex geometry; Matthew Kahle, a second year student in algebra and discrete geometry; Karl Schwede, a second year student studying algebraic geometry; Jason Swanson, a fourth year student, studying financial mathematics and stochastic partial differential equations; and Jeremy Walthers.

The GK-12 Fellowship is funded by a grant from the National Science Foundation to the Department of Applied Mathematics. It enables the recipient to augment his or her studies with K-12 educational work. This year, two mathematics students have been awarded fellowships: Debra Seidell, a first year student from Brown University and Jason Slemons, a second year student interested in number theory and cryptography.

Graduate School Merit Awards, averaging $6,000, are recruitment awards made available by the Graduate School to help with the recruitment of outstanding applicants. This year's awardees are Andrew Frohmader from Case Western Reserve University, Christopher Kunkel from the University of North Carolina, Chapel Hill, Pat Lasswell from the University of Washington, and Catherine Williams from Grinnell College.

Catherine is also the recipient of a Graduate Opportunity Fellowship, sponsored by the Graduate Opportunity and Minority Achievement Program (GO-MAP), for the purpose of bringing outstanding women and minority candidates to our PhD program.

Matthew Ballard from Caltech and Ryan Card from the UW, both first year students, join Davis Doherty, a third year student in

(VIGRE fellows from left top row: Karl Schwede, Robert Hladky, Matthew Blair, Anne Garrison, Jeremy Walthers, Jason Swanson. Bottom row: Matthew Kahle)

algebraic geometry and Matt Kahle, bringing the number of ARCS fellows in our department to four. Each of these $15,000 awards is funded over three years at the level of $5,000 annually by the Achievement Rewards for College Scientists Foundation.

Panki Kim, a fifth year student studying probability theory, is this year's McFarlan fellow. The McFarlan fellowship program, which began in 1992, provides support for graduate students through the income on a bequest given for this purpose by the late Professor Lee McFarlan of the Mathematics Department.

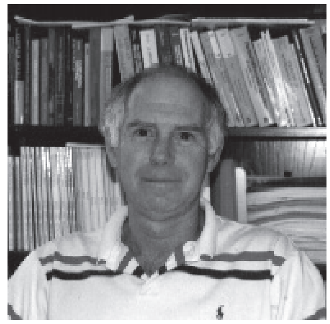
This year, Microsoft Scholar Awards were given to Matias Courdurier from the University of Chile and Luke Gutzwiller from the University of Iowa. Matias and Luke join Ilgar Eroglu, Robert Hladky, Kris Kissel, David Maxwell, a second year student in geometric analysis, and Pablo Shmerkin, a second year student studying fractal geometry, bringing the number of Microsoft Scholars to seven. These $20,000 awards, in the form of yearly supplementary stipends of $5,000 for four years, are funded by a gift from the Microsoft Corporation.

Over eighty full-time students are currently enrolled in our graduate program. These students play a central role in all activities of our department: they share in the teaching of undergraduate courses, they are students in our graduate courses, and, they are active participants in our research program. For the continued success of our program, it is vital that we continue to recruit from among the most talented students. Not only do the awards and fellowships listed above provide valuable encouragement, but they are essential to our efforts to make up for the deficiency in the salaries of our Teaching Assistants, which are well below TA salaries at many of our peer institutions, such as Michigan, Illinois, UCSD and UCLA.

Last year the Department approved a support plan to supplement our TA salaries with awards and fellowships. That plan is now in place, and this year's entering class appears to be among the strongest we've seen in recent years. We are grateful to to all of the institutions and individuals for their generous and continuing support of our program.

(Left: Pat Averbeck, TA advisor. Right: Tom Duchamp, graduate program coordinator)

REU PROGRAM AT THE UNIVERSITY OF WASHINGTON



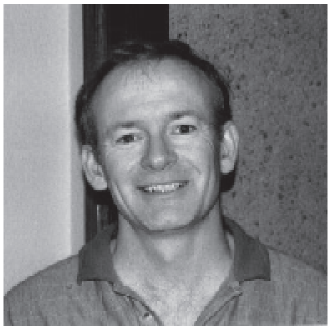
The National Science Foundation supports Research Experiences for Undergraduates in various disciplines at selected universities. Readers of this newsletter probably know that the University of Washington Mathematics Department has had an REU site since 1988. This program is directed by Jim Morrow. The students in the program are undergraduates selected in a competitive process from universities throughout the United States. Each year eight to ten students are selected and are given a stipend from the NSF grant that supports an eight-week stay during the summer in which they participate in research projects under the direction of Professor Morrow.

This year, thanks to the generous support of the VIGRE grant we were able to hire two REU alumni, Ryan Card and Ernie Esser, to be student assistants for the program. The VIGRE grant also supported Tom Duchamp so that he might assist for the first few weeks of the program. In addition (for the first time) we had a Canadian student participate in the introductory portion. The participation of the student assistants and additional faculty made for an exceptional program. In addition to daily one-on-one sessions with faculty and assistants, students in the program benefited from an expansion of the social activities. These activities included picnics, swimming parties, softball, golf, plays, a trip to a Mariners game, and a trip to Mt. Rainier.

The projects are in the general area of "inverse problems for electrical networks." After a week of lectures and reading, students start to work on projects. Students make interim oral reports and eventually write a research paper with their problem solution. Sometimes the work is of sufficient quality to appear in journals and be reported at national meetings.

The students in this program are very strong. In summer 2002, students came from University of Washington, Harvard, Yale, Penn, Colorado School of Mines, University of Texas, University of California at Berkeley, University of Hawaii, and University of British Columbia. There were three UW students in the program, in addition to the student assistants. The two student assistants and one of the REU students comprised the team that won the SIAM prize in the international Mathematical Contest in Modeling. One of these assistants is now a graduate student in Mathematics at the University of Washington. The other team members are currently TAs for the honors calculus sequence.

APPLIED AND COMPUTATIONAL MATHEMATICAL SCIENCES PROGRAM



Mathematics is the common language of the modern technological world. Sophisticated mathematical modeling, simulation, analysis, and computation are now essential tools in virtually every area of social, life, and physical sciences, as well as in business and engineering. From cell phones to automotive control systems to mutual funds management to designer drugs to medical imaging, the mathematical sciences provides the keys to accessing the innovations of today and tomorrow.

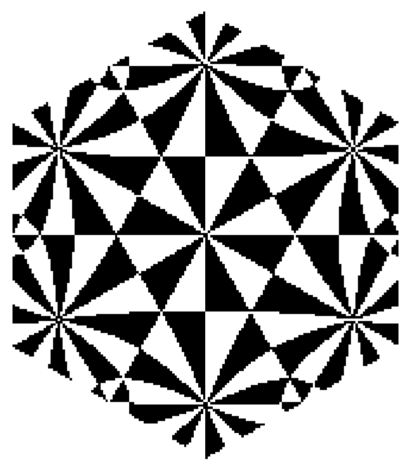
The Applied and Computational Mathematical Sciences (ACMS) BS degree program is designed to provide a broad education in the mathematical sciences and to foster interdisciplinary work in an applied discipline. The emphasis on interdisciplinary work is an integral component of the program. Each student is required to choose from among eight areas of specialization: Biological and Life Sciences, Discrete Mathematics and Algorithms, Engineering and Physical Sciences, Mathematical Economics, Operations Research, Scientific Computing, Social and Behavioral Sciences, and Statistics. Each area of specialization was designed in consultation with the applied departments in order to encourage and facilitate the attainment of a second major in an applied discipline.

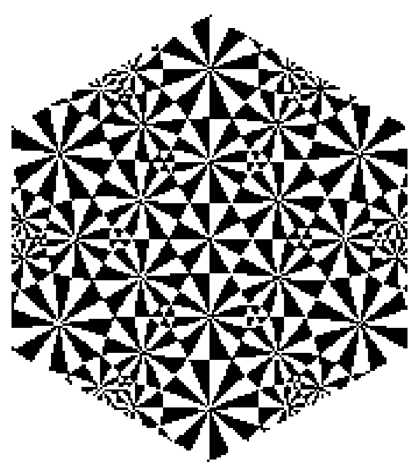
It is safe to say that most students do not come to the University knowing that they are going to major in Applied and Computational Mathematical Sciences. Indeed, it is a rare student who is even aware of the existence of this program. Nonetheless, last year the program completed its fifth year of operation with 185 declared majors, 62 graduating seniors, and 163 alumni. Of the 62 graduating seniors, 17 were double majors. This is an impressive record of growth for such a demanding undergraduate degree. We anticipate that the ACMS program will continue to grow and continue to attract some of the very best students on campus. Our efforts to refine and improve the degree also continue as we engage more applied departments in the design of streamlined double major curriculums.

During the past year our students have had a number of successes. Mentioned elsewhere in this newsletter is the success of the UW teams in *The Consortium for Mathematics and its Applications* annual International Mathematical Modeling Contest. Four UW teams entered the contest, two from Mathematics and two from ACMS. All four teams did very well with the Math Dept. team of Ryan Card, Ernie Esser, and Jeff Giansiracusa being named one of the eight outstanding winners from a field of 522 teams. For their winning solution, this team was also awarded the annual *Society for Industrial and Applied Mathematics* (SIAM) Mathematical Modeling Award. The SIAM award was presented to the team in Philadelphia this past summer. Two members of this team, Ryan Card and Ernie Esser, are ACMS majors as well as Math majors. Ryan Card was also named the ACMS student of the year.

Although the ACMS program is a successful, vibrant, and growing undergraduate program, it is also a program under serious stress. Currently ACMS receives no direct financial support from the University. Its only sources of funding are annual gifts of $2000 each from the Applied Mathematics Department, the Mathematics Department, and the Statistics Department. In addition, the Mathematics Department also contributes student advising, supplements the Program Directors salary, and funds incidentals such as photocopying and postage. In addition, several ACMS students have been able to obtain research grants through the University of Washington VIGRE grant. These grants provide support for students to pursue undergraduate research opportunities. In addition, this past year the Department of Computer Science and Engineering graciously offered to fund the ACMS student awards for 2002. Without this funding, we would not have been able to suitably acknowledge the achievements of our very best majors.

Funding for this year's student awards has yet to be identified. For this reason, the program is very appreciative of all contributions to its Friends of ACMS Fund. This fund contains the only discretionary money for the program. It is hoped that this fund will eventually be able to provide support for student awards and research. In the past this fund has been sustained by faculty contributions. For further information, please contact either Mary Sheetz (206-543-6163; sheetz@math.washington.edu) or Jim Burke (206-543-6183; burke@math.washington.edu).





Designed by Daniel Meyer, graduate student

GRADUATE STUDENT COORDINATOR: MICHAEL VAN OPSTALL

A couple of days ago I was in the lounge before tea, somewhat furiously scribbling in my notebook and discussing formal power series rings with another graduate student. An outsider, clearly awed by our larger vocabulary, approached me and asked my permission to stay in what he had concluded was a "graduate mathematics study room." I assured him that it was fine that he occupy one of our coveted seats.

Having finished my discussion with the graduate student, the visitor came over and asked what I did. He related to me that after he took the undergraduate real analysis class that math was basically the same things over and over again. I was a bit intrigued, since, having taken real analysis, I assumed the student understood that we weren't just doing harder integrals than the 125 students. I assured him that graduate level mathematics was certainly not "more of the same," but he required evidence. He had not taken algebra, so certainly I could tell him there is an entirely different strange world to be unearthed in abstract algebra. I mentioned that in analysis our vector spaces get bigger, actually infinite dimensional, and dealing with that requires some creativity.

I was glad when he asked me what I was working on. I hoped to surprise him by explaining how fundamental some questions in mathematics are. Attempting to stick close to things that he had studied, I explained how eventually, many mathematicians discover differential equations they cannot solve, but are content to study properties of a solution. Then I realized, in a sense, my work is similar. I told him that I was working with some sort of strangely defined geometric object (the moduli space of stable algebraic surfaces). He interrupted me and asked, "What dimension is it?" I told him that was what I was working on. I drew some sort of nebulous amoeba-shape on my notepad and slashed a line through it. The line, I explained, was a certain distinguished geometric object, and really, all I hope to discover is the difference between the dimension of the amoeba and the line. The object that I am studying is itself the solution to a problem. It is not defined by equations that anyone knows, so I am forced to investigate the geometry by studying aspects of the problem to which the geometric object is a solution.

I usually do not have to answer this sort of question. Usually I have to defend mathematics against calculators and computers. Eventually another usual question arose, "How do you apply it?" Most of the work that graduate students in mathematics do is not directed towards a direct physical application. Instead, mathematicians hone their reasoning abilities on increasingly abstract and difficult problems (or abstract methods for solving seemingly innocuous problems) in order to better teach others how to do mathematics. However, mathematics created out of desperation with no dreams of application is often later picked up by someone else and applied. I told the student that we sort of build up a library of techniques and facts. Having done this, the machinery is available already when a theoretical physicist wants to know how strings move. The study of the moduli space of algebraic curves, a problem one dimension lower than my problem, has had immense applications in theoretical physics, although it started out of an obsessive desire for purely mathematical order.

No one knows better than a graduate student who is required to create new mathematics that mathematics is not at all a repetition of the same ideas and similar problems. I did not even mention how even "ancient" mathematics finds new applications, or at least applications not covered in the basic courses. I am sure this future economics graduate student will see this more and more clearly as he discovers game theory and the Black-Scholes equations.

UNDERGRADUATE LUNCHEON

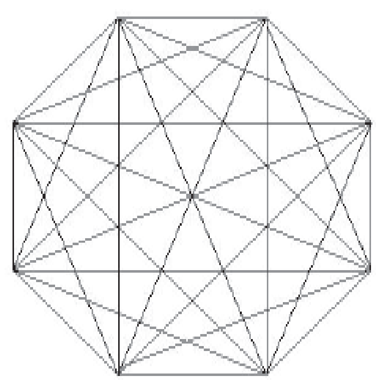
Each year, the Mathematics Department holds a luncheon to honor some of our outstanding undergraduates. Along with the honored undergraduates and their guests, interested faculty and friends of the department attend. Each award is presented by a faculty member familiar with the award winner's work, adding to everyone's enjoyment of the event. The luncheon honoring this past year's undergraduates was held on June 4th at the Faculty Club, and the award winners were:

- Outstanding student in first year honors calculus: Sheng-Fong Pai
- Outstanding student in second year honors calculus: Adam Wilson
- Highest Putnam Exam score by a UW student: Sheng-Fong Pai
- Gullicksen Award: Jeff Giansiracusa
- Outstanding ACMS student: Ryan Card
- Outstanding B.A. Liberal Arts Mathematics major: Jaime Lust
- Outstanding B.A. Teacher Preparation Mathematics major: Carly Thurston
- Outstanding B.S. Comprehensive Mathematics major: Tom Carlson, Kevin Klonoff

In addition, a special presentation was made to honor Ryan Card, Ernie Esser, and Jeff Giansiracusa, members of the UW's national award winning mathematical modeling team.

MATH PUZZLE

If every vertex of a regular octagon is connected to every other, then how many triangles will be formed?



Answer on page 9

MILLIMAN LECTURES

János Kollár

Alain Connes

Each year the Mathematics Department invites a distinguished mathematician to visit the department for a week and deliver a series of lectures called the Milliman Lectures. This Lectureship is funded by the Milliman Fund, an endowed fund established in 1983 by a gift from Grace Milliman Pollack and her husband, S. Wilson Pollack, in honor of Mrs. Pollack's brother, W.A. Milliman, who received his Mathematics degree from the University of Washington in 1926 and who was a founder of the actuarial firm of Milliman and Robertson.

The 2002-03 Milliman Lecturer will be János Kollár of Princeton University, who is scheduled to visit the department during the week of April 14-18, 2003.

Kollár is generally considered to be one of the leading researchers in algebraic geometry today. He was one of three main organizers and one of the main speakers of the AMS Summer Research Institute on Algebraic Geometry in 1995, which is an event in algebraic geometry held once in every ten years, bringing together practically every algebro-geometer from around the world. It is a three-week long conference designed to cover the most important developments of the previous decade. This is the most important single event in algebraic geometry.

His first lecture, suitable for undergraduates, is titled "What is the biggest multiplicity of a root of a degree d polynomial?" The abstract is as follows:

> Let $f(x,y)$ be a real polynomial of degree d which has an isolated local minimum at the origin and $f(0,0)=0$. We say that it has a root of multiplicity M if $f(x,y)$ is $\leq c\sqrt{(x^2+y^2)^m}$ near the origin for some $c > 0$ and M is the smallest possible. We try to answer the question: how large can M be?

Kollár's second lecture, geared toward a colloquium level audience, is titled, "Which are the simplest algebraic varieties?" The abstract is as follows:

> An algebraic variety is a subset of C^n defined by polynomial equations. It is rather clear that the higher the degree of the defining equations, the more complicated the corresponding variety can be. There have been various approaches to define what the "most complicated" varieties are, but it is only recently that a good definition and theory was developed for the "simplest" varieties. The talk will explain the definition and its basic properties, mostly through examples.

Kollár was an invited speaker at the ICM'90 in Kyoto, where Shigefumi Mori, Kollár's main collaborator, received the Fields Medal. He was a plenary speaker at the European Congress of Mathematics in 1996.

His results cover such a wide area that it is hard to simply list them all. He has been an influential force in developing theories dealing with the Minimal Model Problem and the Iitaka conjecture regarding Kodaira dimension of fiber spaces, both of which are very important parts of classification theory. Along with Mori and Miyaoka he developed the theory of rationally connected varieties, which has made a tremendous impact on current research. His results on effective versions of the Hilbert Nullstellensatz make him one of the most quoted authors by people working on computational questions. He has achieved stunning advances in determining rationality, unirationality, ruledness and uniruledness of hypersurfaces that sparked a flurry of new research and new results by others. He obtained results on orbifolds using complex analytic techniques and on varieties in characteristic p using arithmetic methods. He has been one of the main architects of the theory of moduli spaces of higher dimensional varieties, proving many results, including projectivity of complete moduli spaces. He presented his work on Shafarevich's conjecture as the M. B. Porter Lecturer at Rice University. This was also published in a book that many collegues categorized as a very long research article reflecting the fact that the theory presented there was entirely new. In fact, his results on Shafarevich's conjecture are still the best (and basically the only) known results in the higher dimensional case.

He is the author or co-author of five books, some of which are regularly used for topics courses around the world.

In 1952 Nash proved that every compact differentiable manifold can be realized as the set of real points of a real algebraic manifold. He then went on to conjecture that every compact differentiable manifold can be realized as the set of real points of a real algebraic manifold, which is birational to projective space.

In 1998 Kollár proved that this conjecture fails in dimension 3 (and pointed out that it also fails in dimension 2 by work of Comessatti dated 1914). He gave a complete list of oriented real projective algebraic 3-folds that are birational to projective 3-space showing that in fact very few 3-manifolds can be realized this way.

This result is arguably the most significant single result in real algebraic geometry in recent years. Actually it is not the problem itself but Kollár's work on the problem that makes it so interesting.

Kollár has been known as one of the main architects of the Minimal Model Program (which was the main invention of the 1980's and constitutes the cornerstone of classification of complex algebraic 3-folds) and in the course of working on the Nash conjecture he developed the equivalent of the entire Minimal Model Program including some related "side results'" for real algebraic varieties.

This has not even been considered possible previously since real algebraic geometry seems to lie closer to differential geometry and topology than to algebraic geometry itself. The lion's share of algebro-geometric techniques require the field to be algebraically closed, so one would not think at first that such advanced theories as the Minimal Model Program would work for a non-closed field. That was before Kollár's work.

Naturally, his proof includes lots of topology and differential geometry, but it is also a very important link between algebraic geometry over the complex and the real numbers. Even though there is an obvious connection between the two, it is very hard to make good use of it in practice.

The Nash conjecture was answered in the negative by this result. However one could ask how far this conjecture is from the truth. Nash's original results imply that if the requirement about projective space is dropped then the statement is true and by works of Akbulut-King, Benedetti-Marin and Mikhalkin it is known that every compact differentiable manifold can be realized as the set of real points of a real algebraic variety (possibly singular), which is birational to projective space.

Recently Kollár came forward with yet another stunning result. He considered the case when one relaxes the only condition that has been common to all of the previous versions: projectivity. To the great surprise of many, Kollár proved that the Nash conjecture actually holds in the following form:

For every compact connected differentiable 3-manifold M there is a compact complex manifold X which can be obtained from $\mathbf{P}^3$ by a sequence of smooth real blow ups and downs such that M is diffeomorphic to $X(\mathbf{R})$, the set of real points of X.

Possibly the most surprising fact is that the previous result established that this statement could not be true if one required X to be projective. Furthermore, the class of compact complex manifolds described in the statement is very close to being projective. Given that, one would naturally expect that Nash's conjecture would still fail in this class. Kollár has developed a whole new theory around this question that is certain to bring new tools and ideas to many other questions and generate a lot of new research in real algebraic geometry.

This piece of work has potential interest for a wide range of audiences. Ideas and methods from differential and algebraic geometry, topology and algebra play important roles in Kollár's work. One can be amused simply watching how these different disciplines play together in harmony conducted by one of the best in the business.

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The 2003-04 Milliman Lecturer will be Alain Connes. Connes received, among various other prizes, a Fields Medal in 1982 for the classification of von Neumann algebras, and the Craaford Prize in 2001.

He is currently a permanent member at IHES, and also holds a chair at the College de France in Paris. He is a member of several National Academies, including those of France, Norway, Denmark, Canada, and the United States. He is a fellow of the Royal Society.

Connes' interests are very broad, ranging from physics to number theory. His main claim to fame is as the primary creator and mover behind the field of non-commutative geometry. The starting point for this is the theory of operator algebras, but what really distinguishes his work is the many ways in which he has connected this subject to other fields of mathematics. He has written a beautiful and unusual book on the subject in which the emphasis is on presenting ideas and connections rather than proofs. He has used the ideas of non-commutative geometry to develop new methods for renormalization theory and the standard model of quantum and particle physics, and to attack the Riemann Hypothesis. Another of his inventions is cyclic homology.

MATHDAY

The thirteenth annual Mathday will be held on the campus of the University of Washington on March 24, 2003. On that day 1,200 high school students from around the state will attend lectures and panel discussions, participate in hands-on activities, and go on field trips to labs on the campus. Students come from all over the state of Washington and in recent years we have always had representatives from the state of Idaho. The first Mathday was held in 1991. This year the plenary speaker will be Nathan Kutz from Applied Mathematics. Guest lecturers will include Millie Johnson (Mathematics Department, WWU), Cliff Mass (Astronomy Department, UW) Sándor Kovács (Mathematics Department, UW), and others not yet confirmed at the time this article is being written. In 2002 there were more than twenty different activities and field trips. There is a website, http://www.math.washington.edu/~morrow/bookmarks.html, which will be updated with current information. Undergraduate students, graduate students, staff, and faculty contribute to the success of this exciting, educational day in which students learn about the uses of mathematics in academic research and industrial research and development.

VISITORS

Each year the Department welcomes many visitors; these visitors, who come for varying periods of time, teach for us and participate in our seminars. They make significant contributions to the life of the Department. That our visitors come from all over the world attests to the international nature of our subject and to the Department's attractiveness as a center of mathematical work.

Klaus Schmidt, Director of the International Erwin Schrödinger Institute for Mathematical Physics and Professor at the Mathematics Institute, Vienna, Austria. Visiting Professor 2002-03. (Ergodic theory, Harmonic Analysis, Probability Theory, and Operator Algebras.)

Vladimir Sharafutdinov, Head Researcher at the Sobolev Institute for Mathematics and Professor of Mathematics, Novosibirsk, Russia. Visiting Professor Winter and Spring Quarters. (Differential geometry and topology.)

Dmitri Kozlov, Associate Professor, Royal Institute of Technology, Stockholm, Sweden. Visiting Associate Professor Winter Quarter. (Combinatorics, algebra, and topology.)

Stefan Kebekus, Assistant Professor, Bayreuth, Germany. Visiting Assistant Professor Autumn Quarter. (Complex algebraic geometry.)

Daniel Rogalski is a National Science Foundation Postdoctoral Fellow. He received his PhD from University of Michigan, 2002. (Noncommutative rings and noncommutative algebraic geometry.)

Answer to puzzle on page 7: 632

The following is the list of our friends who have contributed to the Department between July 1, 2001, and June 30, 2002. Should you notice an error or omission in this list, please draw it to our attention by a telephone call or e-mail message to Jessica Baird (206-543-1151; jbaird@math.washington.edu).

Cheol and Maria An
Matthias An
Loren and Elsie Argabright
Charles and Carol Austin
Kim Richard Bankson
Lynette Barstow
Alfred Beebe and Shauneen Giudice
Lisa Behmer
John and Tasoula Berggren
Ann Birnbaum
Robert and Sarah Blumenthal
Hans-Juergen Boehm
Phil Bombino
Mike and Belinda Borden
John and Margaret Bossert
Mike Bossert
Michael Brown and Kathryn Renouard
Elaine Buettgenbach
John and Leslie Burch
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Orson Hoeksema
Herbert and Florence Irving
Ralph and Pauline Jenne
Allen and Jane Johnson
Joseph and Jean Karpen
Sim Chee Khian
Bora Kim
Daniel and Etsuko Kimura
Gary and Katherine Kiyonaga
Robert and Claudia Kottwitz
Yosha Kraus
Robert Kurshan
James and Marjorie Leggett
Douglas Lind
Ronald and Sally Linebarger
Deborah Lynn Loyd
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Glenn McCauley and Ellin Huttel
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Each year the Department receives gifts from its alumni and friends, gifts, usually in the form of financial contributions, of immense value to us. These gifts permit us to carry on activities that are of importance to our students and to our scholarly work. For instance, they provide money for scholarships, fellowships, and prizes for our students, undergraduate and graduate both. They support visits to our Department by distinguished mathematicians from other institutions, both American and foreign. They give the Department a much-needed element of flexibility to meet special needs as they arise. For these contributions we are truly thankful. We hope to continue enjoying the support of our many alumni and friends. If you are thinking of making a gift to the Department, or, perhaps remembering the Department in your will, we invite you to discuss the matter with Professor Selim Tuncel, the acting chair of the Department (206-543-1151 or chair@math.washington.edu) or with Dondi Cupp of the Development Office in the College of Arts and Sciences (206-685-6736 or dcupp@u.washington.edu).

Attention Husky Fans!

Tyee program members supporting the University at the President's Club level ($2,000 and above) and who currently qualify for priority seating in Husky Stadium (Tyee seats) and the Bank of America Area at Hec-Edmundson Pavilion (Key 100 and Fast Bank seats) can receive one Tyee point for every $100 given to academic programs within the University. For details regarding Tyee points go to the Husky homepage www.gohuskies.ocsn.com--navigate the site by clicking on Departments, then The Tyee Program, and finally Priority Seating Opportunities.

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