



THE UNIVERSITY OF ARIZONA

MATHEMATICS

Spring 2003

A VIEW FROM THE CHAIR

Nicholas Ercolani

Department Head and Professor of Mathematics

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Presentations,
Symposia, Workshops

The focus of this Spring newsletter concerns our activities in Collegiate Education and our Undergraduate Program. The feature article is about the Department's Business Mathematics course. Richard Thompson who created this course, in collaboration with Chris Lamoureux of the Eller School of Business, describes this novel curriculum and its recent national impact. This course will be featured in a Congressional presentation in Washington on June 17.

This issue also features our April Math Awareness Week (MAW) activities, with the theme *Mathematics and Art*. The sculptures on this page, created by Helaman Ferguson, were inspired by constructions in differential geometry. These were the subject of a special MAW seminar.

In addition we have an article describing the diverse roles our adjunct faculty play in Department activities and in courses at the freshman and sophomore levels.

Recently our Undergraduate Offices, Mathematics Education classrooms, and tutoring rooms moved into a new addition (Math East). This new space was realized through the efforts of the Dean of the College of Science and many personnel in facilities

management as well as the Department's Operations and Business managers, Faye Villalobos and Deborah Gaines. I want to thank all of them for achieving this much-needed expansion in such a short time.

I also want to thank the many of you who contributed toward the items on our Wish List. Thanks to your generosity, we will be able to start construction on a new state-of-the-art computer classroom for our undergraduate courses. This and other developments in our computational infrastructure will be discussed in the next issue of the Newsletter.

Special thanks to those of you who continue to contribute to our scholarship funds. These funds make it possible for us to offer novel opportunities in research and education to our many talented Math Majors and



Costa Minimal Surface

Graduate students, many of whom go on to win prizes and awards such as those described within these pages.



Umbilic Torus

Contact us at:

<http://www.math.arizona.edu/~mcenter/alum>
or <http://www.dept.@math.arizona.edu>

Mathematics for Business Decisions

by Richard B. Thompson

Computers and an interdisciplinary approach make mathematics accessible to business undergraduates.

The Program

Until 1998, the University of Arizona taught all business students the traditional sequence of finite mathematics and brief calculus. Widespread dissatisfaction by all parties led to the development of a completely new, project-based, multimedia approach. The Head of our Finance Department, Christopher G. Lamoureux, created four major business projects: *Loan Work Outs*, *Pricing a Stock Option*, *Marketing Computer Drives*, and *Bidding on an Oil Lease*. We identified the

mathematical and computer tools needed for business decisions in these projects and for the students' future work and subsequent careers, and I wrote self-contained electronic texts resulting in a sequence of two courses. These texts, which are now being published and distributed nationally by the Mathematical Association of America, consist of *Microsoft PowerPoint*® course files supplemented by *Microsoft Excel* workbooks, streaming video clips, and internet links. The new material has now been studied by thousands of students and taught by dozens of teachers in seven different colleges and universities. At the University of Arizona it is currently used in Business Mathematics I and II, taken by all undergraduate majors in the Eller College of Business and Public Administration.

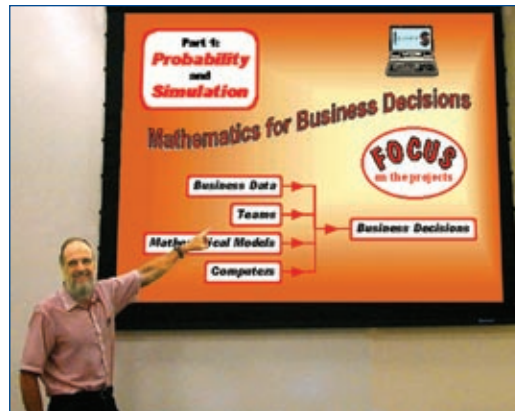


Christopher Lamoureux

Data for a class version of each project is studied by all students, while, at the same time, teams of students are also assigned their own analogous data sets. Immediately after the introduction of a project, each student team gives a preliminary report on its data. After homework assignments have been completed and the necessary mathematical and computer tools studied, the teams present final reports in both written and oral forms. To balance the teamwork, both midterm and final examinations are taken by students individually.

Student projects are based on significant and current mathematics. For example, the mathematics behind two of our four projects won Nobel Prizes in Economics for the creators during the last ten years!

- **John C. Harsanyi, John F. Nash and Reinhard Selten** were awarded the 1994 Nobel Prize in Economics for work containing what is now called the Nash equilibrium. In *Project 2 of Mathematics for Business Decisions Part 2*, students develop a Nash equilibrium bidding strategy in first-price, sealed-bid auctions.



Richard Thompson teaching

- **Robert C. Merton and Myron S. Scholes** were awarded the 1997 Nobel Prize in Economics for work containing what is now called the Black Scholes formula for determining the value of a European stock option. In *Project 2 of Mathematics for Business Decisions Part 1*, students compute the present value of a European call option.

The mathematics in these Nobel achievements is challenging, requiring a background of considerable mathematical sophistication. How does *Mathematics for Business Decisions* make the underlying concepts

accessible to beginning business students? The answer is in two words: Computers and Simulation.

For example, probability comes alive when actual stock price data is used to approximate the probability density function of the random variable that gives the normalized ratio of weekly closing prices. Graphs in *Microsoft Excel* allow students to relate stock volatility directly to the standard deviation of this random variable. Project reports use this volatility to explain stock option values obtained by bootstrapping from the historical data.

In the capstone project, *Bidding on an Oil Lease*, computation gives students a direct connection with research level mathematics in a practical business setting. (Simulation in *Mathematics for Business Decisions* led me to discover a Nash equilibrium bidding strategy whose existence was unknown before 2001. Since then, Larry Wright, also of the Mathematics Department, and I have developed research-level mathematical results in auction theory that support the computation.

Our freshman and sophomore students now present applications of this theory in their team reports.)

Support And Teaching

Development of the novel high-tech material and of new teaching methods to support it has



A Student Project Presentation

been a major challenge. Much of our success is the result of strong support received from all levels of the university administration and from national sources. The project has been aided by the President, the current and former Provosts, the current and former Vice Presidents for Undergraduate Education and the Vice Provost for Educational Technology.

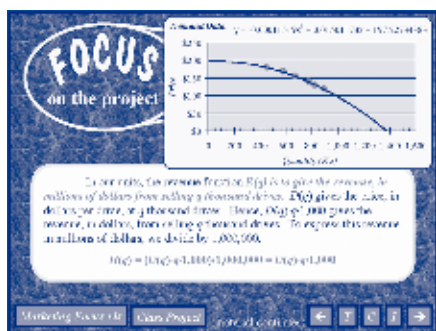
At President Peter Likins' request, *Mathematics for Business Decisions* was showcased in a 1999 presentation before the Arizona Board of Regents. Support and encouragement has also come from the current and former Deans of the College

of Science and of Business and Public Administration. The Mathematics Department has committed both financial resources and faculty time to the program since its inception.

The University of Arizona's new

freshman complex, the Integrated Learning Center (ILC), provides an excellent venue for most sections of *Mathematics for Business Decisions*. We have been able to take full advantage of computer technology available in the ILC. This includes computer projection equipment, access to our program files from the ILC servers, and the ability to have laptop computers delivered to our classrooms. Using the laptops, I have developed a program of computer testing that closely follows the computational content of the courses. Unfortunately, the severely limited supply of laptops has not permitted extension of the testing program to all sections.

The development of *Mathematics for Business Decisions* and the promotion of general interdisciplinary initiatives have received strong support from the National Science Foundation.



Lamoureux and I, along with Deborah Hughes Hallett and William G. McCallum from the UA Mathematics Department, are principle investigators for a \$500,000 dollar NSF grant to develop and disseminate mathematics/business projects.

The most important assistance we have received is the excellent and dedicated teaching by

Mathematics Department faculty members. Many instructors with appointments as senior research faculty, post docs, adjuncts, and teaching assistants have successfully developed expertise with new business concepts, computer skills, and the direction of student teams. The necessary faculty development has been expensive, both in terms of time and money.

Feedback

These mathematics service courses have elicited positive responses from students, faculty, administrators and professional societies. *Mathematics for Business Decisions* uses sound mathematics, significant business projects, and student teams; all linked together by computers.

I really enjoyed your class...It is such a different feeling coming out of Mathematics for Business Decisions than when I finished other math classes. I am really glad that I got the chance to take [it].

A student in Mathematics for Business Decisions

Mathematics for Business Decisions' unique blend...of quantitative concepts, computer skills, mathematical tools and ideas, and business concepts renders this course sequence a much more interesting educational experience for both myself and my students than any other course that I have ever taught.

Julie Tarr, Mathematics Department, Pima Community College

... stunning success. I'm proud of you and Chris, and I'm proud of the Math Department for its contribution to the success of Eller [Business] College students.

Dr. Peter Likins, President, University of Arizona

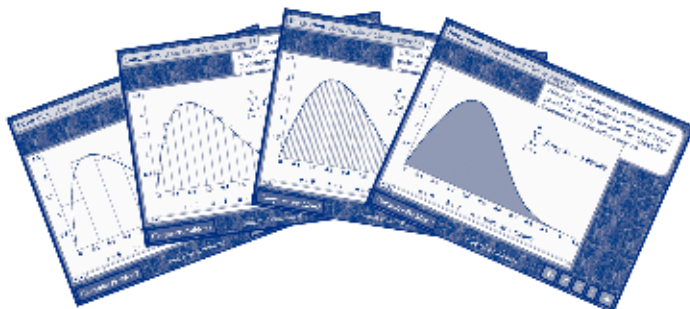
Mathematics for Business Decisions is a sparkling example of how interdisciplinary experiences for students can be shaped through the active collaboration of academic departments.

Dr. Donald J. Albers, Associate Executive Director, The American Mathematical Association

The Future

In the spring of 2003, *Mathematics for Business Decisions* moved into the national arena. One of our discipline's two major professional societies, the Mathematical Association of America (MAA), is publishing and distributing the entire program. International distribution will be handled by the Cambridge University Press. This is a major initiative for the MAA, involving articles in its journals, workshops at national and regional meetings, and contacts with sister societies in the business community. The texts will be published as boxed computer software, with installation CD's and student notebooks. These will be available for

continued on page 5



Contributions of Adjunct Faculty

by Elias Toubassi

The adjunct instructor program was created in 1985 to improve teaching in beginning mathematics courses. These courses are crucial since one or more are required of practically all university students. Moreover, success in beginning math enables the students to progress toward their chosen career, and failure effectively closes many academic options.

The Department, determined to provide caring instructors committed to undergraduate education and a supportive learning environment, recruited high-quality adjunct teaching staff. The documented success of a pilot project convinced the university to provide regular funding to support this program. We started with the equivalent of three full time employees (FTEs) and have grown and evolved over the past 18 years to our current level of 28.5 FTEs.

Adjunct faculty members play a valuable role in many areas critical to the success of the Department mission.

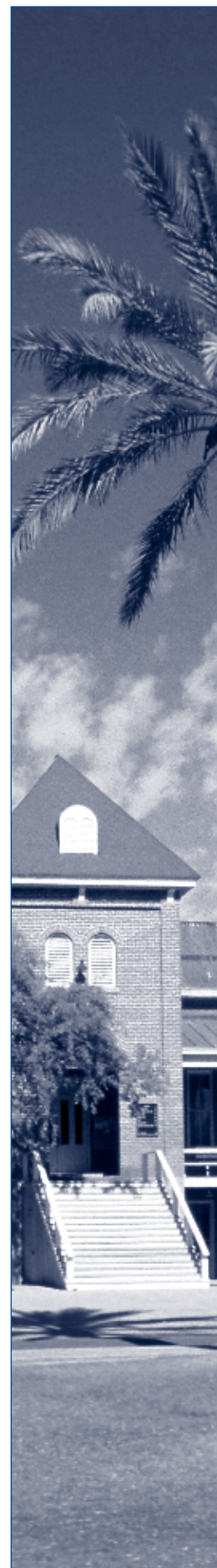
- They provide excellent teaching to our undergraduate students. They are especially vital to our three largest courses: College Algebra, Business Math, and Calculus I. Their success in the classroom has won them teaching awards from the Department, the Faculty of Science, and the University Foundation. It has also earned them special teaching assignments such as honors calculus courses.
- They use their expertise in the classroom to help support others. In particular, they play a key role in the training and supervising of graduate teaching assistants by observing their classroom, providing helpful suggestions, reviewing tests, and offering advice in one-on-one discussions.
- They help in the transition of new colleagues by serving as mentors.
- They work to improve the curriculum in lower division courses. They have authored a workbook supplement to our college algebra course which provides a problem-solving component missing in available texts. This workbook is revised and updated regularly. They also wrote an instructor's guide to the course, filled with helpful hints and suggestions on ways to teach the material.
- Many have contributed to the success of the new business math course by assisting with training workshops and creating study guides.
- Some have assisted with the statistics curriculum by developing the syllabus and creating material for the basic statistics computing class.
- Others have provided support on the department's web page for Calculus I, Multi-variable Calculus, and graphing calculator programs for use in teaching.

Adjunct faculty members make vital contributions in service to the Department. Adjuncts hold Course Coordinator positions for a number of our lower division courses, such as Algebra, Trigonometry, Calculus, and Math in Modern Society. This involves preparation of syllabi, holding informational meetings, and providing general support to instructors. One adjunct serves as Program Coordinator for our math readiness testing program, providing advising and information to incoming students on the most appropriate course to take. Another adjunct serves as Coordinator for the New Start Program for gifted students with financial need. Adjuncts serve on textbook committees, the Undergraduate Committee and the Entry Level Committee.

Some Adjuncts are involved in service on a national scale.

One adjunct serves as chair of the College Level Examination Program in College Algebra. Another is involved in an NSF grant to evaluate the long term impact of technology on the mathematical understanding of students at the undergraduate level. Others have attended and presented at annual meetings or conferences of national scope. Finally, some have authored or co-authored articles on the curriculum in major publications.

This program, begun on such a small scale, has expanded until the Department counts on their participation and energy in virtually every area. We are fortunate to have this dedicated group: *Ed Alexander, James Barrett, Faith Bridges, Richard Cangelosi, Douglas Clark, Scott Clark, Anthony D'Alesandro, Carolyn Edmond, Steven Foster, Laura Kondek, Donna Krawczyk, Kathleen Marrero, Marilou Mendel, Mona Roddier, Ewa Romanowska, Nataliya Sandler, Cristina Schuster, Deirdre Smith, Eugene Smith, Ben Vander Linden, Laurie Varecka, Mariamma Varghese, Steve Wheaton, Andrew Winsberg, and Debra Wood.*



Mathematics for Business Decisions, continued from page 3.

national and international adoption, beginning in May of 2003. All copyrights to the material have been retained by Arizona Board of Regents for the University of Arizona. Thus, the university is in a position to receive financial benefits as well as national prestige from the program.

Further recognition will come on June 17, 2003 when the MAA, NSF, and University of Arizona will feature *Mathematics for Business Decisions* in a Washington, DC showcase presented to members of the United States House of Representatives and Senate. Along with two former students, I will meet individually with members of the Arizona congressional delegation and will then participate in a general presentation for all senators and representatives.

This course has already helped thousands of business students experience the power that well understood and carefully applied mathematics can give them in their chosen field. We hope, and expect, that this positive influence will spread to a much larger group of future business leaders. This will fulfill the expectations that led to *Mathematics for Business Decisions* receiving the **2000 Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics**, presented by the International Conference on Technology in College Mathematics (ICTCM).

To learn more about the new project, visit our website at <http://business.math.arizona.edu/>

News from the Southwestern Center for Arithmetical Algebraic Geometry

by Doug Ulmer

The Southwestern Center (SWC) is a collaboration between ten mathematicians: four from the University of Arizona and six from other universities, such as UC Berkeley and UT Austin.

The Center, founded in 1997 with a *Group Infrastructure Grant* from the National Science Foundation, applied for new funding last year, but success was far from guaranteed. In fact, the program that started the Center no longer exists! Nevertheless, there was strong support nationally for the project and SWC received new grant funding for at least three more years of activities.

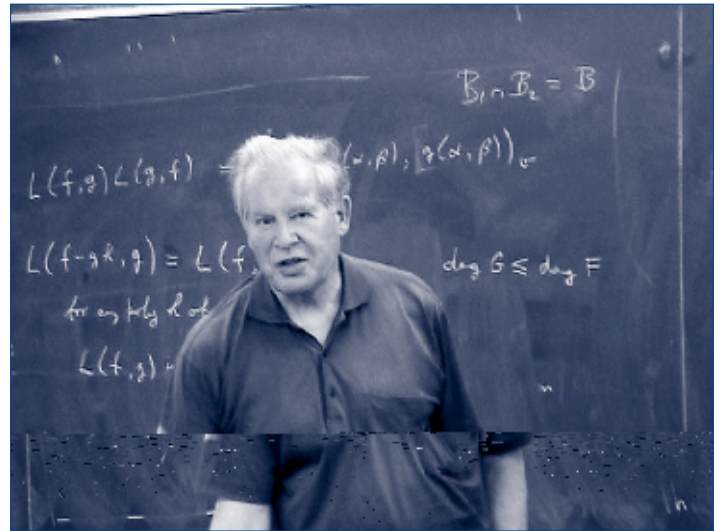
SWC activities included a distinguished lecture series and the annual Arizona Winter School. During this year's

Sir Peter is known worldwide for his achievements in mathematics, including his conjecture with Bryan Birch...now one of the Clay Millennium problems, with a million dollar reward for a solution.

This conjecture is now one of the Clay Millennium problems, with a million-dollar reward for a solution.

The 6th annual Arizona Winter School took place in March. The topic was *Number Theory and Logic* and the school focused on interactions between these areas. In particular, results from logic can be used to understand what can and cannot be computed, independently of improvements in processing power or clock speeds. The Winter School also featured courses about new proofs of deep theorems from number theory using methods from logic such as Model Theory. (Skeptical mathematicians sometimes doubt the relevance of logic to "real" mathematics, but at least as far as number theory is concerned, this doubt was completely put to rest by the Winter School.)

Another fascinating course dealt with the history of interactions between the two fields, focusing on the heroic



Sir Peter Swinnerton-Dyer

distinguished lecture program in December, Sir Peter Swinnerton-Dyer of Cambridge University gave four lectures on *New Methods for Diophantine Equations*. Sir Peter is known worldwide for his achievements in mathematics, including his conjecture with Bryan Birch relating the number of rational points on cubic curves to the analytic behavior of certain complex functions, called L-functions.

period of the early 20th century, when, for example, Gödel proved his famous incompleteness theorem. The speakers at the Winter School came from the UK, France, Germany, and the US, and there were about 100 participants from all over the US and many other countries.

Part of the emphasis of the next few Arizona Winter Schools will be on interactions between number theory and other areas of mathematics and science. The topic for 2004 is "Number Theory and Physics" and the speakers and course topics will be announced on our web site soon.

Another new item coming soon on our web site is annotated streaming videos of our distinguished Lecture Series and of the courses at the Arizona Winter School. In addition to audio and video of the lectures, we will have synchronized notes which can be used in conjunction with the lectures, or printed out for separate study.

For more details, see <http://swc.math.arizona.edu/>

Awards

Putnam

Competition Results

by John Leonard

The results of the Sixty-third Annual William Lowell Putnam Mathematical Competition have arrived, and they are most gratifying. The University of Arizona team placed 29th out of 376 schools fielding teams—in the top EIGHT PERCENT! Three of our students: Ed Carter, Josh Green and Jens Sukkestad scored high enough to make the prestigious “Top Participants” List, roughly the top 15% of the contestants.

We thank the nineteen undergraduates who took six hours on a Saturday, at a critical period of the semester, to participate in the competition: Jason Young, Allen Whitt, Alice Trimble, Jens Arne Sukkestad, Kenneth Porter, Amanda Morrow, Anita Lee, Gergely Kota, Becket Hui, Andrew Hill, James Hatch, Joshua Green, Sujoy Ganguly, Amy Nicole Dashiell, Edward Carter, Breanne Bushu, David Brown, Mathazin Aung, and Benjamin Armbruster.



Lennie Friedlander in the Tree-Ring Lab

Mathematical Contest in Modeling

by Bruce Bayly

Mathematical contests have been around for hundreds if not thousands of years, and today they are more varied and plentiful than ever. The Putnam Examination is perhaps the best-known of the national contests, but a more recent contest, initiated in the 1980s, is the Mathematical Contest in Modeling (MCM) conducted by the Consortium for Mathematics and its Applications (COMAP) with major sponsorship support from the Society for Industrial and Applied Mathematics (SIAM), the Operations Research Society of America (ORSA), and the National Security Agency (NSA).

The MCM differs from most other contests in that it is a team event of up to three undergraduates, and lasts four complete days—yes, 96 hours. At 8:00 p.m. Eastern Standard Time (EST) on Thursday evening COMAP posts three problems on the contest web page, real-world problems without precise mathematical specifications. The students then have the task of developing their own mathematical model,

analyzing it, and writing up the whole thing in the allotted 96 hours. It's not a challenge for the faint of heart, but it has been my pleasure to assist the Math Dept teams over the last decade. Our teams have always succeeded in producing and presenting good models, and also generally place close to the top rank.

This year's team consisted of Ben Armbruster, David Brown, and Ed Carter. On February 6th they were presented with the choice of three problems: (A) to determine a practical number of cardboard boxes for a stunt motorcyclist to land on, (B) to devise a suitable set of targets for gamma ray brain tumor surgery, or (C) to devise an effective strategy for screening aviation baggage. The team chose problem B, and formulated the problem as the optimal packing of spheres of different sizes into an arbitrary three-dimensional region. This then translated into a large nonlinear integer-programming problem, which was programmed into Ed's home computer system. Their report, “Packing Tumors with Spheres”, was judged in the Meritorious category, i.e. the top 15 per cent of all successful entries.

Undergraduates

The Undergraduate Mathematics majors constitute a highly talented group who distinguish themselves in a variety of directions. The public recognition given to our undergraduates is a nice reminder of the high quality of the entire program.

Mention has been made elsewhere of the successes achieved by our Putnam Exam and Mathematical Contest in Modeling teams. **Ed Carter**, who was on both, has also been named the Outstanding Senior from the Math Department for the Spring Commencement. **Josh Green** from the Putnam team received the Award for Excellence—in recognition of outstanding Academic Achievement, and was honored at the College of Science commencement celebration. **Justin W. “Dub” Gaberdiel** was also honored at the College of Science celebration as the Math Department's Outstanding Undergraduate Research Assistant, in recognition of his innovative work on knots, under the direction of Dr. Maria Robinson.

Our majors are distinguishing themselves in other fields also. **Noah Snively**, whose other major is Computer Science, has been

Math East Opening Festivities



Stephane Lafortune and Bill McCallum



Ginny Horak, Rebecca McGraw, Ann Modica, Jim Cushing and Elias Toubassi

named both Outstanding Senior and Outstanding Undergraduate Research Assistant in that Department. Not just in the sciences either—our majors **Agnes Leaf** (French) and **Laura Baker** (English Literature) were nominated by their respective departments for Outstanding Senior in the College of Humanities (as of press time the winner had not been announced). Such a distinction is not unprecedented; **Michael Urbancic** was Outstanding Senior in Humanities at the Winter 2002 commencement with a quadruple major in Math, History, Economics, and Spanish.

On the national scene, senior **Laura Baker** received a Fulbright Fellowship, which she proposes to use in South Africa developing mathematical models of rangeland use. Over the past year she has held a Goldwater Scholarship, and we are pleased to announce that this year two of our majors have been named Goldwater Scholars. **David Brown** (Math) and **Benjamin Armbruster** (Math and Engineering Math) are among a total of only five received in Arizona, and we are proud to have them both in our program. Regular readers of this Newsletter will remember that last year David won a prestigious CATTS Fellowship (from the UA College of Science). This year's CATTS Fellowship goes to **Ajit Divakaruni** (double major with biochemistry).

Graduate Students

Emily Lane is the recipient of this year's Herbert Carter Fellowship. **Michael Kuecken** received the award for Outstanding Graduate Teaching Assistant in Fall of 2002, and Guadalupe Lozano was named Outstanding

Graduate Teaching Assistant for the Mathematics Department, and for the College of Science both in Spring of 2003. **Jennifer Lowe** has been awarded the prestigious CATTS Fellowship for the academic year 2003/2004.

Faculty

Professor David A. Gay was named the Mathematics Department's Outstanding Advisor for the 2002/2003 academic year, and has been nominated for the College of Science Outstanding Advisor award.

David Lomen, Professor, has been appointed to the College Board's Advanced Placement Calculus Development Committee, and is The University of Arizona's nominee for a NSF Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring.

Associate Professor Juan Restrepo was named the Department of Energy's Young Investigator in the Fall of 2002. Restrepo has also been named to the Board of Directors of the Museum of Contemporary Art of Tucson (MOCA) and to the Board of Directors of WKXC and the Foundation for Creative Broadcasting.

Professor William Yslas Vélez has been appointed to the National Research Council's Steering Committee for the Review of the Evaluation Data on the Effectiveness of NSF Supported Curriculum Materials.

Staff

Staff Excellence Awards were given to **Ann Modica**, **Sue Adams**, and **Christa King** during the Spring College of Science Staff awards banquet.

DEPARTMENT OF MATHEMATICS

WISH LIST

Summer 2003

Mathematics East (Newly renovated space)

- **Balcony Commons Area (off 2nd floor)**
 - Railing - \$2,000
 - Shade Structure - \$2,500
 - Furnishings - \$1,000
- **Math (Majors) Center (Rm 144A)**
 - Scanner - \$250
 - Reception Area (Rm 146)- Framed posters - \$500
 - Commons Room (Rm 140)
 - Furnishings & Framed Posters - \$1,500
 - Computer - \$1,000
 - Reference Room (Rm 142)
 - Mathematics materials/publications - \$1,000
 - Computer - \$1,000
- **Seminar/Classrooms (Rm 246)**
 - Electronic Blackboard - \$2,500

Mathematics Building

- **Tiered Computer Classroom (Rm 101)** – UG Courses
 - Flat panel monitors - \$18,000 (\$600 ea)
 - 30 networked computers - \$24,000 (\$800 ea)
 - Software licenses [Maple, Matlab, MS Office] - \$10,000
- **Tiered Computer Classroom (Rm 102)** Statistics/Probability/Math Ed Courses
 - Flat panel monitors - \$15,000 (\$600 ea)
 - 25 networked computers - \$20,000 (\$800 ea)
- **Graduate Student Commons Rm (702)**
 - Furnishings - \$1,000
- **Seminar/Classroom (Rm 402)**
 - Electronic Blackboard - \$2,500
 - Computer Projection Equipment - \$5,000
- **Computer Server Rooms (Rms 231, 233)**
 - Raised floor - \$15,000
 - Racks - \$2,500
- **Total Building** - Network Rewiring to 100BaseT - \$70,000
- **Seminar/Classroom (Rm 501)**
 - Electronic Blackboard - \$2,500
 - Computer Projection Equipment - \$5,000
- **Faculty Commons Rm (Rm 226)**
 - Furnishings - \$1,000
 - Whiteboards - \$500
- **Staff Commons Rm** - Furnishings - \$500

Scholarships

- **Clay Travel Fund** - For graduate travel to meetings - \$400 ea
- **Pierce Memorial Fund** - UG Math Majors - \$1,000 ea
- **Lusk Scholarship in Mathematical Sciences** UG Math Majors - \$1,000

Math Teaching Lab

- **Full walls for offices** - \$10,000
- **Re-routing Cooling Systems** - \$10,000

Construction of New Space (60,000 sq. ft.) \$20,000,000

Recruiting Workshop

by Leonid Friedlander, Associate Head,
Graduate Program



The 17th annual Recruitment Workshop took place March 8 to March 11, 2003. A total of 30 prospective students participated. This workshop is a joint venture of the Mathematics graduate program and the Applied Mathematics Interdisciplinary Graduate Program. Although the programs are different, we cooperate on many levels. Traditionally, we arrange for Mathematics applicants to share a hotel room with their Applied Mathematics peers.

The workshops give the applicants an opportunity to get a glimpse of Tucson, the University, the Department, to mingle with current graduate students, to talk to faculty, to find out about research being done here, and to get answers to numerous questions.

On Sunday, most of our guests went for a hike in the Tucson Mountains. The hike was organized by the current graduate students, and several faculty members also joined the crowd. For those who came from the East Coast, a warm, sunny day was a welcome change from winter weather. In the evening, everybody was invited to dinner in our home.

On Monday and on Tuesday, there were quite a number of talks scheduled. The topics varied over Number Theory, Computational Algebra, Geometry and Dynamical Systems, Mathematics Education, Mathematical Biology, and Nonlinear Optics. In addition to going to the talks, our guests were busy meeting with the faculty.

This year, the workshop was very successful. Five Math participants and eight Applied Math participants have accepted our offers. I would like to thank everybody who gave a talk, went to the hike, came to dinner and spoke with workshop participants. My special thanks go to Adam Spiegler and Emily Lane, Mathematics and Applied Mathematics graduate students representatives, and to Linda Silverman and Stacey Wiley of the Applied Math Program, and to Nellie Rios in the Mathematics Graduate Office for all their time and effort in making this event successful.



New Faculty Profiles

Rabi Bhattacharya, a probabilist and a statistician, is returning to Tucson with a half-time appointment. After graduating from Chicago in 1967, he taught at Berkeley for three years, Arizona for 10 years and Indiana for 20 years. Rabi and his wife Gouri have a daughter and a son, and two small grandchildren.

Ildar Gabitov was born in 1950 in Krasnoyarsk, Russia, and received his B.S. and M.S. in mathematical physics from the Leningrad State University and his Ph.D. in Theoretical and Mathematical Physics from the L.D. Landau Institute for Theoretical Physics. In 2002 Ildar joined the mathematics faculty at the University of Arizona. His research interests include nonlinear partial differential equations and their applications to nonlinear optics and optical communications. Additionally, he is interested in statistical and nonlinear electrodynamics. He likes skiing and hiking.

Karl Glasner was born in 1970 in Cheyenne, Wyoming, and received his B.S. in physics from the University of Wyoming and his Ph.D. in Applied Mathematics from the University of Chicago. After postdoctoral work at the University of Utah and Duke University, Karl joined the mathematics faculty at the University of Arizona in 2002. His research interests include various types of interface motion such as those arising in thin film dynamics, reaction diffusion processes, and materials science. Additionally, he is interested in the geometry and computation of the equations of interface motion. Karl spends his free time hiking with his wife Nicole and daughter Kaya. His other interests include playing music, in particular jazz piano and classical guitar.

Virginia Horak earned her B.S. and M.A. degrees in mathematics from The University of South Dakota, and began her career as a junior high mathematics teacher. She earned her Ph.D. in mathematics education from The University of Iowa in 1977. Virginia worked part-time and full-time in The University of Arizona Mathematics Department and the College of Education as a mathematics educator for the next 10 years, then for nine years she was a mathematics specialist for the Tucson Unified School District. She returned to our department in August of 2002. Professor Horak lives in Tucson with husband Willis, and has two children: a son who is a grad student in mathematics at Cornell, and a daughter who is a pharmacology/toxicology grad student here at the University of Arizona. She also enjoys cooking, traveling, skiing, bridge, scuba diving.

Rebecca McGraw received her Ph.D. in Curriculum and Instruction from Indiana University in 2002. Prior to that she worked for four years as a high school mathematics teacher in Bloomington, Indiana. In addition to the nature of classroom discourse and the development of mathematical ideas through discussion, her interests include in-service and pre-service mathematics teacher education and the influences of technology on students' understanding of mathematics. McGraw is also working with a team of mathematics educators from across the nation on an analysis of data from the 1990-2000 National Assessments of Education Progress. Regionally, she works on a NSF project supporting implementation of standards-based middle grades mathematics curricula, and, locally, she serves as a coach for the Center for Recruitment and Retention of Mathematics Teachers. In her spare time, McGraw enjoys painting and swimming, and is a budding rockhound.

Summer Math Camps at Arizona

by Dan Madden



In 1986, thanks to the generosity of Tucson philanthropist Ashby Lohse, The Mathematics Department brought in 16 talented mathematics students from Arizona's junior high schools for the first two week summer mathematics camp. That camp was an unqualified success. The students had a great time: learning mathematics, solving exploratory problems, and writing computer programs. The camp leaders, Dan Madden and Fred Stevenson, had even more fun than the kids. The camp fit perfectly with Mr. Lohse's personal vision that learning and hard work could be fun and enjoyable. So he told the Department that he would fund the Camp for the indefinite future.

The Arizona Summer Math Camps just completed their 18th year. We still limit the Camp to 16 students. The students live and work on Campus for the full two weeks of the camp. While the exact mathematical content of the camp has changed, the main focus is still the solution and presentation of exploratory problems. The Camp remains an opportunity for mathematically talented students to have fun as they tackle the most challenging questions they have ever been expected to answer.

In 1987, Dan and Fred received 14 applications from students at Whiteriver Junior High School. Within the application for the camp there is a "take home" test. The Whiteriver students had all

spent a great deal of time working on the problems. While the solutions were distinctly written by 14 individuals, it was apparent that the students had worked on the problems together. Solutions to even the hardest questions were presented, and they showed real imagination and talent. Clearly something was happening in Whiteriver. When Fred made a call to Whiteriver, he found that some students had formed an after-school group to work on the test problems. The group met as often as possible for almost six weeks. Fred and Dan went to Mr. Lohse with the dilemma these 14 applications presented, and his immediate response was to ask them to set up a one-week camp just for the Whiteriver students. During the first Apache Math Camp, we discovered that this group had the advantages of one extremely talented student leader, and the support of an inspirational teacher.

Every year since, Fred and Dan have run two Summer Mathematics Camps. The two-week camp is for students between the 8th and 9th grade. The Department advertises the camp to all Arizona

schools, but applications are accepted from across the country; several outstanding students have come to the camp from other states. The cost of the camp remains nominal thanks to the Department and to the generosity of Mr. Lohse and his family.

The Apache Math Camp continues to this day thanks to the dedication of Whiteriver math teacher, Toby Castillo and his wife Sarah. An unexpected problem in Whiteriver caused the 2002 camp to be cancelled, but it returned to full strength in 2003.

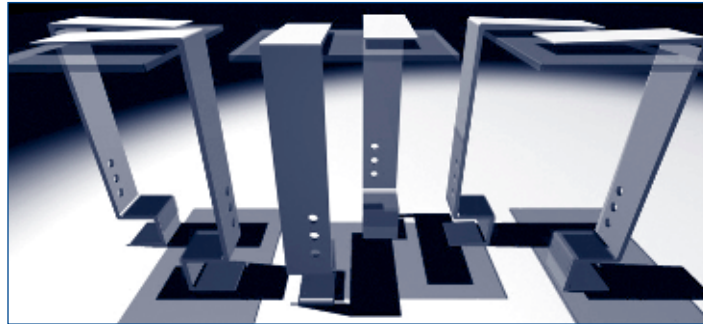
Applications for the two-week camp are available after February 1st each year. You can request an application or other information by writing **Fred Stevenson or Dan Madden by mail** or **Madden@math.arizona.edu** or **frstv@math.arizona.edu**.



Math Awareness Week 2003

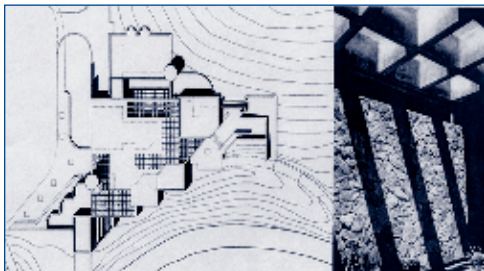
By Bruce Bayly, Associate Head,
Undergraduate Program

For many years, April has been designated Mathematics Awareness Month. Each year the Joint Policy Board for Mathematics chooses a theme that illustrates the relationship between Mathematics and some aspect not always considered mathematical. Past themes have included *Math and the Oceans* and *Math and the Genome*; this year the theme was *Mathematics and Art* (visual arts specifically). The UA Math Awareness program is generally organized by the Math Center, but we must give major credit to Olga Yiparaki, a Visiting Assistant Professor, who seized the initiative and really made it happen. We have traditionally selected one week in April as our *Mathematics Awareness Week*, for a concentrated program of events and presentations.



The Integrated Shade Seat Bus Shelter - Broadway Boulevard - Tucson, Arizona
Line and Space Design

This year we began on **Monday, April 7th** with a slide show by **Les Wallach**, Tucson architect and founder of Line and Space Design, the company retained to design the University of Arizona Poetry Center, and responsible for both the Boyce Thompson

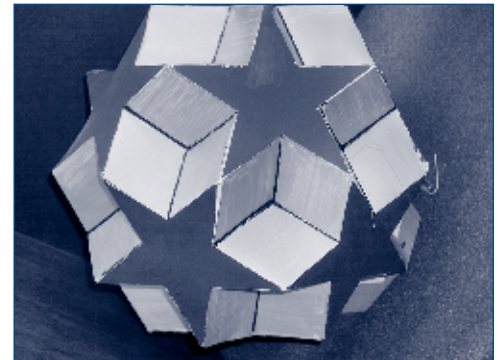


Boyce Thompson Arboretum - Superior, Arizona
Line and Space Design

Arboretum and the Arizona-Sonora Desert Museum, among many other "innovative and ecologically sound architectural projects." His talk on the guiding principles behind his award-winning designs was attended by a mixture of mathematicians, architects (including a small group from Ohio), other artists, and the general public. (see www.lineandspace.com)

Tucson High Magnet School teacher **Ginny Bohme** gave the **Tuesday presentation** on her uses of art in geometry courses at different levels, which tempted several of us to go back to high school ourselves and retake Geometry with Ginny!

On **Wednesday** we had a lunchtime seminar on the Theory and History of Perspective Drawing, given by Optical Sciences graduate student **Kevin Gross**. Kevin also gave us a brief account of Professor Charles Falco's controversial claims regarding use of imaging mirrors by Renaissance artists. Kevin showed us innovative perspective imaging techniques he has been developing with the aid of his digital camera and computer.



Polyhedral models built by students in Ginny Bohme's
Geometry classes at Tucson High School

Wednesday was also Math Movie day, and **John Leonard**, Senior Lecturer in Mathematics, showed a delightful video: "The Fantastic World of M.C. Escher." The video featured interviews with friends and associates of that remarkable artist, recounting their interactions and impressions.

On **Thursday**, undergraduate student (double major in Mathematics and Computer Science) **Kevin Wampler** talked about the Mathematics of Computer Graphics. Of course, this is a huge subject, but Kevin chose to specialize in the use of recursive mapping techniques to produce fractal images that can be designed to mimic structures found in Nature, like trees and flowers, mountain ranges and landscapes, and far-fetched images like nothing ever previously imagined. Despite

his youth, Kevin gave an exceedingly professional presentation, and we expect great things from him in the near future.

Friday April 11th had originally been left unscheduled, but by an amazingly fortuitous chance, **Claire and Helaman Ferguson**, co-authors of *Helaman Ferguson: Mathematics in Stone and Bronze*, were going to be in Tucson. Helaman Ferguson worked in a variety of

mathematical fields, notably computational number theory in which he is the creator of one of the "ten best algorithms of the 20th century," and now spends most of his time sculpting.

His works are breathtakingly beautiful representations of subtle mathematical objects, such as the *Umbilic Torus* and *Costa's Minimal Surface* featured on the front page. Claire Ferguson, whose background is in Literature and Art (she was an Ada Comstock scholar at Smith College), writes on the connections between art and mathematics. At SIAM's Fiftieth Anniversary meeting last July, the Joint Policy Board for Mathematics presented its Communications Award to Claire and Helaman Ferguson, saying the two "... have dazzled the mathematical community and a far wider public with exquisite sculptures embodying mathematical ideas, along with artful and accessible essays and lectures elucidating the mathematical concepts."

The Fergusons happily agreed to give a presentation on their work, and even with only three days' notice, there



"Costa Surface" sculpted by Helaman Ferguson

was a strong turnout in the Integrated Learning Center's largest lecture hall. The audience was rewarded with an exceptionally well-coordinated presentation by both Helaman and Claire. They were much gratified by their warm Tucson reception and have promised to pay a return date in the near future – so watch this space!

For the entire month of April we had exhibits in the Math building lobby on the theme of Mathematics and Art. Indeed, our permanent exhibit of mathematical models falls into that category.

We were fortunate to arrange for the loan of several large-scale photographic works by **Joseph Labate** of the UA



Art professor Joe Labate's photographic study "Mask"

Art Department. Before becoming a photographic artist, Joe worked in Civil Engineering, and his artwork draws heavily on quantitative ideas from his technical background.



"Waiting to Fly" by local steel sculptor Anne Franklin, lent by Pima College Downtown Campus

We also obtained the loan of the welded-steel sculpture *Waiting to Fly* by **Anne Franklin**, whose day job is teaching Mathematics at Pima College Downtown.



Perspective study by Breanne Bushu, Art major and Math minor at University of Arizona

Each year the Joint Policy Board for Mathematics chooses a theme that illustrates the relationship between Mathematics and some aspect not always considered mathematical. ...this year the theme was Mathematics and Art.

Soldered steel made its appearance in the traditional Math Awareness Week puzzle, which this year was to guess the total length of wire used in a trefoil knot sculpture built by **Maria and Sam Robinson**.

We were also pleased to exhibit the work of students such as UA Art major (and Math minor) **Breanne Bushu**, who contributed two elegant studies in perspective for our display. **Ginny Bohme** from Tucson High School and **Kathy Lackow** from Sabino High School contributed selected projects produced by students in their geometry classes.

Although intended to develop mathematical concepts, the projects tended to take on

lives of their own and evolve far beyond, and several of the best students have announced their intentions of pursuing their studies in Art school!



Math Awareness Week Contest. This metal sculpture consists of a trefoil knot wrapped in coils of wire. The Math Awareness Week contest was to estimate as closely as possible the total length of wire used. The winner was Craig Hutchings, whose guess of 551.3 ft. was with 10% of the actual value 566.1 ft.



Model from Kathy Lackow's Calculus class at Sabino High School, representing the volume of solids of revolution by the method of slices

Interactions between members of the Mathematics Dept and the art world will continue in various forms. We will continue to exhibit work with mathematical themes from members of the UA Art Department and other local artists, and we hope to increase interaction with

the College of Architecture. Members of the Mathematics Education group have already been working with the UA Art Museum to develop a *Mathematical Tour of the Art Museum* as a resource for Mathematics and Art teachers in local schools.

Looking further, some of us are dreaming of a future Mathematics building designed by **Les Wallach**, with a specially-commissioned Ferguson sculpture in the forecourt and inspiring mathematical artwork scattered throughout the interior. Donors, this is your chance to have the finest building on the UA campus named after you.

Presentations, Symposia, Workshops

Jim Cushing, Professor, is an invited speaker for the SIAM Conference on Applications of Dynamical Systems Session on "Applications of Difference Equations," in Snowbird Utah, May 27-31. He is the main lecturer for the Rocky Mountain Mathematics Consortium Summer Conference on "Discrete Dynamical Systems & Their Applications to Population Dynamics" at the University of Wyoming, July 7-18 and will give the plenary address, "Dynamical Systems and Their Application to Biology", at the National Center for Theoretical Sciences (CTS), National Tsing Hua University, Taiwan, June 24-28.

Nick Ercolani, Professor and Department Head, has been invited to speak at the AMS-IMS-SIAM Summer Research Conference on Spectral and Inverse Spectral Theory of Jacobi Operators, in Snowbird, Utah, June 7-13, 2003. He is also one of the principal organizers of the year-long Thematic Program on Partial Differential Equations, to be held at the Fields Institute beginning August of 2003. (Details can be found at www.fields.utoronto.ca/programs/scientific/03-04/pde/)

William Faris, Professor, is an invited participant in the IMA 2003 summer program "Probability and Partial Differential Equations in Modern Applied Mathematics" in Minneapolis.

Hermann Flaschka, Professor, will participate in the program on "Moment Maps and Poisson Geometry" at the Erwin Schrodinger Institute in Vienna, in August 2003.

Joceline Lega, Associate Professor, will be in residence at the Kavli Institute for Theoretical Physics (KITP) in Santa Barbara, California, from August 11-30, 2003, and then at the Fields Institute in Toronto from September 1 through November 30. She will give an invited lecture entitled "Pattern Formation in Physics and Biology," held at KITP and coordinate a workshop on "Patterns in Physics" held at the Fields Institute November 14-18, 2003.

Alan Newell, Professor, has been invited to participate in the Field's Institute's special Thematic Program on Partial Differential Equation, and to be a part of the Program at the Kavli Institute for Theoretical Physics (KITP) in Santa Barbara, California.

Richard Thompson, Associate Professor, has been invited to represent the Mathematical Association of America at the Coalition for National Science Funding Showcase in Washington, DC in June 2003.

William Yslas Vélez, Professor, is an invited panelist for the program "So Many Opportunities, So Few of Us" at the 2003 annual meeting of the Western North American division of the International Biometrics Society, and the 2003 Western Regional meeting of the Institute of Mathematical Statistics, in June 2003 in Golden, Colorado. Velez is also a panelist for the National Science Foundation's Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP) beginning June 30, 2003. On July 29, 2003 he is the Plenary Speaker for the Project NEXT fellows at the MAA Summer Mathfest.

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