News from the Department of Mathematical Sciences
University of Massachusetts Lowell

Tangents

Spring 2003

Alumni Reception and Awards Ceremony

The 2003 Alumni Reception and Awards Ceremony will be on Friday, April 25. This year, it will be a two-part event:

1. From 5 p.m. to 7 p.m., we will meet in the Alumni Library to present awards and display student work. Light refreshments will be served.
2. At 7, we will adjourn to the Brewery Exchange on Cabot Street. for more substantial refreshments.

One of the highlights of last year's reception was the presentation of the Richardson-Bedell Scholarship to **Andrew B. Golay.**

Russ and Mary Bedell present the Richardson-Bidell Scholarship to Andrew B. Golay.

Department Revises Bachelor's Degree Requirements

If you're reading this newsletter, you were probably a math major and share our surprise at the small numbers of undergraduates who choose to major in math. This is a problem at nearly every university in the United States. As part of the never-ending battle to increase majors, the department has spent the past two years revising the program of study leading to the bachelor of science degree in mathematics. Pending approvals from various committees, mathematics majors will be able earn a general degree or concentrate in a specific area including (but not limited to) applied/computational

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Books by UML Math Faculty

Several members of the department have authored books. In this issue, we describe books by our current faculty. Next fall we will report on those by retired faculty, including Profs. Makovoz, Kaiser and Ruskai.

Kenneth Levasseur and coauthor Allen C. Hibbard have written *Exploring Abstract Algebra with Mathematica*, which has been published by Springer-Verlag-TELOS, xiv+467 pp. The book comes with an interactive CD-ROM (Windows and Macintosh) and there is a Web page at www.central.edu/eaam/.

A research monograph by V.S. **Prasad** and coauthor Steve Alpern, entitled *Typical Dynamics of Volume Preserving Homeomorphisms*, Cambridge Tracts in Mathematics, v. 139, was published by Cambridge University Press, Cambridge, 2001. xx+216 pp. It describes the joint research of Prasad and Alpern over the last 25 years on the celebrated theorem of Oxtoby and Ulam.

A delightful book has been written by **Daniel A. Klain**, with his coauthor, the late Gian-Carlo Rota. It is entitled Introduction to *Geometric Probability* in Lezioni Lincee [Lincei Lectures] by Cambridge University Press, Cambridge, 1997. xiv+178 pp.

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An assortment of books by math faculty

Kiwi's Korner

Spring 2003. Where does the time go? The department has been in the new building for a full semester now and slowly the bugs are being ironed out—unstable networks, unpredictable email, leaky ceilings... Despite the financial situation in Massachusetts we are attempting to hire in the area of Biomolecular and Medical Informatics. The University has established this as a Signature Program and four departments are actively involved in developing concentrations in this area—Biology, Chemistry, Computer Science and Mathematics. It is a hot field these days and it is difficult to compete with industry for promising candidates. However, we have invited two strong applicants for interviews.

The Alumni & Awards dinner is scheduled for Friday, April 25. Last year's event went very well—drinks and snacks were available during the more formal part of the proceedings and then we all went to a local restaurant to dine and chat. If you can make the event this year we would all be delighted to see you. On a sad note, two fairly recent alumni, Antti Arjanen and David McDevitt, passed away suddenly this winter. Both had been students in the graduate program. I had Antti as a student in my classes and remember him as a very colorful character who brought a rare sense of wonder to his studies. Dave left shortly before I arrived but I met him during one of the Alumni & Awards dinners. He was a very successful consultant who believed strongly in the role mathematics plays in science and engineering—so much so that he was invited give a talk to our students about his experiences. His talk was by far the best attended student seminar the department has ever offered.

James Graham-Eagle

Thanks to those alumni who have contributed hard-earned dollars to the department over the past few years. This money has been used in a variety of ways—to help with the purchase of equipment and teaching aids, sponsor students at colloquia, support faculty attendance at conferences etc. With the increasing use of Maple in our courses and the introduction of a graduate SAS course we would like to (finally) have a PC lab of our own. If you would like to help make this and other department initiatives possible, please consider making a donation—there are more details about this in this issue.

This is the fourth installment of Tangents and I would like to take this opportunity to thank Dan Klain, Guntram Mueller and Alex Olsen for their help in producing it. Special thanks go to Ken Levasseur who, in addition to being a contributing editor, oversees its layout, printing and distribution.

Kiki

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Department Revises Bachelor's Degree Requirements

mathematics, bioinformatics, business applications, computer science, probability/statistics and teaching. The minimum number of credits in mathematics will be 45. Of these credits, 37 will be from a common list required for all math majors and the remaining credits chosen from one of the listed areas of concentration.

Program details are incomplete but you can see the most recent information at www.uml.edu/dept/math/programs/undergrad/math_requirements.html.

The Problem

You have 55 cards arranged in a circle. On the underside of each card is an arbitrary number, all different from each other and unknown to you. You wish to find a card whose number is larger than the numbers on the two neighboring (adjacent) cards. In other words, you are looking for a local maximum on the circle.

What is the fewest number of cards that need to be turned over in order to guarantee that you find such a card? The choice of which card to turn can depend upon the results of the preceding turns.

Solutions to previous problems

The Fall 2002 problem was: Two circles with radii r and s are externally tangent to one another and are tangent to a line. What is the radius of the circle that lies between the circles and line and is tangent to each of them?

The radius, $\frac{rs}{(\sqrt{r}+\sqrt{s})^2}$, was correctly derived by Andrew Miller ('66 and '72), Tom Walsh ('95), Cory Chapman (husband of Maura (Costello) Chapman ('96 and '97), and Tom Lumenello (LTI '64). They all get a "UML Math Challenge" tee shirt for their efforts.

All solutions essentially used the fact that the dashed side of the right triangle in Fig. 1 has length $2\sqrt{rs}$. Two more triangles created the same way in Fig. 2 generate equations that make it possible to solve for the radius of the inner circle. As a footnote to this problem, you might want to investigate "Ford Circles." They are a family of circles that play a role in proving Hurwitz' Theorem, an important theorem in number theory.

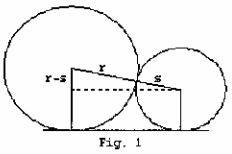

Fig. 1

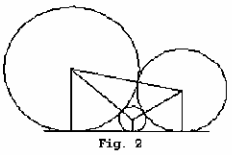

Fig. 2

James Graham-Eagle, Chair

Writers: Ken Levasseur, Raj Prasad, Ann Marie Hurley, Dan Klain, Guntram Mueller, and Alex Olsen

Tangents is produced biannually by the Publications Office for the Department of Mathematical Sciences. Your comments are welcome.

Alumni and Faculty Collaborate in Technology Initiative

UMass Lowell and local teachers at the Butler Middle in Lowell connected on technology with UMass Lowell's "Ready to Teach" program as part of a three-year, $1 million project funded by the U.S. Department of Education. The "Ready to Teach" project team from the Butler School in Lowell was one of several design teams in Chelmsford, Methuen and Lowell that incorporated technology into the classrooms.

Marvin Stick

During the 2001-2002 academic year, **Marvin Stick**, an associate professor in the University's Mathematics Department, worked with **Susan Lamontagne** (M.S. Mathematics for Teachers, Class of 1996) to develop a TI-83 graphing calculator curriculum in Pre-Algebra for her accelerated group of 26 seventh grade students at the Butler School. This was to be Marvin's first visit to a seventh grade class since his experience as a seventh grader **many, many** years ago. He worked with Sue and the school's technology director, Maureen Sweeney, during the academic year at design team meetings focused on integrating the TI-83 into the classroom material. The general approach was to first demonstrate the concept without the calculator and work it out with the students by hand. The usefulness of the calculator would come into play, as computation became more complicated.

Marvin used the TI-83 to problem solve situations that perhaps otherwise would have been analytically too difficult for the seventh graders. At first, a bit nervous at the thought of interacting with seventh graders in the classroom, Marvin quickly gained his composure and led class discussions and instruction with the graphing calculator to:

- Solve systems of linear equations;
- Find roots and the vertex of a quadratic;
- Graph growth and decay functions and solve for various parameters in a compound interest formula.

The culmination of this effort was a showcase for parent's night last May. In addition to those of us directly involved, 15 parents and four school faculty members joined the student showcase. The students presented six mini lessons while their parents used the graphing calculators to reproduce outputs generated by their children. Sue worked tirelessly to organize and prepare the student groups. For each mini lesson, there was a math introduction followed by a graphing calculator treatment of the material. Parents followed students by using a TI-83. A student from each group pointed to a large TI-83 display so that parents could reproduce graphs that students were showing on the TI- generated LCD display. Maureen was ever-present to capture the presentations and parental involvement on video.

The first mini lesson, essentially a warm-up, looked at amounts of money adults might spend on cups of coffee over the course of a month or year at $1.75 per cup. The second lesson examined the break-even point when renting videos for $2.50 each with a $5 membership or renting for $5 per video without a membership fee. The third mini lesson continued with linear functions, but looked at solving an inequality. The problem presented was to find the region of feasible solutions for the number of chaperones given that there are 200 students and there must be at least one chaperone for every six students. (The seventh graders and their parents were concerned with solving inequalities; only we "adult mathematicians" talk about it as a region of feasible solutions.)

The fourth mini lesson dealt with quadratics and was to find the time of impact when dropping an object from a height of 900 feet. The fifth and sixth lessons dealt with exponential growth. In mini lesson five, annual and daily interest problems of the form $2000(1.05)^x$ and $2000(1+.05/365)^{365x}$ were compared over time x. Lesson six posed the problem: Inflation today is 3.5% and the price of an oil change is $24. What will the price of the oil change be five years from now, and how long from today will it take for the price to double?

One of the students prepared a flyer for parents' night. At the bottom of it appeared the following sketch:

It was a fun night!

Thanks For the Contributions!

We thank all who have contributed to the Department of Mathematical Sciences over the past few years. Your generosity has enabled us to make purchases, award scholarships and engage in activities that would otherwise have been impossible due to cuts in the state budget. With this issue we are enclosing an envelope to make it easier for you to make a contribution.

Many of you have responded generously to the UMass Lowell phonathon and other fundraising contacts. These requests can benefit the Department of Mathematical Sciences directly if you specify that you wish to have your gift directed to Mathematics. Otherwise it will provide valuable assistance to the University at the College level.

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Books by UML Math Faculty

Enrique Gonzalez-Velasco has written a textbook, *Fourier Analysis and Boundary Value Problems*, published by Academic Press, Inc., 1996. xii+551 pp.

The next two authors, **Guntram Mueller** and **Ronald Brent**, have teamed up to write a series of five books that are called the *Just in Time...* series published by Addison-Wesley. They include *Just-in-Time Algebra and Trigonometry for Students of Calculus*, (2nd Edition), *Just-in-Time Algebra for Students of Calculus in the Management and Life Sciences* (2nd Edition), *Just Enough Algebra for Students of Statistics*.

Shelley Rasmussen's textbook on statistics, *An Introduction to Statistics With Data Analysis*, was published by Brooks/Cole Series in Statistics. Although it is out of print, there are used copies available through Amazon.com, as are all of the previously mentioned books.

For extended descriptions and reviews of books that are listed here, go to our web page, www.uml.edu/dept/math, and look for the "UML Math Authors" link.

What Are You Up To?

Want to keep your classmates up to date on what you're doing and where you are? Take a few moments to tell us where you are, and whatever else you might like to share. We'll add it to the UML Math Alumni page on the Web: www.uml.edu/dept/math/alumni.htm. In addition, we have a distribution list for math alumni news. To subscribe, send a message to majordomo@ulowell.uml.edu with the text "subscribe uml-math-alumni your_email_address" in the body of the message

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This Year Mod 10 and Mod 100

It is now 10 years since Andrew Wiles of Princeton University proved Fermat's Last Theorem. After a few adjustments and revisions, the proof is now widely accepted as correct. During the mid-17th century, Pierre Fermat asserted, without proof, that the equation $x^n + y^n = z^n$ has no solution in integers x, y, z, provided that n is an integer greater than 2. (There are many solutions for n = 2, however!) Although Euler was able to verify that neither $x^3 + y^3 = z^3$ nor $x^4 + y^4 = z^4$ admit integer solutions (results published in 1770), the general problem remained open until Wiles's 1993 proof.

Christian Doppler

Mathematicians born in '03 include Christian Doppler (1803), for whom the frequency-shifting Doppler effect is named; John von Neumann (1903), who built the first programmable computer; and Andrei Kolmogorov (1903), one of the fathers of modern probability theory.

Tangents
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