College of
Science and Letters
ILLINOIS INSTITUTE OF TECHNOLOGY

# N APPLIED MATHEMATICS DEPARTMENT EWSLETTER

*Solving complex problems with sophisticated mathematical methods*

# New Lecture Series To Honor Karl Menger, Key Figure in Department's History

In Spring 2007, IIT's Applied Mathematics Department will launch the IIT Menger Lecture Series to honor Karl Menger. We also will create IIT Menger Prizes for student research.

Menger, a professor at IIT from 1946–1971, is considered one of the finest mathematicians of the 20th century. He taught all levels of mathematics at IIT and was an adviser to master's and doctoral-degree students including **Howard L. Arnould** (MATH MS 49); **Philip Calabrese** (MATH 63, MS 65, PhD 68); **Marianne Littau** (MATH MS 72); **Michael McKiernan** (MATH PhD 56); **Seymour Parter** (MATH 49, MS 51); **Berthold Schweizer** (MATH MS 54, PhD 56); **Lester Senechal** (MATH 56, MS 58, PhD 63); **Richard Sielaff** (MATH MS 56, PhD 59); **Helen Skala** (MATH PhD 69); **Herbert Ian Whitlock** (MATH MS 63, PhD 67); and others. Hundreds of IIT alumni, faculty and faculty emeriti remember Menger personally. Since his retirement, many people study or work here in part because of his legacy.

The new IIT Menger Lecture Series and Prizes will honor that legacy and Menger's many contributions to the mathematics field. Each year, a distinguished mathematician will visit us for several days, give one or more lectures, and meet faculty, students and alumni. Details of the lecture will be posted on our Web site and emailed to alumni later this fall.

A bequest from Karl Menger's estate will be used to launch the IIT Menger Lecture Series and Prizes. We are also soliciting supplemental funds from mathematics alumni and other friends to endow the lecture series and prizes so they can continue for generations. For more information, please call the department.
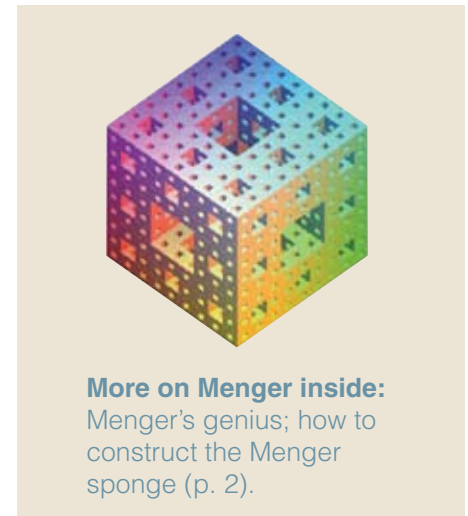
**More on Menger inside:** Menger's genius; how to construct the Menger sponge (p. 2).

## Do you remember Menger?

If you were a student of Karl Menger's at IIT, share your memories. Send them to: **newsletter@math.iit.edu** or call 312.567.3132. We'll compile the best stories and share them in a future issue.

## From the Editor

Greetings! This is our first newsletter in quite some time, so there is a lot to talk about. We chose to focus on a few highlights, but there will be more appearing on our website, http://math.iit.edu.

The department has expanded to include four new faculty members in the past two years and a growing number of undergraduate and graduate students. In addition to teaching, our faculty write books (see page 3), serve on the editorial boards of top mathematics journals (for example, Fred Hickernell is an associate editor for the *SIAM Journal on Numerical Analysis*), hold leadership positions in industry organizations (e.g., Buck McMorris is president-elect of the International Federation of Classification Societies), and frequently speak at international conferences.

We welcome your questions and comments, and we would like to hear about what you have been up to since you were at IIT (see page 4). If you live in the Chicago area or plan to visit Chicago soon, stop by for a colloquium or seminar, or just to say hello.

Michael J. Pelsmajer
Assistant Professor

## Menger's Genius

In March 1921, while a physics student in Vienna, Menger heard Hans Hahn lecture on *Neueres über den Kurvenbegriff* (What's new concerning the concept of a curve) and became interested in mathematics. Hahn had pointed out that there was at that time no satisfactory definition of a curve. Authorities such as Felix Hausdorff and Ludwig Bieberbach had declared this problem to be virtually unsolvable. Within a few days, Menger—with no other mathematical background information about the problem other than what Hahn had said—came up with a solution and presented it to Hahn. Menger's interest in this topic led to his work in curve and dimension theory.

## Construction of the Menger Sponge

Take a cube, divide it into 27 = 3 x 3 x 3 smaller cubes of equal size, and remove the cube in the center along with the six cubes that share faces with it. You are left with the eight small corner cubes and twelve small edge cubes holding them together. Now, imagine repeating this process on each of the remaining 20 cubes. Repeat again. And again...

Read more on Menger at **www.math.iit.edu/Menger/menger.html,** compiled by Professor Greg Fasshauer.

Also see **www.ams.org/notices/199605/comm-menger.pdf** by Seymour Kass, an IIT graduate (MATH PhD 66) and professor of mathematics, University of Massachusetts.

# IIT Teams Excel in Mathematics Competition

IIT teams took first, second and fourth place in the Undergraduate Mathematics Competition at the 85th annual meeting of the Illinois Section of the Mathematical Association of America (ISMAA). Coached by Assistant Professor Michael Pelsmajer, the Math Club brought 15 students to the competition, a highlight of the ISMAA meeting, held in April at North Central College in Naperville.

The first-place team consisted of **Keith Campbell** (second-year ECE major), **Jonathan Beagley** and **Anthony Parrillo** (both third-year Math majors). Tying with another team for second place was the team of **Christos Mitillos** (second-year Math major), **Laura Rodriguez Mosquera** (first-year ECE major) and **Jeffrey Stanford** (third-year CS major). **Elliot Barlow** (second-year MMAE major) and **Xuan Kang** (second-year BME major) formed the team that secured fourth place.

In the ISMAA competitions, students get six questions and can submit solutions for any four of them. Team members can collaborate but, as the contest rules put it, "Electronic computational devices (and slide rule and log tables and abacii) are not allowed." Answers are evaluated for correctness, clarity of expression and elegance.

"The Math Club draws students who are passionate about mathematics and like testing their skills in competition," said Pelsmajer. "It's a mark of the department's strength that so many students from IIT placed in this competition. We're ready to see what we can do this year."

The Mathematics Association of America has 29 regional sections and is the largest professional society that focuses on undergraduate mathematics education. The two-day Illinois regional meeting also featured talks and presentations by both

### "The Math Club draws students who are passionate about mathematics and like testing their skills in competition."

faculty and students on mathematics research areas, such as graph theory, statistics and knot theory, as well as teaching methods. Upcoming Math Club competitions include the Virginia Tech Regional Mathematics Contest in October and the Putnam—the most famous national math competition for undergraduates—in December.

Math Club members Charles Medrano, Chi Hang Tam, Jonathan Beagley, Keith Campbell, Vinit Prabhu, Mike Langman, James Pierce

## Mathematics Alumni News

**Edward Erickson** (MATH 68, MS 70) continues as Chairman of the Board of Immunicon Corporation, a public biomedical products company, after serving as CEO from 1999-2005. He built three life science companies for successful IPOs.

**Lloyd Gavin** (MATH PhD 73) is Professor Emeritus of Mathematics, California State University at Sacramento.

**John M. Kerulis** (MATH BS 70) is a systems programmer at CSC in Dallas, TX.

**Joel D. Krauss** (MATH 71), a partner with Market Strategy Group, was recently named to the Board of Overseers of the College of Science and Letters at IIT.

**Jacob Matijevic** (MATH BS 69), rover engineering team chief at NASA's Jet Propulsion Laboratory, Pasadena, CA, was quoted in media stories around the country this spring about the Mars rover Spirit.

**Richard J. Mihalek** (MATH BS 51, MS 53, PhD 58) is Associate Professor Emeritus, University of Wisconsin-Milwaukee. His areas of expertise are geometry and number theory.

# STUDENT FOCUS: Angeliki Ermogenous, Fourth-Year Undergraduate

My interest in financial mathematics began after I took my first advanced economics class in capital investments.

Learning to apply quantitative techniques to fundamental economic concepts, I became intrigued with the usefulness of mathematics in pricing assets and deciding between different investment projects. Of all the other applications of mathematics that I had studied, none attracted me as much as their applicability to the financial world.

As part of expanding my knowledge in financial mathematics, I began research with Professor Jianqiao (Jeffrey) Duan on stochastic calculus last summer. I was fascinated to see that everything I had learned for the last three years in college was only a subset of stochastic calculus. As my background knowledge was very limited, I had to read a number of graduate-level books to become comfortable with the new concepts. Once Professor Duan saw that I knew enough about stochastic processes, he asked me to write a research paper on Brownian motion. In order to do that, I had to research a lot and explore in depth this fascinating phenomenon.

While reading about Brownian motion, I decided to take my paper a step further and to relate this physical phenomenon to the pricing of stocks and options, and more specifically the famous Black & Scholes pricing model.

I completed a paper entitled "Brownian Motion and Its Applications in the Stock Market," which I presented at the University of Dayton's Undergraduate Mathematics Day in November. I also submitted my paper for publication review, and it was published this spring in the *Electronic Proceedings of Undergraduate Mathematics Day,* University of Dayton, Volume 2 (see http://academic.udayton.edu/EPUMD/).

## New Publication

***Associative Functions: Triangular Norms and Copulas,*** by Applied Mathematics Professor Maurice (Jerry) Frank, Claudi Alsina (Universitat Politècnica de Catalunya, Barcelona, Spain) and Berthold Schweizer (University of Massachusetts, Amherst), World Scientific, 2006.

This book presents the foundations of a subject that in recent years has provided increasingly important mathematical tools for several areas of study: statistical and financial modeling, fuzzy sets and systems theory, risk assessment, multi-valued and quantum logic, hydrology, and the theory of functional equations. It brings together and extends results from the widely scattered literature and adds a great deal of new material.

A substantial portion of the book is based on notions that originated in our department in the late 1950s and whose development has continued here at IIT ever since. Triangular norms arose naturally from Karl Menger's ideas about probabilistic geometry. Copulas (linking probability distributions) are part of the work of Abe Sklar, Professor Emeritus in our department.

The book is appropriate for mathematicians, statisticians, economists, financial analysts, and other scientists; advanced undergraduate and graduate students interested in functional equations, copulas and their applications.

## Excellence Awards

Dean Buck McMorris recently inaugurated the "Dean's Excellence Awards" to honor outstanding work in the College of Science and Letters. Two members of the Applied Mathematics Department were among the first to receive honors. **Professor Jianqiao (Jeffrey) Duan** won an award for excellence in research. He focuses on random dynamics and stochastic partial differential equations; nonlinear dynamics and partial differential equations; and modeling, analysis, simulation and prediction (MASP) of random and multi-scale phenomena (fluids, geophysical flows, environmental flows, etc). **Gladys Collins,** Administrative Associate, received the Dean's Excellence Award for Staff. In addition, **George Skontos** won IIT's Outstanding Student Employee of the Year.
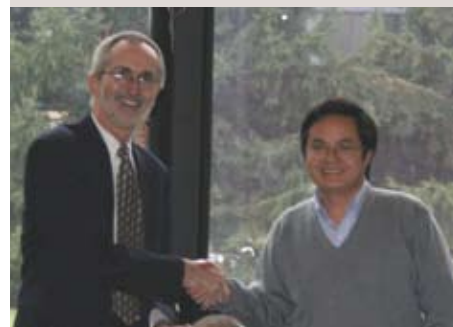
## NAME IT & WIN!

Name our newsletter and win a copy of Jerry Frank's book!

Send your suggestions to **newsletter@math.iit.edu**

# New Faculty

The discrete applied mathematics group (www.math.iit.edu/about/research.html) received a big boost last year, when Robert Ellis joined the department as a new assistant professor.

**Name:** Robert B. Ellis

**Education:** PhD in Mathematics from the University of California, San Diego

**Professional Experience:** National Science Foundation (NSF) Vertical Integration of Research and Education (VIGRE)  Postdoctoral Fellow, Texas A&M University; Mathematical Association of America (MAA) Project NExT (New Experiences in Teaching) Fellow 2005-2006.

**Research interests:** Probabilistic methods, graph theory and combinatorics, with applications to ad hoc wireless networks and coding theory.



■ Snejana Abarji from Stanford University's Center for Turbulence Research also joined the department as a new associate professor. She received her PhD from the Landau Institute.

■ Beginning in Fall 2006, the Applied Mathematics Department will have two new faculty: **Hemanshu Kaul,** PhD from the University of Illinois at Champaign-Urbana, who will be an assistant professor, and **Jesus Miranda,** PhD from IIT, who will be a senior lecturer.

## Contact Us

Please send news of your professional or other achievements to:

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## Professor Ed Steuben Retires

Professor Ed Steuben, who won the Bauer Family Award for Excellence in Undergraduate Teaching last year, retired at the end of the 2006 school year after 43 years of dedicated service to the university. He served in many positions at IIT, including vice president for Student Affairs and interim chair of the Department of Applied Mathematics. IIT President Lew Collens called him "an exceptional and dedicated colleague." *You may contact Professor Steuben at steuben@iit.edu.*

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