The Quaternion

Volume 21: Number 1; Fall, 2006

The Newsletter of the Department of Mathematics and Statistics

USF UNIVERSITY OF SOUTH FLORIDA

An Old Answer to an Old Problem

Students have always had difficulties with mathematics: when King Ptolemy asked Euclid if there was an easier way to learn the subject, Euclid said, "There is no royal road to geometry." The problem has economic consequences. The United States leads the world in STEM (science, technology, engineering, mathematics), but our lead is shrinking: our share of high-tech development and of Nobel prizes is falling. Meanwhile, American students avoid STEM in favor of less mathematically demanding areas, while those who do go into STEM have difficulties with mathematics: failure rates for first semester calculus nationwide tends to be fifty percent or higher – and the USF rate is about fifty percent.

This has inspired a number of reform proposals and experiments, and one experiment is being conducted here at USF under the auspices of the *Mathematics Umbrella Group* (MUG), under the direction of **Dr. Arcadii Grinshpan**. The experiment is motivated by changing the emphasis *from* the formal study of definitions & theorems & proofs *to* using algorithms in a realistic setting. Specifically, in some Engineering and Life Science Calculus courses, students may do a major project in lieu of a cumulative final. The project is selected from a list of proposals from the local community submitted by businesses, private organizations, and university faculty, and it is often a problem whose solution would serve a very practical end.

For example, one proposal from the Roskamp Institute (now in Sarasota) was a study of the feasibility of purchasing a breeding pair of laboratory mice. "Real-world" problems differ

see Old Answer *on Page 2*

Transition: In Memoriam

Professor A. N. V. "Vijay" Rao passed away on June 26 after an illness.

He was born in Kurnool, in the province of Andhra Pradesh in south central India, in 1936. He studied electrical engineering in Madras, graduating from Gindi University in 1957; he then spent about ten years working as an engineer and teaching engineering. During that time he married his wife Sarala and they had their first son, Krishna.

The young family then moved to Rhode Island, where he ultimately got his mathematics Ph.D. in 1971. After a year in Virginia Polytech, he came to USF in 1972, and ultimately became a full professor in 1980, when their second son Sanjiv was four years old. He was interested in statistics and probability, concentrating on stochastic equations and inequalities, differential games, integral and differential equations, reliability theory, statistical modeling, and stochastic control theory. He was a critical member of the USF statistical group and of the mathematics department as a whole.

Professor Rao was very active in the community. He founded a school, Gurukulam, was founding president of the Hindu Temple of Florida, and first president of the Telugu Association of Florida, the latter of which honored him with a Life Time Achievement Award last year. (Professor Rao read and wrote poetry composed in the Telugu language of Andhra Pradesh.) On campus, he organized the Urban Scholars Outreach Program, which provided free tutoring to disadvantaged children, and for which he was awarded the Time Warner Humanitarian Award. The faculty advisor for

see Rao *on Page 2*

The Quaternion is an annual publication of the USF Department of Mathematics and Statistics, which can be visited on the web at <http://www.math.usf.edu/>. Our e-mail address is <mathdept@math.usf.edu>, our snail-mail address is Department of Mathematics and Statistics, University of South Florida, 4202 E. Fowler Ave., PHY114, Tampa, FL 33620. Our phone number is (813) 974-2643, and our fax number is (813) 974-2700.

Old Answer, *from Page 1*

from textbook problems in that a substantial effort goes into determining what the problem *is*, and then reformulating the problem mathematically. Here, the problem was how many mice the lab should expect to have over time, and from that compute the total cost of housing the mice during that time. (This may sound to pet owners like a trivial expense, but as one of the students observed about these genetically engineered creatures: "if you think your car is expensive, try taking care of lots of little mice!") The core of the mathematics was a recurrence formula that modeled the population growth over time.

It may seem odd in this era of "accountability" to dispense with tests in favor of projects, but this is not a new idea. In many medieval guilds, a craftsman would be promoted from *journeyman* to *master* based on a *masterpiece* ("meesterstuk") the craftsman created. European universities and the Chinese civil service introduced standardized exams for economic reasons: they required less expertise to grade. The debate between the two traditions has raged for a millennium: exams minimize variation of evaluation and thus allow for greater (mid-range) quality control, while masterpieces stress practical (as opposed to formal) knowledge and skills exam-driven courses ignore. In academia today, large lower-division courses rely on exams, while the meesterstuk tradition can still be seen in the term papers, honors and masters' theses, and doctoral dissertations of the upper division and graduate programs.

So far, the passing rate for participants in the MUG program is about three fourths, a substantial improvement over the regular course. While the program is voluntary, it is seven years old, so we hope for continuing success. Anyone interested in the Mathematics Umbrella Group is invited to contact Dr. Arcadii Grinshpan at the Department of Mathematics and Statistics, or visit the MUG at <http://www.math.usf.edu/mug/>.

Rao, *from Page 1*

the Students of India Association, he was awarded the Outstanding Faculty Advisor Award in 1990. He was also awarded the INDO-US chamber of commerce award.

He was very generous with his time and energy to his students, and was committed to being the "ideal guru." At the funeral service on June 30, there were many stories of his patience with students, his willingness to spend great amounts of time with them, and his kind and even temper. He was a valuable member of the department, of the university, and of the community, and will be sorely missed.

R. Kent Nagle Lecture

The Department of Mathematics and Statistics sponsors a lecture series dedicated to the memory of our colleague, R. Kent Nagle, who was very concerned about mathematics, mathematics education, and mathematics in the community. We invite leading mathematical people to come to USF and speak about issues of the day.

Louis H. Kauffman, Professor of Mathematics at the University of Illinois at Chicago, came to USF last February to speak about *Unknots, Collapsing tangles and DNA Recombination*. The talk began with a series of accessible examples of knots in art, magic, and DNA, including demonstrations with a piece of rope, and some computer animations. Professor Kauffman then talked about the mathematics of knots, of diagrams of knots, and of the difficulty in telling whether two diagrams of knots represent the "same" knot. In particular, what may appear to be an immense tangle could actually be an "unknot", i.e., something that could just be pulled straight.

While knots in art and magic can be compelling, the motivation for this work comes from DNA, which often forms knot-like linked strands, contrary to the expectation that they should separate during cell division. There are biological mechanisms (e.g., enzymes) that deal with such complications, and a mathematical model of knots is an important step towards understanding these phenomena.

Professor Kauffman is a leading mathematician in knot theory, having introduced many important concepts and techniques, several of which bear his name. He has launched a leading journal and authored many books and papers on knot theory and its connections beyond mathematics.

For more information on the series, consult the Nagle Lecture Series webpage at <http://www.math.usf.edu/Nagle/index.html>.

Student News

Six math students received their Ph.D.s last year.

Gokarna R. Aryal, (under C.P. Tsokos), Dissertation title: *Study of Laplace and Related Probability Distributions and Their Applications*.

Louis R. Camara, (under C.P. Tsokos), Dissertation title: *Statistical Modeling and Assessment of Software Reliability*.

Jemal E. Gishe, (under M.E.H. Ismail), Dissertation title: *Finite Family of Orthogonal Polynomials and Resultants of Chebyshev Polynomials*.

Abdelelah M. Mostafa, (under K. Ramachandran), Dissertation title: *Regression Approach to Software Reliability Models*.

Joseph N. Quarcoo, (under A. Kartsatos), Dissertation title: *Contributions to the Degree Theory for Perturbations of Maximal Monotone Operators*.

Lakshminarayan Rajaram, (under C.P. Tsokos), Dissertation title: *Statistical Models for Environmental and Life Sciences*.

Thirteen students received M.A.s: Anand R. Bhat, Vamsi K. Chikkam, Richard J. Decker, Sandra D. Draper (under X.-D. Hou, thesis title: *Evaluation of Certain Exponential Sums of Quadratic Functions over a Finite Field of Odd Characteristic*), Christina L. Hamlet, Niluk John, Zahra Kottabi, Thucdoan T. Nguyen, Andrew Purcell (under T. Bieske, thesis title: *Analysis of Quasiconformal Maps in* **R**), Ziwen Wei, Sue-Yen E. Wong, Ling Wu, Chunchun Zhao.

And 21 received baccalaureate degrees.

Graduating in summer, 2005: Glen Gonzalez, Karen Huria, and Alden Weddleton.

Graduating in fall, 2005: Travis Bronson, Shannon Evans, Christine Fitch (Magna Cum Laude), Nicole Hooper, Pauline Maiello, Ola Malas, Edward Navarro, Darshit Patel (Magna Cum Laude).

Graduating in spring, 2006: Amber Age (Cum Laude), Seth Ascher (Summa Cum Laude), Gary Bachner, Tyanne Campbell (Magna Cum Laude), Serde Marcelin, Ryan McLaughlin, Marek Merlak, Jaclyn Shepard (Summa Cum Laude), Caleb Sparkman, Nicole Trapp.

And the vast majority of students passing through our classrooms major in other subjects, and take mathematics courses to construct the toolkit they will need later in life. We wish all of them well in their future adventures.

Center for Mathematical Services

Thirty-eight gifted and high-ability 8th – 12th grade students participated in the summer program of the Center for Mathematical Services this summer. Students listened to lectures by Carol Williams and Mile Krajcevski and took courses in mathematics, computer science, and biomedical sciences and worked on projects with Arun Mukherjea and Brian Curtin. Two students were supported by a grant from the Academy of Applied Sciences, won by CME Director Jogi Ratti.

Mathematics Clubs

The USF Student Chapter of the MAA and Pi Mu Epsilon (the Math Honor Society) are sponsored jointly by Fernando Burgos and Mile Krajcevski.

The clubs met every other Friday and featured speakers who addressed topics from "The Mathematics of Viruses" to "Using Statistics to Model Software Failures" and "Applying Operations Research to Efficient Organ Transplantation and Allocation". Six presentations were made by USF students, five of them undergraduates.

Student members of the clubs traveled to the MAA/PME MathFest in August, the Suncoast Regional Meeting of the MAA in December, the AMS/MAA Joint Meetings in January, and the Math Awareness Conference organized by St. Petersburg College in March. A grant from USF Student Activities as well as math faculty donations helped defray the students' costs.

Matt Williamson, a math major and last year's PME president, delivered the student presentation "Twist Number of Links from the Jones Polynomial" at the AMS/MAA meetings, based on his REU research.

The math clubs continued the "The Math Problem of the Month" contest, which is open to all USF undergraduate students. Each month, a problem is posted and students have the month to submit their solutions; the winner receives a math book. This year's prizes were purchased with a grant from the USF Council of Honor Societies. At year's end the "Outstanding Problem Solver" was Vien Van Truong.

The Florida Epsilon Chapter of PME inducted 18 new members on April 28, almost all undergraduate math students. The 40th annual PME Induction Banquet was attended by inductees, their families, and math department faculty. The speaker was Robert C. Eslinger, Professor Emeritus from Hendrix College and past national president of PME, who spoke on "Rolling Cones."

The 2006 PME Outstanding Scholar was Darshit J. "DJ" Patel, a double major in math and computer science. DJ now works at Raymond James Financial Services.

In February, 2006, two teams of undergraduate mathematics and engineering students participated in the Mathematical Contest in Modeling sponsored by the Consortium for Mathematics and its Applications. Professor Brian Curtin coached the team of Clayton Beardsley, Brent King and Brian Vohaska, while Professor Nan Kong of the Department of Industrial Engineering coached the team consisting of Egor Dolzhenko, Scott McDermott and Gabriel Zayas Cabán.

All 23 county high schools participated in the two PME and Math & Stat Department-sponsored Hillsborough County Math Bowls. Each school sent four teams, bringing more than 350 very bright math students to our campus. The overall fall winner was Plant High, with Middleton winning in spring.

USF UNIVERSITY OF SOUTH FLORIDA
Department of Mathematics & Statistics
4202 E. Fowler Ave., PHY114
Tampa, FL 33620

Non Profit Org.
U.S. POSTAGE
PAID
Tampa, Florida
Permit No. 257

The Quaternion

The Newsletter of the USF Department of Mathematics & Statistics

In this issue:

News of the Mathematics Department
An Old Answer to an Old Problem

++

We'd Like to Hear from YOU!

The Department of Mathematics & Statistics would like to hear from alumni, friends, collaborators, members of the community, and fellow explorers of and guides to the world of mathematics. Contact us at: 974-2643, or fax 974-2700. E-mail <mathdept@math.usf.edu>. We have a web-page at <http://www.math.usf.edu/>. Snail-mail address is Department of Mathematics & Statistics, University of South Florida, 4202 E. Fowler Ave., PHY114, Tampa, FL 33620.

New Faculty

We are pleased to announce the arrival of three new faculty this year, Catherine Beneteau, Dmitri Khavinson, and Brendan Nagle.

Appeal for funds

We are a new department in a new university, and developing new programs to meet the needs and provide opportunities for our students and our community to fulfill their aspirations. With all due respect to Benjamin Franklin, many of the best things in education and scholarship cost money. We would appreciate any assistance we can get from alumni and the community. Feel free to contact our chair, Marcus McWaters, at the above address for details.