Duke University Math News

May 8, 2006

Another school year, another class of excellent math majors.The 40 math majors graduating this spring scatter towards a variety of career paths including actuarial work, graduate school in mathematics, physics and computer science, high school teaching, and financial analysis and consulting.

DUMU secretary Keigo Kawaji and others in the math club have arranged many events this year from the very successful Duke Math Meet to ice cream socials and a screening of the movie PROOF to a decisive win over a team of Physics majors on the basketball court.The seniors and other math majors were recognized for their accomplishments at the annual math party on April 20.

In this issue, you can read about the strong finish by the Putnam team and the extraordinary feats of the 21 students who competed in the Mathematical Contest in Modeling.Five majors are graduating with distinction in mathematics.Others are just starting or continuing their senior thesis projects.Those who participated in the major competitions were given the 2005-06 version of the Duke Math shirt.These shirts are available for purchase for $7 in the math department office.

For those of you returning, best wishes for an interesting and productive summer. For those moving on, please send us updates and information that we can share in a future Duke Math News.

Events

Graduate Luncheon

At noon, immediately after Graduation Exercises on Sunday May 14, senior math majors and their families will meet in the LSRC dining room. In a short ceremony after lunch, those whose first major is mathematics will receive their diplomas.

Hartemink Talk

Alex Hartemink, assistant professor of computer science at Duke, gave the inaugural lecture in the Duke Math Alumni Series to a large group of undergraduate students and faculty. In his lecture, "Of yeast, birds, mice, and men: Bayesian machine learning and systems biology", Hartemink discussed the various interactions of neurons and genes and demonstrated how his software package Banjo is able to discover interrelationships. Among the applications of his research is a better understanding of how birds learn songs.

Hartemink graduated from Duke in 1994 with a triple major in Mathematics, Physics and Economics. After a year in Oxford as a Rhodes Scholar, Hartemink entered the computer science graduate program at MIT. His work there on DNA computers led to an interest in genomics and statistics. After his lecture, several members from DUMU continued the discussion over a meal at Parazade Restaurant.

Gergen Lectures

Two series of Gergen lectures were presented this spring.

Gang Tian of Princeton University lectured on Geometry and Analysis of low-dimensional manifolds.He discussed recent works on the Ricci flow and its application to the geometrization of 3-manifolds, and its relation to Perelman's work towards the Poincare conjecture.

Leslie Greengard of the Courant Institute lectured on Fast Multipole Methods. Such methods are applicable to the study of electromagnetics, elasticity, and fluid mechanics among other fields.

John Gergen served as chair of the mathematics department from 1937 to 1966. Friends and relatives contributed to the Gergen lecture series fund.

Undergraduate News

Duke Math Meet

Each fall for the past decade, DUMU has hosted the ARML style Duke Math Meet for High school students from throughout the southeast.The meet has become quite popular, attracting over 180 stu-

dents last November. A team from Thomas Jefferson High School in Virginia won the event.

For the past three years, Paul Wrayno '06 has been the Math Meet Coordinator, contacting high school teachers and assisting the many teams that visit here.In these three years, nearly 500 students have attended these meets. In recognition of his service, Wrayno has been given a Duke math shirt with number 496, the third perfect number. Tyler Huffman '09 has agreed to be Meet coordinator next year. We wish him great success.

Another Third in the Putnam

For the sixth time in seven years, the Duke Putnam team ranked third among the nearly 400 teams competing. Last December, over 3500 of the most talented of the math undergraduates in the United States and Canada worked for six hours on twelve exceedingly challenging math problems. Out of a possible 120 points, nearly half of the participants received a score of 0. Each member of the Duke team of Nikifor Bliznashki '07, Lingren Zhang '08, and Jason Ferguson '09 correctly solved at least four of the problems. Zhang ranked among the top 20 while Bliznashki and Kshipra Bhawalkar '08 were named Honorable mention (top 2%). The other Duke scorers among the top 200 participants were Aaron Pollack '09, Tirasan Khandhawit '08 and Brandon Levin '07.Morgan Brown, Greg Filpus and Paul Wrayno placed among the top 500.

Menger Prize

For her Honorable Mention ranking in the Putnam competition, Kshipra Bhawalkar joins Putnam team members and Nikifor Bliznashki and Lingren Zhang as winners of the Menger prize for excellence in mathematical competitions. Karl Menger made significant contributions to mathematics, economics and philosophy. He was an active member of the Vienna Circle, a group of philosophers, mathematicians and social scientists including Carnap, Godel, and Reidemeister before immigrating to the United States in 1936.Each of the Menger winners received a check of $250 from a fund donated to Duke University by Menger's daughter.

Mathematics Contest in Modelling

For 96 hours, from February 2 to 6, seven teams of three Duke undergraduates each competed in the annual Mathematical Contest in Modeling (MCM) and the Interdisciplinary Contest in Modeling (ICM). Of the over 900 teams from around the world that competed this year, 15 submitted papers that were deemed Outstanding.Of these 15 teams, three consisted of Duke students.At the annual math department party, the nine Duke students on these Outstanding teams each received a 2005-2006 Duke Math shirt with their name and number printed on the back.

Sponsored by the Consortium for Mathematics and its Applications (COMAP), these contests require teams of three students from colleges, universities, and high schools around the world to tackle a real-world problem by constructing and analyzing a mathematical model.Students are allowed to use books, the internet and any other non-animate source during these four days.After developing their mathematical solution, they must write a paper explaining it.These papers tend to range from 30 to 60 pages. A panel of judges rates each paper as either Outstanding, Meritorious, Honorable Mention, or Successful Participant.

This year's ICM problem requires students to model economic and policy issues associated with the AIDS epidemic.Four of the 224 entries in the ICM were awarded an Outstanding rating. The Duke teams of sophomores Arnav Mehta, Qianwei Li, and Aaron Wise; and of freshmen Tyler Huffman, Barry Wright III, and sophomore Charles Staats III captured two of these four esteemed designations.The team of Mehta, Li, and Wise was also selected by the Institute for Operations Research and the Management Sciences (INFORMS) for a special plaque and a $300 cash prize for each team member. This is the first year that a team from Duke has earned an Outstanding rating in the ICM.Next year's ICM problem will continue in the theme of public health.

Duke's third ICM team, Ian Appel, James Dias, and Vyacheslav Kungurtsev, earned a Meritorious rating, placing them in the top 21% of papers.

The two MCM problems this year were about designing an irrigation schedule and portable sprinkler system, and planning wheelchair availability at air-

ports.The team of Nikifor Bliznashki '07, Matthew Fischer '06, and Brandon Levin '07 earned an Outstanding rating for their solution to the sprinkler problem.Of 748 teams that attempted one of these two problems, only 11 were selected as Outstanding winners.INFORMS also picked this Duke team for a special plaque and cash prize.

Three other teams represented Duke in the MCM: Russell Posner '08, Keigo Kawaji '07, and Tirasan Khandhawit '07 also constructed a solution to the sprinkler problem.The teams of sophomores Michael Bauer, Matthew Edwards, and Lingren Zhang, and of Abhijit Mehta '06, James Zou '07, and Yvonne Yamanaka '08 both worked on the wheelchair problem.All three of these teams earned Meritorious ratings, placing them in the top 16% of teams worldwide.

Team members come from a wide range of disciplines and majors, including mathematics, engineering, economics, and computer science.

The MCM faculty advisor Dr. W. Garrett Mitchener expressed great satisfaction with the breadth and the depth of the student interest. Since 1998, nine teams from Duke achieved this Outstanding status. As an undergraduate at Duke, Mitchener was on the first two of these. Before Mitchener returned here as a postdoctoral fellow, Duke rarely fielded more than two teams in a given year and never had more than one Outstanding team in any single year. The seven teams this year broke last year's record of five teams. At the math party, Mitchener was honored with a Duke Math shirt with Coach G' printed on the back.

For more information see `www.math.duke.edu-news-awards-competitions.html#modeling`

Goldwater Scholar

Brandon Levin '07 was one of four Duke students to be named B.M.Goldwater Scholars last month.This award of $7500 for excellence in engineering, science and mathematics is given to about 300 undergraduates in the US.Since this program began in 1986, 62 students from Duke including 26 math majors have been so honored.

Levin plans to pursue a career in research in pure mathematics.Last summer as a PRUV Fellow, he worked under the mentorship of Professor Les Saper on questions in number theory.Levin has excelled at the Putnam and MCM competitions at Duke.He has been a counselor and lecturer at the high school math program PROMYS in Boston and helped in local ESL programs.He currently serves as DUMU president

Graduation with Distinction

The following math majors will be graduating with distinction after completing mentored research projects as PRUV Fellows.

- Yee Lok Wong *Models of Instant Runoff Voting* [with J. Mattingly] Wong will be attending graduate school in applied math at MIT.
- Qinzheng Tian *Simulation of Newtonian fluid flow between rotating cylinders* [with T. Witelski] Tian has accepted a position at UBS.
- Adam Chandler and Pradeep Baliga *A dynamic cellular automata model of toll plaza traffic flow* [with G. Mitchener] Chandler will attend Oxford University and Baliga will work at Jane Street Capital, a trading company in New York.
- Matthew Fischer *Stabilizing a subcritical bifurcation in a mapping model of cardiac-membrane dynamics* [with D. Schaeffer] Fischer will work as an actuary at Cigna Healthcare and eventually expects to attend medical school.

The following rising seniors completed their PRUV research and expect to graduate with distinction next spring. Nikifor Bliznashki, Slava Kungurtsev, Brandon Levin, Ibraheem Mohammed, and James Zou.

Math majors who will be involved in intensive mentored research this summer include Michael Bauer, Tirasan Khandhawit, Stepan Paul, Charles Staats and Lingren Zhang.The following math majors will be working on a project involving mathematics, computer science and genomics: Kshipra Bhawalkar, Morgan Brown, Tyler Huffman, Russ Posner

Julia Dale Prize

The Julia Dale Prize for Excellence in Mathematics has been split this year between seniors Adam Chandler and Yee Lok Wong.

Chandler, a math and chemistry major, a B.M.Goldwater and a Rhodes Scholar, has competed research projects in statistics, biology and linguistics while at Duke. His senior thesis, an extension of his Outstanding MCM project with Pradeep Baliga and Matt Mian, involves an extensive mathematical model for efficient design of toll booths.Chandler will enter the math program at Oxford University next year.

Yee Lok Wong, a math and ECE major, has excelled in course work, earning an A+ in about two thirds of his courses at Duke.In his senior thesis, Wong develops sophisticated models for fair voting in runoff elections.Wong will pursue a doctorate in applied math at MIT.

Graduate Program News

Graduating Ph.D Students

David Anderson will accept a postdoctoral position at the University of Wisconsin or work as a mathematical biologist at the Stedman Nutrition center.His thesis *Stochastic Perturbations of Biochemical Reaction Systems* was written under the direction of Michael Reed and Jonathan Mattingly

Ryan Deering's thesis *Fine-scale Analysis of Speech using Empircal Mode Decomposition: Insight and Applications* was written under the direction of James Kaiser.

Thomas Laurent will taking a year off before applying for a post doctoral research position in Europe. His thesis *New Phenomena in Non-Local partial Differential Equations* was written under the direction of Michael Reed.

Faculty News

NSF Grant for training HS teachers

The National Science Foundation awarded a grant of $448,000 to the Master of Arts in Teaching program at Duke.The three year grant will provide stipends and tuition expenses to 11 students annually in return for a two-year commitment to teach in a high-need school system.The program will be administered by principal investigators Richard Hodel, associate professor of mathematics, and Susan Alberts, associate professor of biology and by Ro Thorne, director of the MAT program.

Arlie Petters Honored

Early this spring the National Academy of Sciences honored mathematics and physics professor Arlie Petters by inducting him into the Portrait Gallery of Distinguished African-Americans in Science, Engineering, and Medicine.Petters was honored for his pioneering work in gravitational lensing, a phenomenum in Einstein's general relativity that probes the nature of spacetime around black holes.His portrait will be on permanent display at the National Academy's Keck Center in Washington, DC.

A generalization of Lagrange's 4-squares theorem

An article in Science News describes what author Ivars Peterson calls "A surprising far-reaching overhaul for theories about quadratic expressions." Assistant professor Jonathan Hanke and Princeton University professor Manjul Bhargava solved a problem dating from the 18th century about representing integers by quadratic forms.The great Indian mathematician Srinivasa Ramanajun had obtained partial results on this problem in 1916.In 1993, Princeton professor John Horton Conway and former Duke undergraduate Will Schneeberger '92 made a major advance in the field with their so-called the "15 Theorem." Hanke and Bhargava solved the related "290 conjecture" of Conway and Schneeberger that that states one need only check a condition on 29 numbers less than 290 in order for a positive definite form to represent all positive integers.For more details, see `www.sciencenews/org/articles/20060311/bob9/.asp`.

Math Degree Candidates, Academic Year 2005-2006

First Majors

Ahmed Abdelrasoul
Kyle Enzle Burkhalter
Adam Daniel Chandler
Katherine Marie Dawson
Grant Alexander Degler
Nicole Dudek
Matthew Adam Fischer
Desmin J James
Andrea Sami Kanderian
Joseph Yongsuk Kwon
Peter Remmer Merkx
Yousef Mohammed Mian
Jameson Kyle Pickett
Stephen Lawrence Relyea
Qinzheng Tian
Matthew Paul Varca
Paul M Wrayno
Caroline Chuanhsing Yang
Guangbin Zou

Second Majors

Pradeep Rabeendra Baliga
John Paul Barton
Peter Quartermaine Blair
Jenni Atkins Boyd
Mark James Donahue
Aaron Douglas Hedlund
Paula Georgiana Ivy
Kevin Pounds King
Barry Matthew Lichman
Andrew Justin McFarland
Abhijit C Mehta
Matthew Kamal Mian
Benjamin Andrew Mickle
Jadrian J Miles
Daniel Edward Patrick Morris
Jacqueline Ou
Wilko Ziggy Schulz-Mahlendorf
Jason Benjamin Shapiro
Charles Parker Liu Treacy
Huanjie Wang
Yee Lok Wong

Third Major

Ryan J Werstuik

Minors

Ashley Johnson Burns
Steven Jeffrey Campbell
Edward William Chu
Joyce Elizabeth Coppock
Thomas Joseph Corona
Andrew Benjamin Gerst
Jason Andrew James
Ingrid Kaldre
Raymond Thomas Kozikowski
David James Larado
Lynh Yen Le
James Frederick Marschner
Daniel Warner Narvey
Kathryn Diane Ness
Ethan Moran Puchaty
Naim Ur Rashid
Aditi Reddy
Rahul Satija
Zachary Ryan Scheel
Paul Ralph Sellers
Bryce Eric Senz
Anne Elizabeth Timmins
Dominick Totino
Steven R Vickers
Seth Howard Weinberg
Joel Harrison Wiles

Master of Arts

Shu Dai
Hyeongkwan Kim
Mau-kwong George Lam
Alberto Mokak Teguia
Andrea Cherese Watkins
Jason Robert Wilson

Ph.D

David Frederick Anderson
Timothy Ryan Deering
Thomas Boris Laurent

Duke Math News

The *Duke Math News* is published several times a year and is distributed to those in the Duke mathematics community by campus mail. For previous editions and other news, see `www.math.duke.edu/news/`. We welcome items of interest for our next issue. Send them to `jones@math.duke.edu` or `dkrain@math.duke.edu`

To read about other news, honors and events concerning mathematics at Duke, visit `www.math.duke.edu/news/`. The on-line calendar at `www.math.duke.edu/mcal` lists both regular and special seminars and colloquia for the upcoming weeks. The department maintains video archives of talks, lecture series and special conferences at Duke, many of which are available, on-line. See `www.math.duke.edu/computing/broadcast.html` for more information.

—*David Kraines, DMN Faculty Sponsor*

Faculty Sponsor
David Kraines ..... `dkrain@math.duke.edu`
Production Manager
Sunny Oakley ..... `jones@math.duke.edu`

Department of Mathematics
Box 90320
Durham, NC 27708-0320
`http://www.math.duke.edu/math_news/`