



Department of Mathematical Sciences Newsletter

- Fall 2006 -

Financial Mathematics Program

By Youngna Choi



The Department of Mathematical Sciences is proud to report a new degree option, BS in Mathematics – Mathematics of Finance Concentration. This is an addition to the existing three mathematics major programs, BS in Mathematics, BS in Mathematics – Applied Mathematics concentration with two tracks (Track 1: Discrete Applied Mathematics and Operations Research, Track 2: Statistics), and BS Mathematics – Mathematics Education.

During the past couple of decades, the growth of business corporations has produced complex modern financial instruments; and as a result, the need for new mathematical methods and models in financial economics to study and analyze these instruments has been increasing. The BS in Mathematics has two primary goals: first to provide New Jersey students with an opportunity to learn the mathematics applicable to the financial industry and actuarial science. Second, to provide Tri-State area employers with well-trained and highly educated students with the mathematical training and knowledge to be immediately productive in the financial industry or as actuaries.

The program consists of required mathematics courses (23 credits), specialization courses that include MATH 466/467 Mathematics of Finance I/II (12 Credits), collateral requirements in computer science and business (18 credits), free elective courses (9 credits) and general education courses. Students will be educated for entry level positions in almost all areas of the financial

industry. This program will also serve students interested in actuarial science. The mathematics courses required for the Mathematics of Finance concentration cover, among other topics, the material tested on the first two actuarial examinations, Course P/1 (Probability) and Course FM/2 (Financial Mathematics) offered by actuarial societies. Thus this program will provide career options other than teaching and graduate studies.

The new program will officially go into effect September 2007. During the academic year 2004-2005, MATH 466/467 - Mathematics of Finance I/II were offered as mathematics electives. Three students who took these courses are now working in the actuarial industry; one of them passed the actuarial examination Course P and another passed the actuarial examination Course FM. Two MBA students took MATH 467 to learn the subject and to enhance their careers; one obtained a desired job and the other was promoted. Among the three people who have been following the requirement of the new program to graduate with a Mathematics of Finance major in May 2007, one of them successfully finished an internship with an investment bank during the summer of 2006 and will go back as a regular employee upon graduation. The other two are preparing to take actuarial examinations to enter the field. The Department believes that the new program will be of great interest to undergraduate students. For more information, please contact **Dr. Youngna Choi** at choiy@mail.montclair.edu or the Chair, **Dr. Helen M. Roberts** at robertsh@mail.montclair.edu.

Getting Your Fair Share – And More

by Michael Jones



The American Mathematical Society (AMS) sent a press release to media outlets in early November announcing an article to appear in the December 2006 issue of the *Notices of the AMS*. The article has the seemingly non-mathematical title of “*Better Ways to Cut a Cake*” by Steven J. Brams (political scientist at New York University), **Michael A. Jones** (mathematician at Montclair), and Christian Klamler (economist from University of Graz, Austria). The media response has been overwhelming, with all three co-authors being interviewed for radio programs, newspapers, websites, and podcasts. Newspapers from Austria, Poland, Germany, and the United States (the Newark Star Ledger – Sunday November 25, 2006) have published articles based on the news release and interviews with the co-authors. Klamler was interviewed for New Zealand radio. Jones was interviewed for the Canadian Broadcast Corporation’s Quirks and Quarks (science news program) and for Steve Mirsky’s Scientific American podcast (to air soon). Discovery Online discussed cake-cutting and (loosely) demonstrated the procedure. Links appear below.

The article describes procedures that divide a heterogeneous good (usually viewed as a cake) between two or more people. The cake is heterogeneous, e.g., a piece may contain frosting,

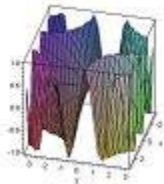
nuts, sprinkles, etc. that people value differently. The differences in how value is distributed is the key for each of the n people receiving what they view to be at least $1/n^{\text{th}}$ of the cake, and usually more. The results focus on how procedures can yield allocations that satisfy the three properties of a fair division: envy-freeness (no person desires what another has received), efficiency (although some other way to cut the cake may help a person, it will hurt another), and equitability (each person believes that he has received the same amount according to his preferences or distribution) under a minimal number of $n-1$ cuts. For the 5-minute description, just ask **Dr. Michael A. Jones** in the hallway.

- Canadian Broadcasting Corporation's Quirks and Quarks radio program; the interview aired on November 18, 2006 and appears on their website at: <http://www.cbc.ca/quirks/archives/06-07/nov18.html>

- Sharing Your Cake - and Eating It, Too. Scientific American (online); refers to Better Ways to Cut a Cake. Link: <http://www.sciam.com/article.cfm?articleID=BE6C72AB-E7F2-99DF-31646B192A04E597\sc=I100322>

- Discovery Channel Beyond (online); video demonstration of cake-cutting Link: <http://dsc.discovery.com/beyond/player.html?playerId=203711706&categoryId=210013712&lineupId=78375496&titleId=301961682>

Mathematical Sciences Department Seminar



The Mathematical Sciences Seminar welcomed a variety of speakers this semester from Montclair State University and other institutions. **Dr. Aihua Li** (MSU) spoke on “Certain Matrix Equations”, **Dr. Michael Huber** (Muhlenberg College) gave a talk on “Modeling Rare Baseball Events”, **Dr. Leah Shaw** (US Naval Research Lab) lectured on “Synchronization in small delay-coupled

networks of lasers”, **Crystal Dahlhaus** (student MSU) spoke on the “Mathematics of Refinancing”, **Dr. Arup Mukherjee** described the “Liquid Crystals: Elastic Continuum Models and Analysis” and **Dr. Richard O. Moore** (NJIT) spoke on “Pulse interactions in self-heated parametric gain devices”. The regular announcements and abstracts of these talks can be found at on the departmental webpage at <http://mathinfo.montclair.edu/seminars/seminars.php3>. All graduate and undergraduate students are welcome to attend these talks.

Dr. Maletsky Retires After 49 Years

By Helen M. Roberts (originally appeared in CSAM Newsletter)



After 50 years of teaching mathematics, **Dr. Evan Maletsky** retired from Montclair State University in June. Professor Maletsky taught in the Department of Mathematical Sciences from September 1957 through June 2006. He previously taught a year at Pascack Valley Regional High School. Throughout his 49 years at Montclair, Evan has taught thousands of mathematics educators and mathematics majors at the graduate and undergraduate levels as well as general education students. Evan is a distinguished alumnus of Montclair having earned his B.A. and M.A. degrees in 1953 and 1954, respectively. In 1961 he earned a Ph.D. in Mathematics Education from New York University. Throughout his career at Montclair, Evan has personified the teacher and learner. He has been innovative in his teaching; exploring new areas and developing new and creative approaches to the teaching of mathematics at all levels. Dr. Maletsky has shared his expertise with Montclair students seeking to become mathematics educators, as well as students just taking a single mathematics course. He has shared his love for and creative ways of teaching mathematics throughout the nation and beyond. Students and mathematics educators around the country have benefited dramatically from Evan's introduction of new and exciting ideas into the teaching of mathematics. The numerous invitations to make presentations and give workshops attest to his excellence as a teacher. It is exciting that what he teaches to other mathematics educators is in turn shared with thousands of teachers nationwide who in turn share what they learn with their students. The ripple effect of his scholarship has been dramatic. An example is his work on incorporating fractals into all classroom levels. Evan has studied new topics, mastered the material so that he could create new and original material, evaluated the material, subjected it to peer review, and lastly shared it with educators who in turn shared it with their own students. (His course on fractals has been one of the most popular electives in the MSU Honors Program.)

Students and others who have attended Evan's presentations and workshops have repeatedly praised him. Graduate students eagerly waited to take his courses. His teaching has personified his philosophy that he is always a teacher and a learner. Dr. Maletsky's excellence as a teacher has been acknowledged by the awards he has received such as the Mathematical Association of America-NJ Section Award for Distinguished University Teaching of Mathematics in 2002; the Student Government Association MSU Teachers in Excellence Award in 1998; the MSU Distinguished Teacher Award in 1993; and the Association of Mathematics Teachers of New Jersey Outstanding Mathematics Educator Award in 1991. In addition, he has received awards for being an outstanding researcher and a member of the MSU community. In 1991 he was the first to be named the Margaret and Herman Sokol Faculty Fellow and in 1984 the MSU Alumni Association Outstanding Faculty. As a researcher and author Evan has been very prolific. He has co-authored four books, co-authored more than 30 textbooks, contributed to other books, and submitted his research to journals such as *Student Math Notes*, *Mathematics Teacher*, *Arithmetic Teacher*, *The Virginia Mathematics Teacher*, and the *New Jersey Mathematics Teacher*. Dr. Maletsky has been a very active citizen of the Department of Mathematical Sciences, serving on many committees such as the PAC, search committees, and the committee that prepared the proposal for the Ed.D. in Pedagogy, specialization in Mathematics Education. In the doctoral program, he has served on portfolio committees and was the mentor for the student who earned the second doctoral degree in the history of Montclair State. He was the co-director of a \$2,500,000 State Workforce grant that started the successful and important graduate program for Mathematics for Middle School teachers. He was an active member of the Algebra Initiative that led to an extremely successful program for mathematics teachers in the Newark School District. Dr. Maletsky has also been an active member of professional organizations and has served in various positions in those organizations. Dr. Maletsky has been an extremely important member of the Department of Mathematical Sciences, the Montclair State community as well

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as the Mathematics education community throughout the United States for 49 years. We wish him well in his retirement and we are delighted that he will teach courses for us

occasionally and will be involved as an outside member of doctoral committees. We look forward to his continued association with the Department of Mathematical Sciences.

New People in the Department

Dr. David Trubatch is our new faculty member in Applied Mathematics. He came to Montclair State after six years at the US Military Academy (West Point). At the Academy he was a Davies Fellow (working with Army Research Lab scientists) and, later, the assistant director of the Center for Teaching Excellence. He was fortunate to work with, and learn from, many insightful and interesting teachers at the Academy including Brian Winkel, Fred Rickey and Gary Krahn. Before joining the faculty at the Academy, Dr. Trubatch earned his PhD from the University of Colorado in Boulder. His thesis advisor was Mark Ablowitz. Dr. Lora Billings was his classmate in what was then the early days of Applied Math at Boulder and, along with the rest of their first-year class, they spent a lot of time working on homework for the graduate

analysis course. In between Boulder and West Point Dr. Trubatch spent several months on a fellowship at the University of Stellenbosch in Stellenbosch, South Africa. Between college graduation and graduate school, Dr. Trubatch worked for two years with mentally handicapped adults and one year doing health-care policy research.

Rick McCollough is our new Office Assistant. Rick started in the Dean's Office (CSAM) then went on to work for the grant funded outreach program (PRISM) for Math and Science Teachers. Rick joined the Mathematical Sciences Department September 1, 2006. On the weekend, he teaches two science courses, Insects and Other Creepy Crawlers and Our Fascinating World, for the grant funded outreach program for Academically Gifted and Talented Children.

Student Achievements and News

Last summer, Physics major **Michael Papalos** set up the Beacon Project consisting of a radio antenna, installed on the roof of Science Hall, and a radio receiver inside Science Hall near the greenhouses. The goal of the project is to monitor 18 automatic radio beacons around the world at 5 frequencies. **Nathaniel Frissell** has developed an interactive website to view these data. These monitors indicate when the Earth's ionosphere is strongly ionized in directions toward Spain, New Zealand and other exciting places. They are also using the Radio Jove dual dipole and receiver to monitor the

radio output from the sun at 20.1 MHz. It is expected that there is a correlation between activity on the sun and the response of the Earth's ionosphere. They will report on this with Mary Lou West at the American Astronomical Society meeting in Seattle in January.

Physics major **Christine Vadovszki** was selected to be part of an REU (Research Experience for Undergraduates) at the University of Maryland last summer. She investigated nonlinear dynamical systems and will speak about her experience at the Physics club meeting December 13.

Faculty Activities

Dr. Lora Billings was awarded \$133,426 from Army Research Office, Mathematical Sciences Research Area of Cooperative Systems, for a three year project entitled: "Controlling interacting systems in noisy environments." She also gave three talks this semester:

- November 4, 2006, Plenary speaker, "Antibody dependent enhancement: Complex dynamics in the evolution of diseases," Mathematical Association Of America New Jersey Section - Fall Meeting, Seton Hall University, South Orange, NJ.
- October 24, 2006, Mathematical Biology Seminar Lecture, "Multi-strain disease models

Faculty Activities (continued)

with antibody-dependent enhancement,” Center for Applied Mathematics and Statistics, NJIT, Newark, NJ.

- October 10, 2006, Invited Lecture, “Multi-strain disease models with antibody-dependent enhancement” DIMACS workshop on Models of Co-Evolution of Hosts and Pathogens, Rutgers University, New Brunswick, NJ.

Dr. Youngna Choi had two articles appear: one is “The Curl of a Vector Field: Beyond the Formula” (with K. Burch) in PRIMUS, Vol. XVI, No. 3, Sep. 2006, pp.275—287 and the other is “Topology of Attractors from Two-Piece Expanding Maps” in Dynamical Systems, an international journal vol. 21, No.4, December 2006 pp.385—398. Dr. Choi also received the “Bright Idea Award” sponsored by the New Jersey Policy Research Organization (NJPRO), an independent affiliate of the New Jersey Business & Industry Association (NJBIA) and New Jersey's leading policy organization conducting innovative, timely and practical research on issues of importance to New Jersey employers, and the Stillman School of Business at Seton Hall University. These two organizations publish *Publications of New Jersey's Business Faculty*. This is a compilation of scholarly research on business-related issues that are relevant and educational to New Jersey firms. Her article “Compensating balance: A comment” (with Yeomin Yoon, Seton Hall) was recognized as the best paper in finance among the articles published this year. Dr. Choi is the second MSU faculty member who has received this award.

Dr. Thomas Devlin's 4th edition of his book entitled “JMP®ing into the Basic Practice of Statistics, Fourth Edition” was published by W. H. Freeman. He also submitted a paper to the *Mathematics Teacher* entitled “Why Aren't They Called Probability Intervals?”.

Two members of the Physics faculty worked on projects with selected students from Montclair High School who participated in the MSU Weston Science Scholars Program. **Dr. Dean Hamden** and **Carolina Lopez** (an MSU alumnus) led six students in investigating the properties of baseballs. In particular they studied how they responded to heat. They dropped baseballs of different temperatures onto sanded ash wood beams to simulate baseball bats, and found that hot balls bounced better than cold ones and had a higher coefficient of restitution. **Dr. Mary Lou West** investigated variable stars

(the Sun and Delta Cephei) with three high school students. Their measurements showed that the Sun is a small amplitude semi-regular variable due to its sunspots, while Delta Cephei is a large amplitude variable star with a very regular period of 5.3 days.

Drs. Eileen Fernandez and Michael Jones were named to the Editorial Board of PRIMUS. This is the inaugural editorial board. In the past a single editor existed. The journal is presently published by Taylor & Francis Group. The appointment became official in September 2006. Dr. Fernandez, in collaboration with Dr. Michael Jones also published the paper “Emphasizing the NCTM Content Standards in Undergraduate Courses for Prospective Teachers”. The paper appeared in *Mathematics and Computer Education*. 40, 3 (Fall 2006), 237-247.

Dr. Michael Jones had five papers appear in scientific journals:

- “Better Ways to Cut a Cake”. S.J. Brams, M.A. Jones and C. Klamler. *Notices of the American Mathematical Society*, 53 (2006), 1314-1321 .
- “Shift-Induced Dynamical Systems on Compositions and Partitions. B. Hopkins and M.A. Jones. *Electronic Journal of Combinatorics*. Volume 13 (1) 2006, #R80.
- Discrete and Continuous Models for the Evolution of Lizard Populations. M.A. Jones and A. Mukherjee. Section 6.5, p. 340-348, in *Mathematical Modeling: Education, Engineering and Economics (ICTMA 12)*, (Ed. by C. Haines, P. Galbraith, W. Blum, and S. Khan) Chichester: Horwood Publishing.
- Emphasizing the NCTM Content Standards in Undergraduate Courses for Prospective Teachers. E. Fernandez and M.A. Jones. *Mathematics and Computer Education*. 40, 3 (Fall 2006), 237-247.
- The Geometry Behind Paradoxes of Voting Power. M.A. Jones. Proceedings of the DIMACS-LAMSADE Workshop on Voting Theory and Preference Modeling, Annales du LAMSADE, No. 6, October 2006, 193-209.
Dr. Jones also gave the following talks:
- A Voting Theory Approach to Golf Scoring, Manhattan College, Mathematics Department Colloquium, November 15, 2006.
A Voting Theory Approach to Golf Scoring, Monmouth University, Mathematics Department and Kappa Mu Epsilon Colloquium, November 8, 2006.
- A Geometric Approach to Paradoxes of Voting Power, University of Paris Dauphine,

Faculty Activities (continued)

LAMSADE/DIMACS Workshop on Voting Theory and Preference Modeling, October 28, 2006.

In May, **Dr. Aihua Li** with **Dr. Youngna Choi** and **Dr. Helen M. Roberts** co-organized *Graph Theory Day 51 Conference* held at Montclair State University. Also in May, Dr. Li gave an invited presentation entitled "Genetic Operators Design Using Division Algorithm in the Solution Space" at the *IASTED International Conference on Modeling, and Simulation* held in Montreal, Canada. In June, Dr. Li participated in the MAA PMET (Preparing Mathematicians to Educate Teachers) Workshop for Preparing Middle School Teachers held in Lincoln, Nebraska. In October, Dr. Li helped promote MSU's Science Informatics program through an exhibition in the New Jersey Science Convention. In November, Dr. Li was appointed to be the MAA-NJ section liaison coordinator and she participated in the MAA New Jersey Sectional Fall Meeting held in Seton Hall University and Graph Theory Day 52 Conference held at West Point. This fall, Dr. Li reviewed two articles for *Mathematical Reviews* and refereed two articles for the *Houston Journal of Mathematics*. She also had the following three publications appear

- Xiaona Pan, Fucheng Liao, Aihua Li, "Certain Linear and Radical Models of Discrete Time Series", *International Journal of Pure and Applied Mathematics*, Vol. 28, no. 4, pages 487-501, 2006.
- Aihua Li, Irena Swanson, "Symbolic Powers of Radical Ideals", *Rocky Mountain Journal of Mathematics*, vol. 36, no. 3, 2006.
- Guiting Li, Bingtuan Wang, and Aihua Li, "Genetic Operators Design Using Division Algorithm in the Solution Space", *Proceedings of the IASTED International Conference on Modeling and Simulation*, pages 286-290, Montreal, May, 2006.

Dr. Arup Mukherjee co-authored a paper (with Dr. Michael Jones) entitled Discrete and Continuous Models for the Evolution of Lizard Populations. The paper appeared in Section 6.5, p. 340-348, in *Mathematical Modeling: Education, Engineering and Economics (ICTMA 12)*, (Ed. by C. Haines, P. Galbraith, W. Blum, and S. Khan) Chichester: Horwood Publishing. Dr. Mukherjee also gave a talk in our Department in which he discussed "Liquid Crystals: Elastic Continuum Models and Analysis".

Dr. Bogdan Nita has co-authored five papers which have been published or are in the process of being published:

- Analytic continuation of perturbative solutions of acoustic 1D wave equation by means of Padé approximants by B.G. Nita, to appear in *Journal of Applicable Analysis*.
- A comparison of the imaging conditions and principles in depth migration algorithms by B.G. Nita, *International Journal of Tomography and Statistics*, Nr. 4, No. FO6, pp. 5-16.
- Multi-dimensional seismic imaging using the inverse scattering series, by F. Liu, A.B. Weglein, K. Innanen and B.G. Nita, *SEG Expanded Abstracts*, 76th Annual Meeting of the Society of Exploration Geophysicists, New Orleans, Louisiana.
- An inverse scattering method for constructing the wavefield at depth and the transmission response from reflection data (INVITED) by A.B. Weglein, B.G. Nita, K.A. Innanen, E. Otnes, S.A. Shaw, F. Liu, H. Zhang, C. Fan and G. Pavlis, *Geophysics*, vol.71, No. 4, pp. SI125-SI137.
- Exploiting the free surface effect separate forward and back scattered teleseismic wavefields (INVITED), by C. Fan, G. Pavlis, A.B. Weglein, B.G. Nita, *Geophysics*, vol.71, No. 4, pp. SI71-SI78.

Dr. Nita also presented his research at the following conferences:

- Point-Scattering Description of Reflections and Headwaves in Acoustic Media, 2006 SIAM Annual Meeting, Boston, MA, July 14, 2006.
- Imaging conditions in depth migration algorithms (INVITED), 2005 Mission-Oriented Seismic Research Program Annual Meeting, University of Houston, TX, May 11, 2006.

Dr. Baojun Song authored (together with Dr. Diana Thomas) a paper entitled "Dynamics of Starvation in Humans" which was accepted for publication by the *Journal of Mathematical Biology*.

Dr. John G. Stevens and Prof. Donna J. Cedio-Fengya (of William Paterson University) published "Mathematical Modeling of Biowall Reactors for In-situ Groundwater Treatment" in *Mathematical Biosciences and Engineering*, vol. 3, no. 4, pp. 615-634 (Sept., 2006). Prof. Stevens continues to consult with ExxonMobil Research and Engineering Co. (Annandale, NJ) on concepts having to do with advanced internal combustion engines and related combustion and efficiency issues.

Faculty Activities (continued)

Dr. Diana Thomas gave an invited presentation on "Mathematics of Fat and Starvation" at Math Fest in August 2006. She also co-authored (with Dr. Baojun Song) a paper on the "Dynamics of Starvation in Humans" which was accepted for publication by the Journal of Mathematical Biology.

Dr. Phil Yecko published an article in the journal "Theoretical and Computational Fluid Dynamics" (vol. 20, no 6). The article is titled "Ligament formation in sheared liquid-gas layers" and it is written with T. Boeck, J. Li, E. Lopez-Pages and S. Zaleski.

Other News



New course in Applied Math! **Dr. Phil Yecko** will be teaching a course in **Fluid Dynamics** for the Spring 2007 semester. The

course will be an introduction to the physical principles on which the mathematical models of fluids are based and will study the two most general such models, the incompressible Euler and Navier-Stokes equations in some depth. The course will include a focused development of an understanding of partial differential equations and of nonlinearity in dynamical systems. Fluid mechanics problems will be used to provide insight into a number of tools in applied mathematics, such as complex analysis, scaling, self-similarity and group theory, boundary layers, eigenfunction expansions, Fourier and Laplace transforms and perturbation theory. Applications to everyday fluid mechanics –such as blood flow, dripping faucets and hurricanes-- will be used to enhance the presentation of course material.



The amateur radio course this semester resulted in nine people passing FCC tests. Three were MSU students, including Matt Klics (physics major), Courtney

Winter, and Joe Przebieglec. The courses were taught by Nathaniell Frissell (physics major), Mike Clarson, and Eric Sonnenwald (E&ES).

The Physics Club meets on Wednesday afternoons, usually 3:30-4 PM in RI-261.



Sometimes members go to departmental talks instead. This semester members heard the presentations of Michael Huber, Leah Shaw, and Arup Mukherjee. Meetings have also featured experimenting with Diet Coke and Mentos out on the

lawn, hearing Dr. Hamden discuss baseball properties, and watching a video on unusual careers for physicists. Unfortunately, the transit of Mercury was clouded out. December 12 will be a field trip to Princeton University to hear Jim Bell, Cornell, (Mars Rover team) discuss "Postcards from Mars."



This semester **Dr. Ernest Ma** is teaching Quantum Mechanics for the first time in some years. The physics program is growing in sophistication as well as in numbers of students. They have also received some new equipment. "The PASCO hand-held GLX data taking devices can be partnered with various sensors to go out into the field and take data simply and elegantly" says **Dr. Robert Dornier**.