

R.I.T Department of Mathematics and Statistics Newsletter

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A MESSAGE FROM THE HEAD

By Sophia Maggelakis, Head of the Department of Mathematics and Statistics

In today's world where science and technology have increasing importance in both the work and home environments, preparing students from different backgrounds for careers in science, mathematics, engineering and technology is critical. Our department is continuously faced with the challenge of providing students with the necessary mathematical foundation to succeed in these fields when they bring diverse educational backgrounds, career aspirations, physical and learning disabilities, and real-world experience to our universities.

Each quarter, we offer approximately 35 first-year calculus sections to approximately 1200 students who are majoring in engineering, chemistry, physics, imaging science, mathematics and computer science. Prior to 2001, the success rate in these calculus sections was low with the percentage of the Ds, Fs, and Ws (Withdrawals) close to 35%, which is approximately the national average. We had problems with the correct placement of students, lack of student preparation, and lack of student motivation. All these problems resulted in student dissatisfaction and poor performance. Three years ago, we implemented a successful Calculus Pilot Program, which consisted of

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RIT Hosts 18th Midwest Conference on Combinatorics, Cryptography and Computing

The Department of Mathematics in cooperation with the College of Science and the Golisano College of Computing and Information Sciences hosted the 18th Midwest Conference on Combinatorics, Cryptography and Computing on October 28-30. Local organizers of the conference were **Dr. Hossein Shahmohamad, Dr. Darren Narayan, Dr. Bernard Brooks, Dr. Carl Lutzer** of R.I.T and Dr. Ebrahim Salehi of UNLV. They were assisted by majors Ali Al-Rasi, Julia Bethel, Carol Callesano, Ted Dziuba and Sam Thieme. Over 90 attendees visited RIT for what was an international conference. Many of our department's students attended, in all there were 35 students from all over North America.

The keynote speaker for the conference was Dr. Andrew Odlyzko, the current Director of the Digital Technology Center at the University of Minnesota and former head of the Mathematics and Cryptography Research Department at AT&T Laboratory.

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Pictured from left: Dr. Bernie Brooks, Dr. Andrew Odlyzko, Dr. Hossein Shahmohamad and Dr. Darren Narayan

Faculty News

Mathematics and Statistics assistant professor **Darren Narayan** published two research papers : "An Application of Perfect Matchings to Surface Reconstruction" was published in the Bulletin of the Institute of Combinatorics and its Applications and "Tournaments with Feedback Path Powers" was published in the Journal of Combinatorial Mathematics and Combinatorial Computing.

Assistant professor **Bernard Brooks**, Mathematics and Statistics, presented "Rumour Propagation Modeled as a Dynamical System on a Network" at the Canadian Mathematical Society 2004 summer meeting at Dalhousie University in Halifax, June 13th 2004.

Harry M. Schey, Mathematics and Statistics professor, completed the revisions for a new (fourth) edition of his book Div, Grad, Curl and All That, an Informal Text on Vector Calculus. The new edition of the text, first published in 1973, is scheduled for release in January 2005.

Mathematics and Statistics assistant professor **Hossein Shahmohamad** was an Invited Speaker at Department of Mathematics Seminar at the Institute for Advanced Studies in basic Sciences in Zanjan, Iran on August 14, 2004. The title of his talk was "Chromatic and Flow Polynomial in Graph Theory."

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David Farnsworth, Department of Mathematics and Statistics professor, had his article "The Most Compact Subdomain of a Continuous Probability Distribution" published in the Fall 2004 issue of Teaching Statistics.

Assistant professor **Michael Radin**, Mathematics and Statistics, organized a session on dynamical systems during the Canadian Mathematical Society (CMS) Summer 2004 Meeting in Halifax, Nova Scotia; June 13-15, 2004 and he presented "Trichotomy Behavior of a Difference Equation" during the CMS Meeting. Prof. Radin presented "Trichotomy Behavior of a Difference Equation" during the 2004 SIAM (Society for Industrial and Applied Mathematics) Annual Meeting in Portland, Oregon; July 12-16, 2004. Additionally, Prof. Radin served as a reviewer for the Society for Chaos, Psychology and Life Science.

Mathematics and Statistics assistant professor **Hossein Shahmohamad's** manuscript "Constructing Flow-Equivalent Graphs" appeared in Journal of Combinatorial Mathematics and Combinatorial Computing 50, 2004, pp. 115-121.

Assistant professor in the Department of Mathematics and Statistics **Tamas Wiandt** reviewed the new text by Peter Olver: Applied Linear Algebra for Prentice Hall.

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Summer Research of Julia Bethel

During this past summer, Julia Bethel, a 4th year student in applied mathematics, worked with **Dr. Patricia Clark** in modeling epidemics of meningitis in Africa.

In 2001, six countries in the African meningitis belt (Benin, Burkina Faso, Central African Republic, Chad, Ethiopia and Niger) suffered an outbreak of meningococcal meningitis disease, which was monitored by the World Health Organization (WHO).

The goal of the research was to determine the minimum number of people necessary in the African meningitis belt to maintain an epidemic. It is assumed that in a sparsely populated area, disease would spread at a slower rate due to less frequent contacts between individuals. But in vastly overpopulated regions, even minor diseases would spread quickly. It is assumed that the outbreak in 2001 was above this critical population, but Dr. Clark and Ms. Bethel wanted to know by how much more the population was above this critical limit.

Their approach uses the standard S-I-R model (short for susceptible, infected and removed). The WHO data required some ingenious analysis based on data from a variety of sources to obtain the model parameters. When Julia contacted the WHO, they requested her analysis when it is complete. The initial results of their research indicates that the population was twice the level necessary for the epidemic. The results may be helpful to the local governments of the affected regions for vaccination purposes.

Julia received financial support for the summer through RIT's Honors Program and presented her results to the college at the end of the summer.

New Lecturer

Prof. Tiffany Pritt is from Indiana, Pennsylvania. She studied mathematics as an undergraduate at an institution specializing in education, the Indiana University of Pennsylvania. She went on to graduate school at Penn State University and received a master's degree in mathematics. Afterwards, she taught in a branch campus of Penn State located in Fogelsville, Pennsylvania for one year teaching mostly college algebra level courses.

At RIT, Tiffany is ecstatic to teach a subject she was never able to do at Penn State, calculus. Surprisingly, Prof. Pritt likes the weather here in Rochester, claiming that the weather in Pennsylvania is worse.

In addition to teaching in a hectic quarter system, Tiffany finds the time to engage in many of her hobbies: hiking, bike riding (along the Erie canal), classical music, and jazz.



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ries. Dr. Andrew Odlyzko's talk "Cybersecurity and its Limitations" was extremely well attended with over 160 people enjoying his presentation. His talk coincided with the Dean's Lecture Series sponsored by the Golisano College of Computing and Information Sciences. Dr. Odlyzko is an expert in the area of internet security and traffic and is probably best known for an early debunking of the myth that Internet traffic doubles every three or four months.

The conference also featured an invited lecture from Joseph Gallian, Distinguished Professor of Teaching and Professor of Mathematics at the University of Minnesota-Duluth. Dr. Gallian has won numerous honours for his excellence in teaching, including awards from the Mathematical Association of America and the Carnegie Foundation for the Advancement of Teaching. In addition, Dr. Gallian has received numerous recognitions for his sustained excellence involving research with undergraduates and is author of a highly acclaimed textbook on abstract algebra.

Additional invited speakers included Jonathan Farley of MIT, Jack Graver of Syracuse University, Garth Isaak of Lehigh University, and Renu Laskar from Clemson University.

A special issue of the Journal of Combinatorial Mathematics and Combinatorial Computing (JCMCC) has been set aside for the papers generated by the 50 other talks that were held in 4 parallel sessions.

A professor is one who talks in someone else's sleep. ... W. H. Auden

I knew a mathematician who had a recurrent dream. He dreamt that he was a partial derivative. Jeremy Bernstein

New Faculty

Dr. Ephraim Agyingi, a visiting professor in our department, was born in Cameroon. He took his bachelor's degree in mathematics from the University of Ilorin in Nigeria. He also holds a master's degree in computational math from that same university. He received his doctorate in numerical analysis from the University of Manchester in England. His thesis was devoted to numerical analysis of Volterra integral equations; three papers reporting on aspects of this work are currently in preparation.

Ephraim came to RIT from the Tom Baker Cancer Centre-Calgary and the University of Calgary, where he was a postdoctoral fellow working in medical physics.

Ephraim is married and he and his wife, who is an environmental scientist, live in Henrietta. For recreation he enjoys bicycling and soccer.



Dr. Yolande Tra, an assistant professor in our department, was born and raised in Madagascar, the fifth of eight children. She holds a bachelor's degree in mathematics from the University of Madagascar, a master's in applied math from the University of Aabidjan, Ivory Coast, and a master's in statistics from Ball State University in Indiana. She received her doctorate in statistics from the University of Missouri in 2000. Her thesis was on Bayesian analysis of nest survival, an account of which has been published in the journal *Biometrics*. Her current research is in the application of Bayesian statistical analysis to clinical trials in cancer. She was a lecturer at the University of Michigan before joining our department.

Yolande is married and the mother of three children. Her husband is currently a graduate student at Queen's University in Kingston, Canada in the field of pathology where he studies protein markers for cancer detection.

When asked what she does in her spare time, Yolande pointed out to this interviewer that her three children live with her, and suggested we guess how much spare time she has.

Dr. Joel Zablow, a visiting assistant professor, was born and raised in New York City. He received his bachelor's degree in mathematics from Reed College, a master's in mathematics from the University of Oregon, and his doctorate, also in mathematics, from the City University of New York. In his thesis, Joel investigated operations on curves and surfaces including Heegaard splitting of three-manifolds. He has published a paper on this topic in the *Journal of Knot Theory*. His current work involves a study of quandles, a non-associative algebra related to a mapping class group of a surface.

Joel currently resides in Rochester and while the weather holds up, bicycles to work. He enjoys music and is an amateur cellist. He also likes outdoor activities, especially backpacking. Joel is an avid reader of fiction to get away from the math he reads which he insists is not fiction.



SPRING/SUMMER/FALL DEAN'S LIST

Ali Al-Raisi (S*)	Brian Harrison (S)	Abbie Stokes-Riner (S*)
Julia Bethel (S*)	Stephanie Jones (S*)	Tiffany Swasta (S)
Julie Blackwood (S*)	Pooja Kosunam (S)	John Szymanowski (S)
Joni Borrelli (S*)	Bryan Lenker (S*)	Samuel Thieme (S)
Heather Brazeau (S*)	Todd Lundin (S)	James Urick (S)
Neil Brenner (S)	Paul Martino (S)	Heather Wheater (S*)
Carol Callesano (S)	Elizabeth Meyer (S)	Hye Yon Yi (S)
Tonya Campbell (S)	Caitlin O'Donnell (S)	
Derrick Cerisier (S)	William Orr (S)	
Patrick Curran (S)	Ruth Ostrander (S)	<i>Congratulations to all!</i>
Shana Dagel (S*)	Margaret Pokorny (S*)	S – Spring Quarter 03-3
Michael Denning (S*)	James Porter (S*)	Su – Summer Quarter 03-4
Gregory Dufore (S*)	Matthew Robinson (S)	F – Fall Quarter 04-1
Theodore Dziuba (S*)	Charles Schillberg (S)	* denotes 4.0 GPA
Matthew Ford (S)	Mark Schindbeck (S)	
Ryan Fuller (S*, Su)	Martin Setto (S)	
Nicolas Germain (S*)	Nicolas Shayko (S)	
Caitlin Glegg (S)	Michael Short (S)	
Andrew Goldman (S)	Shelley Speiss (S*)	
Kevin Gonzales (S*)	Chris Steinkirchner (S)	

Honorary Memberships

The Department of Mathematics and Statistics is very pleased to announce our majors who have been selected to receive the 2004 Department of Mathematics and Statistics Honorary Membership Award.

Ali Al-Raisi, 3rd year SMAC
 Michael Denning, 2nd year SMAS
 Ryan Fuller, 4th year SMAI
 Lucas Habegger, 4th year SBID
 James Porter, 4th year SMAC
 Martin Setto, 2nd year SMAC
 Shelley Speiss, 3rd year SMAM
 Marc Weinmuller, 2nd year SMAS
 Hye Yon Yi, 3rd year SMAM

Along with the award comes a membership to either the Mathematical Association of America or the American Statistical Association. These prestigious honors are awarded based on the overall academic achievement and performance of our majors.

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a combination of methods and innovative materials that had proven to be effective at other institutions. The pilot program focused on the following objectives:

- Provide students with a frame of reference for application of calculus concepts in their field of study
- Combine traditional lecture classes with workshops that promote active learning. In the workshops students work together on projects and discovery problems that introduce new calculus concepts
- Increase students' appreciation of the usefulness and beauty of mathematics, and apply already learned concepts to real life problems
- Teach students to be better problem solvers with a deeper conceptual understanding of calculus and a better attitude regarding its usefulness
- Improve students' success rates and persistence in calculus
- Instill in students a strong foundation of core skills that can be used in a variety of contexts and recalled in succeeding courses.

Our Engineering Calculus sequence was redesigned to include educational material that links mathematical topics with applications to a variety of engineering and scientific settings. Using the model of the Emerging Scholars Program at University of Texas Austin, University of Kentucky, and University of Wisconsin-Madison, we incorporated workshops in all our calculus sections. Instead of going to a traditional recitation session, students go to a collaborative learning workshop for two hours per week in addition to the four lecture hours per week. With funding from the Provost, and with the support and encouragement of the Dean of the College of Science, three classrooms were renovated into workshop rooms. Each room is equipped with ten round non-movable tables with internet connections, ten laptops, and 40 chairs (4 chairs per table). During a typical workshop, students work cooperatively in small groups on worksheets provided by the workshop leaders (Instructor and a Teaching Assistant) who guide students and keep them on track. These 20 hours of workshops are a required part of the course with mandatory attendance. Missing more than two workshop hours results in automatically lowering a student's grade. The worksheets include a wide variety of difficult questions and discovery problems. The purpose of the discovery problems is to introduce and drive the calculus concepts. Students are free to check their answers with other group members, or with other groups. To assess the effectiveness of workshops, a survey was developed and administered to all students at the end of each quarter. The goal of this survey was to ascertain strengths and weaknesses of the workshop activities, as well as to provide feedback on student attitudes about the workshops. The theme that emerged from these evaluations was a positive response to the workshops. Students like the learning environment of the workshops, because it allows them to take a more active role in the educational process. They are able to support each other and feel that they are part of a community of learners who share similar frustrations and difficulties. They also enjoy meeting other first-year students, actively participating in problem solving, and learning the material by teaching their peers. To ensure uniformity in the way students' success is assessed, the course coordinator of each calculus course makes sure that all instructors teach the same amount of material and that there is an appropriate level of communication among all faculty teaching the same course. Part of the final exam is common to all sections, including common grading, to insure that all students learn the core material that is needed for the succeeding math courses.

Study and analysis of the pilot program results indicate that students learn best and retain the most material when presented with a mixture of learning modalities, including lecture, collaborative problem solving, and working on real-world applications. A comparison of the percentage of Ds, Ws, and Fs during the pilot years to the pre pilot years indicates that the percentage of Ds, Ws, and Fs was reduced by more than 10 points for each of the courses in the first year calculus sequence. These encouraging results lead to the adaptation of the strategies of the pilot program to the way we now teach our first year calculus sequence for mathematics, statistics, science, computer science, and engineering majors.

Our next challenge is to adapt this model to our other calculus sequences. We realize that this will be a much greater effort, but if it improves the success rates in all our calculus sequences and produces students with a deeper conceptual understanding of mathematics and a better attitude regarding the usefulness of calculus, it will be a well worth effort.

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Marcia Birken, Department of Mathematics and Statistics, and Anne C. Coon, Department of Language and Literature, presented two workshops in October at Writers and Books Literary Center in Rochester, NY. The first workshop entitled "Patterns in Poetry and Mathematics" explored some of the fundamental patterns from both fields and the unexpected ways in which they overlap. The second workshop on "Fractals in Poetry and Mathematics" introduced the mathematical concept of fractal geometry and looked at how fractals have been used by contemporary writers in the ideas, forms, and interpretation of poetry.

Department of Mathematics and Statistics assistant professor **Raluca Felea** gave a talk at the Fall Western Sectional Meeting at Albuquerque, NM, on October 16 and 17, 2004. She also participated in the Seventh New Mexico Analysis Seminar, October 14-15, at University of New Mexico.

New Faculty continued

Dr. Raluca Felea was born in Focsani, Romania. Her motivation for studying mathematics began in high school when she won a few school-wide mathematics competitions. She received an undergraduate degree in mathematics at the University of Iasi in Romania. After graduating, she studied mathematics in the master's program at the University of Iasi for one year.

Raluca came to the United States in 1998 and attended the University of Rochester, working with Dr. Alan Greenleaf on inverse problems related to wave propagation.

Raluca is very busy in her new position at RIT. But she says the people here are friendly and somehow claims that the weather is nicer here than in Romania.



Study Abroad By Victor Kostyuk

Victor Kostyuk, a 5th year student in computational mathematics, recently returned from an extremely busy year overseas. Victor applied and was accepted to the Research Experiences for Undergraduates (REU) program and in the summer of 2003, he was able to study in New Jersey for 3 weeks and in Prague, Czech Republic for 4 weeks.

During the following academic year, Victor participated in the Budapest Semesters in Mathematics. This program is for undergraduate mathematics majors in their junior/senior years. A student accepted to the program spends one or two semesters in Budapest to study under the tutelage of eminent Hungarian scholars. The courses are taught in English, the classes are small, and credits are transferable. Additionally, the school is near the center of historic Budapest in Hungary. Victor was able to take many classes in mathematics, including set theory, algebraic topology, Galois theory, and measure theory.

In the fall 2004 quarter, Victor returned and completed his minor all at once by taking five economics courses. He has completed all of his course work required for graduation, but is currently in Moscow taking more math classes as part of the Math in Moscow (MIM) program.

Victor is the recipient of the RIT Presidential Scholarship, the RIT Alumni Scholarship, the Nathaniel Rochester Society Scholarship and is designated an RIT Outstanding Undergraduate Scholar. He plans to enroll in a Ph.D. program in mathematics next fall.

More information about the programs mentioned here can be found at <http://www.nsf.gov/home/crssprgm/reu>, <http://www.stolaf.edu/depts/math/budapest>, and <http://www.ams.org/employment/mimoscow.html>.



A Co-op Experience By Greg Dufore

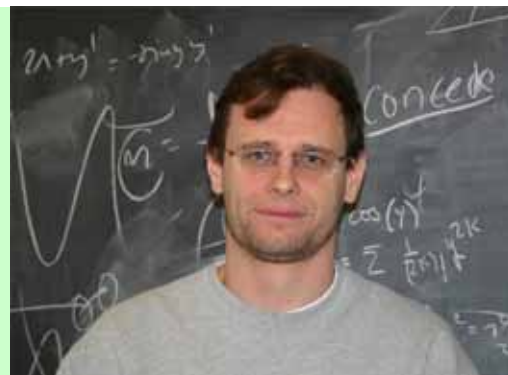
I have been on co-op since the end of May. I am working at a company called Alcan in Oswego, NY. Alcan produces rolls of aluminum that become beverage cans and parts for cars. Being an applied statistics major, I am not heavily involved in the day to day workings of the plant. I have primarily worked on their new continuous improvement effort. I am working with a Lean Six Sigma team to try and improve inventory accuracy as well as overall efficiency of the plant. Being part of this team has given me insight into a statistical based improvement effort that is becoming popular with many of America's top industries. Decisions in the system are all data driven. This means lots of organizing experiments and surveys. I work on all ends of the analysis; design of the experiment, data collection, data analysis, and presentation of results. The most important things I have learned from this is how to work in a team and present my analysis clearly. I have found it to be very important to present your work so that anyone can follow it from beginning to end. This is especially true when working with a diverse group of people. After working at Alcan for almost 5 months, I would definitely consider a job in this field. It is very rewarding to be able to work on all ends of the Lean Six Sigma process.

New Faculty continued

Dr. Tamas Wiandt was born in Hungary. He received his undergraduate degree at the Jozsef Attila University in Szeged. Afterward, he became a research assistant for the Hungarian Academy of Sciences, where he shared an office with well-renowned mathematician Bela Szokefalvi-Nagy. He also spent a considerable amount of time playing soccer (on an amateur level), where one of his teammates was Peter Leko, a grandmaster chess player currently ranked 6th in the world.

Tamas left Hungary in 1995 to study more and spent six beautiful years in Minnesota, completing his degree under the guidance of Richard McGehee. He also spent three years as a G.C. Evans Instructor at Rice University in Houston, Texas. His research interests are in dynamical systems theory, where he started on the theoretical end of the spectrum, but he is becoming more attracted (strangely?) to the applied side.

Tamas is married, his wife Aniko is an English, German and Spanish teacher by trade but also received an undergraduate degree in Economics at the University of Minnesota. Currently she spends most of her time with their daughter, Hanna, who is 3 years old and is enjoying her first real winter with a Santa in snow, not under a palm tree.



Ms. Patricia Diute is a New York state native. As an undergraduate, she studied classical Greek and Latin, German, philosophy and mathematics at the University of Rochester. She continued on to graduate school in mathematics, studying algebraic topology. During this time she also joined the Mathematics and Statistics Department at RIT as an adjunct faculty as well as consulting for the Xerox Corporation. In 1988, she joined the Eastman Kodak Company, where she worked on optimization problems for manufacturing. For the past ten years she worked in the Imaging Science Division of the Research Labs. Her work supported digital image processing and supported several organizations, including Consumer Imaging, Health Imaging, and the Remote Sensing. She holds several U.S. patents as a result of these efforts, and has authored numerous internal publications. She is happy to be back at RIT and looks forward to using her industry experience in the academic setting.

Patricia's other interests include music, photography and oil painting.



Problem Corner: Lights On, Lights Off

This problem was communicated to us by Victor Kostyuk from the Budapest Institute. Don't let that discourage you; it's still a fun problem.

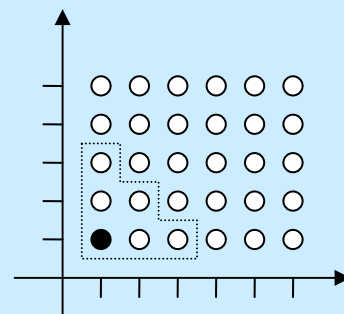
Let's say we have lights located at positive integer coordinates (so there are an infinite number of lights, extending to the right and upward in the picture to the right). Lights are either ON (white) or OFF (black). Initially, only the lamp at (1,1) is OFF and all others are ON. There are two simple rules for turning a light ON:

Rule #1: If a light is OFF, you can only turn it ON if the lights immediately above it and immediately to the right of it are both ON.

Rule #2: If you turn a light ON, then the lights immediately above and immediately to right of it will automatically turn OFF.

Goal: Determine the minimum number of moves required to turn all the lights OFF in the region bounded by the dashed lines.

Solutions should be submitted to Matt Coppenbarger at mecmsa@rit.edu.



Contributors:

Prof. Matthew Coppenbarger
Prof. Sophia Maggelakis
Prof. Harry Schey
Prof. Wanda Szpunar-Lojasiewicz
Shelly Cicero

Julia Bethel
Greg Dufore
Victor Kostyuk

Print and Web Version:
Prof. David Crystal

Send your news item to:
E-mail: mathdept@rit.edu
Or mail to:
Rochester Institute of Technology
College of Science
Department of Mathematics and Statistics
85 Lomb Memorial Drive
Rochester, NY 14623

Symmetry in Nature



Photo by D. M. Crystal