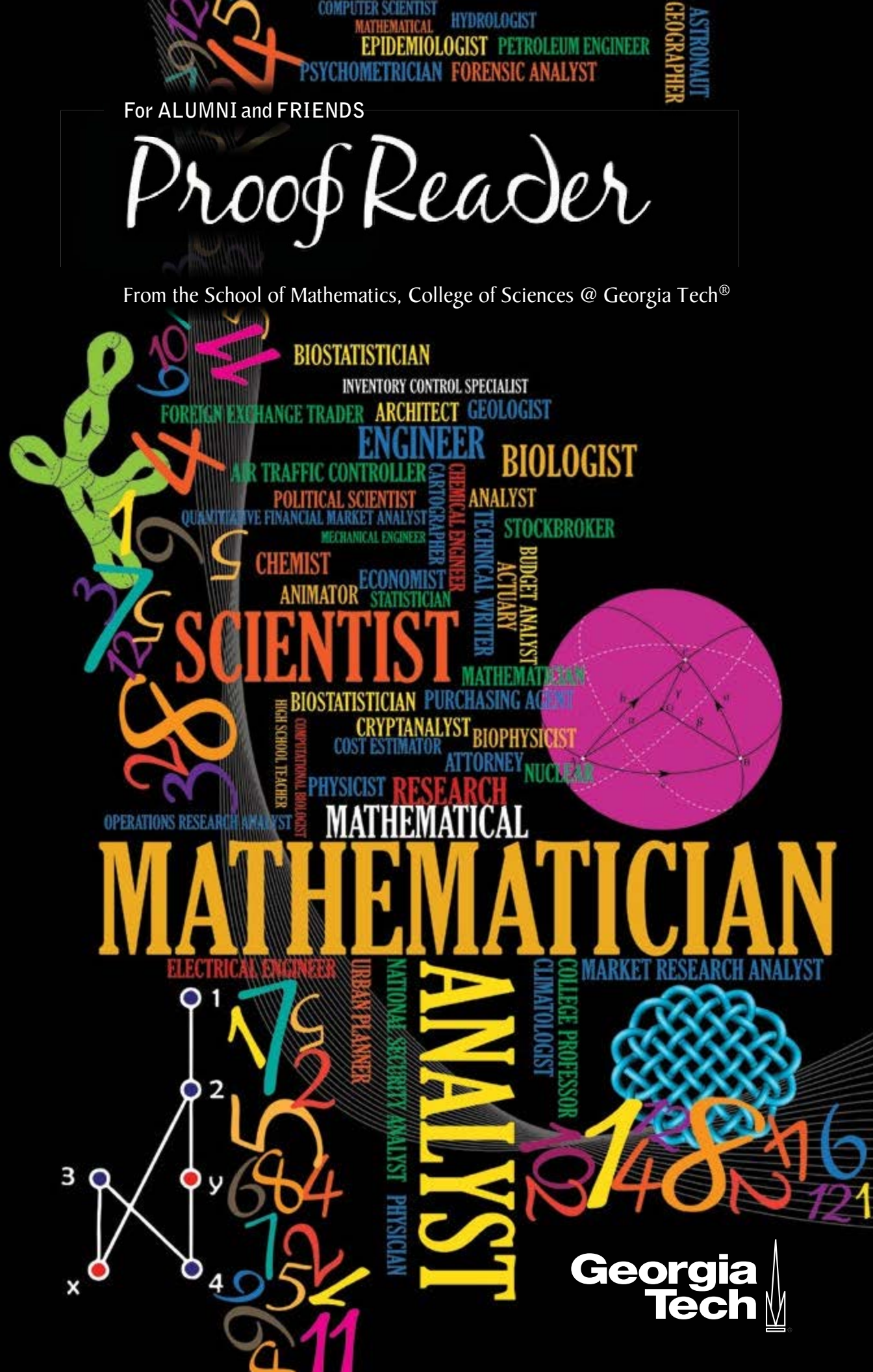


For ALUMNI and FRIENDS

Proof Reader

From the School of Mathematics, College of Sciences @ Georgia Tech®

Georgia Tech

Notes from the Chair

It's been an exciting year here in the School of Mathematics. One of the outcomes of our Academic Program Review last year was a recommendation to expand the number of postdoctoral fellows employed by the School. Ramping this up will be a multiyear project, but we have made a very good start by using new state funding, federal grants, and other resources to recruit a dozen new PhDs for two-year appointments. They will join continuing postdoctoral fellows so that we will have a corps of 16 recent PhDs in these positions next year.

Postdoctoral experience is now an essential part of the career track for mathematicians headed for research-intensive institutions such as Georgia Tech. The brightest and most ambitious fresh PhDs typically take positions as "named" postdocs for two or three years before their first tenure-track appointment. (Some of our new postdocs will be "Jack Hale postdoctoral fellows" in honor of our late colleague profiled in the 2010 edition of *ProofReader*.) Our cadre of postdocs will contribute to our undergraduate teaching mission in several ways, helping us reduce class sizes, diversify our advanced offerings for majors, and bring the latest ideas to campus. They will also develop their own research programs in collaboration with our senior faculty. Because we expect our postdoc program to be an increasingly important aspect of our efforts, we are putting quite a bit of work into designing training and mentoring structures that will allow the fellows to make the most of their time here and be well-positioned for appointments at other top institutions. We are delighted to be able to expand this aspect of our mission—stay tuned for more news on this in coming years.

Another exciting development is that we have been able to increase the number of students recruited for our main PhD program. The demographics and increasing ambitions of our faculty mean that we have a lot of spare "advising power," so we plan to significantly expand our graduate student population.

At the undergraduate level, we have seen remarkable increases in the preparation of incoming students. Linear algebra, once a quite advanced topic, is now a subject of study for a typical Georgia Tech freshman! The School is responding to these changes by taking a serious look at the themes and organization of the entire two-year core mathematics program. As you might imagine, any changes here potentially affect almost every student on campus, so we will be moving cautiously, with consultations across the Institute. Stay tuned for more news here too.

In research news, I am delighted to note that over 20% of our faculty were recently named to the inaugural class of the Fellows of the American Mathematical Society. See page 5 for a photo and more on this honor.

I mentioned above that our faculty includes a large percentage of young and ambitious professors. One reflection of this is the increased number of major conferences and workshops hosted by the School. You can read more about one of these, a summer graduate school on "Applied Algebraic Geometry," on page 30. Our senior faculty are of course also

very active, and several of them organized the first of what will be a series of major international conferences in honor of Jack Hale. See page 27 for a report on this event, which brought over 200 researchers to Tech to honor Jack.

There will be two very significant transitions in our staff—long-term staff members Jan Lewis and Genola Turner retired on June 30th. Genola has supported our graduate programs for many years, and Jan has worn several hats at Tech, including functioning as my "chief of staff" for the last four years. They will both be greatly missed. See pages 24 and 25 for profiles of these two remarkable women.

This year we will have a homecoming event sponsored by the College of Sciences the evening of November 1. There will be music, food and good conversation. We hope you will be able to return to campus for this event. In the meantime, please send us news of your activities and let us know of your ideas for the School. We would be very happy to hear from you.

Best wishes,
Doug Ulmer
Professor and Chair

SoM Statistics Spring 2013

Faculty	54	(tenured or tenure track)
Emeritus Faculty	14	
Academic Professionals	3	full-time
	1	part-time
Instructors	2	
Visitors	12	(for semester or more)
Postdocs	9	
Staff	12	full-time
	1	part-time
Graduate Students	67	
Undergraduate Students		
Math	145	
Discrete Math	23	

About the Cover:

Mathematics is central to almost every activity in science and engineering, not to mention many other pursuits. Our cover celebrates this fact by mentioning some of the many careers where mathematical training is important. We hope it reminds you of the role mathematics has played in your successes.

Twelve Math Faculty Named as Inaugural Fellows of the AMS

by David Terraso

Twelve faculty from Georgia Tech's School of Mathematics were named Fellows of the American Mathematical Society (AMS) on Nobemer 1, 2012. The listing represents the society's inaugural class and includes 1,119 fellows from more than 600 institutions.

The faculty from Tech were math professors Matt Baker, Jean Bellissard, John Etnyre, Wilfrid Gangbo, Michael Lacey, Michael Loss, Doron Lubinsky, Prasad Tetali, Robin Thomas and associate professor Brett Wick. Adjunct math professors also recognized were Bill Cook, from the School of Industrial and Systems Engineering, and Dana Randall, from the School of Computer Science.

"I am delighted that such a large number of Georgia Tech faculty members have been named as Fellows of the AMS," said Doug Ulmer, chair of the School of Mathematics. "It is an indication of the quality of work being done here and its impact in the wider world."

The Fellows of the AMS designation recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication and utilization of mathematics. Among the goals of the program are to create an enlarged class of mathematicians recognized by their peers as distinguished for their contributions to the profession and to honor excellence.

"The AMS is the world's largest and most influential society dedicated to mathematical research, scholarship, and education," said AMS President Eric M. Friedlander. "Recent advances in mathematics include solutions to age-old problems and key applications useful for society. The new AMS Fellows Program recognizes some of the most accomplished mathematicians—AMS members who have contributed to our understanding of deep and important mathematical questions, to applications throughout the scientific world, and to educational excellence."

Left to right: Back row: Wilfrid Gangbo, Matt Baker, Michael Lacey, Brett Wick, John Etnyre, Michael Loss. Front Row: Prasad Tetali, Robin Thomas, Dana Randall, Jean Bellissard, Doron Lubinsky. Not pictured: Bill Cook, adjunct from the School of Industrial and Systems Engineering.

Congratulations to the New Fellows!

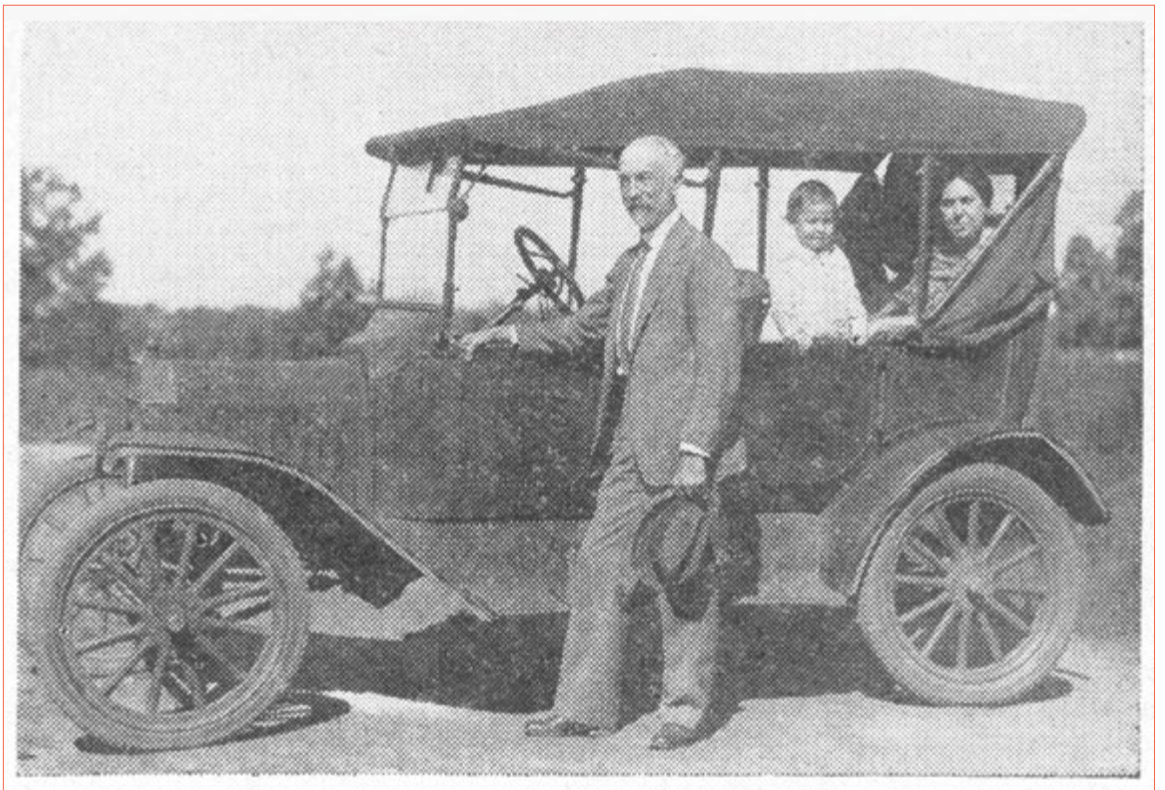
by Doug Ulmer

AMS Fellows are "mathematicians recognized by their peers as distinguished for their contributions to the profession." The inaugural class of fellows represents less than 4% of the membership of the AMS, but they are about 20% of the faculty of the School of Mathematics. Perhaps more impressive than the large number of faculty named is the diversity of research in the mathematical sciences they represent. These faculty members carry out research in areas extending from analysis, discrete mathematics, number theory, partial differential equations, probability theory, and topology to mathematical physics, optimization, and theoretical computer science. This diversity of highly regarded researchers is emblematic of the breadth and depth of mathematical activity at Georgia Tech.

Bobcat's Wreck (Floyd Field's "Ramblin' Wreck")

by Richard Duke

Floyd "Bobcat" (or "Bocat") Field was the third chairman of the mathematics department, and the Institute's first dean of men. He is also known as the owner of the first vehicle dubbed the Georgia Tech "Ramblin' Wreck." Some claim that the term itself goes back farther, to cars cobbled together by early Georgia Tech engineers working on the Panama Canal or in the jungles of South America, but Field owned the first Ramblin' Wreck in Atlanta. This was his black 1914 Ford Model T. Field was an avid motorist and drove his car everywhere. This included to and from his home, which after 1920 was a house that he and his eldest two sons built in Decatur, as well as to his family home in Oregon and to meetings of the AMS and MAA all over the country. The Model T became so familiar on campus that when there were rumors in 1927 that he intended to retire it, there were student protests. When he did replace it with a Model A in 1928 the *Technique* ran an obituary that read in part as follows: "The car itself was a stimulus to flagging spirits. What persistence lay in its performance, as year in and year out it hauled the dean to and from school. Of course its body was not in keeping with the latest style, or its color one to excite an artist, but what can be more beautiful than faithfulness. Who can ask more of machinery than to have it run." In



Dean Floyd Field is beaming in anticipation of his first trip west. That's his wife and daughter in the car.

memory of the Model T, Field started an annual "old Ford race" from Atlanta to Athens, but after outings in 1929 and 1930 he and others decided that this was too dangerous, and in 1932 the race was replaced by the on-campus Ramblin' Wreck parade.

Field was born in Salem, Oregon, in 1873. He obtained a bachelor's degree from Willamette University in 1897 and another from Harvard in 1900. The next year he taught at a private school in Massachusetts and married Lillian Roblin, also from Oregon. In 1902 both he and his wife received AM degrees from Harvard. After a year at Pennsylvania State College he became head of the mathematics department at the Evanston Academy of Northwestern University. While there he also attended courses at the University of Chicago. He was hired by Georgia Tech as an instructor in 1906, the same year as Vernon Skiles. In a note in a Harvard alumni publication he stated that the health of his eldest son was the reason for his move to the South. In 1909, after the departure of a man named Otto Geckeler who had become chairman upon the death of Lyman Hall, Field was named acting chairman, and the next year he was made a full professor and head of the department. In 1912 he went back to Harvard, but during that year his wife died, and he returned to Atlanta. He would later remarry and have a daughter and a third son.

In 1921 Field lobbied the trustees for the creation of the post of dean of men, and when they agreed he was given the position himself—with the understanding that he would remain head of the mathematics department, continue to teach 10 hours a week, and get no increase in pay. He continued as department head until 1934, when that position was taken by D. M. Smith, and would remain dean until 1946.

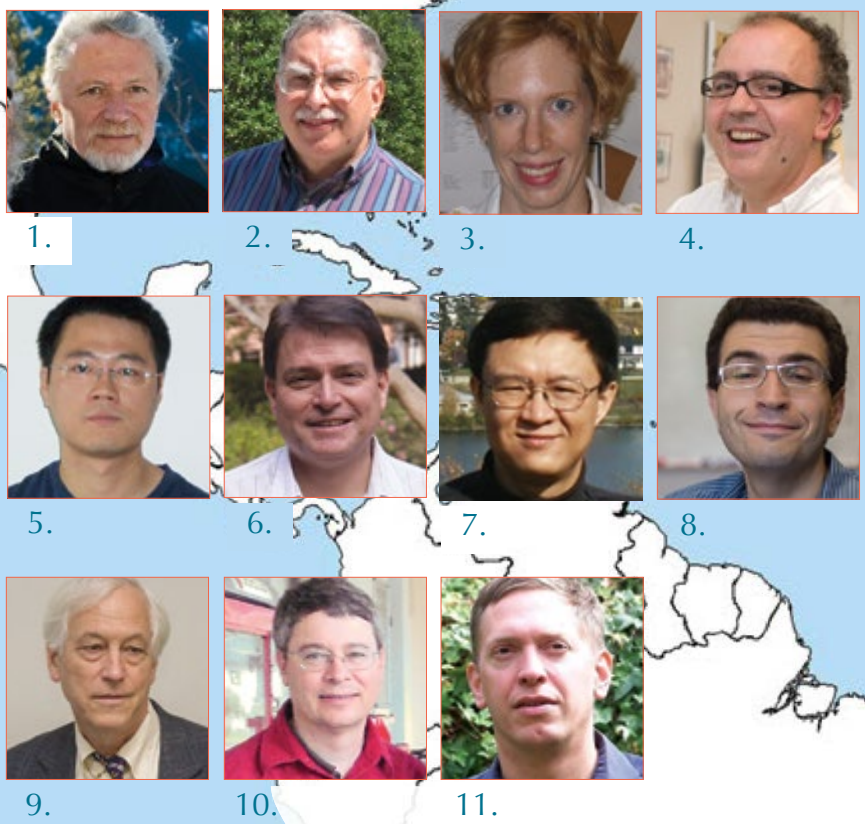
As dean, Field was involved in nearly every aspect of campus life. He is often credited with creating the Greek system at Georgia Tech. In fact fraternities had been around for some time, the first being ATO, which was founded at Tech in 1888. But Field did bring about a fraternity "system." He organized an Interfraternity Council, oversaw the establishment of the fraternity row along Third Street, and insisted the houses follow sound business practices and be ranked by average GPA.

The 1946 *Blue Print* was dedicated to Field when he finally retired, but he remained active after that. In 1951, for example, at the age of 78, he represented Georgia Tech at a conference in Athens (whose topic was, fittingly, gerontology). In 1962, four years after his death, the Floyd Field Residence Hall at Techwood and Bobby Dodd Way was dedicated to his memory.

Where in the World Are Georgia Tech Mathematicians?

Where? Well, from time to time, they are working with their research collaborators in **Africa...Benin, Senegal Asia...China, India, Japan, South Korea; Europe...the Czech Republic, Denmark, England, France, Italy, the Netherlands, Romania, Scotland, Spain, Sweden, Switzerland; the Middle East...Israel, Turkey; Oceania... Australia; North America…Mexico, the United States (SC, IL, CA, MI); and South America...Argentina, Brazil, and Colombia.** As you look at the maps, you will see photos of some of the faculty members who continue to pursue research throughout the world: a well-traveled group!

—The Editors



1. LYONIA BUNIMOVICH is working with Valentin Afraimovich, San Luis Potosi, Mexico.
2. RAFAEL DE LA LLAVE is working with Arturo Olvera, National Autonomous University of Mexico (UNAM), Mexico.
3. CHRISTINE HEITSCH is working with Svetlana Poznanovik, Clemson University.
4. CHRISTIAN HOUDRÉ is working with Victor Pérez-Abreu, from CIMAT in Guanajuato, Mexico.
5. ZHIWU LIN is working with Vera Mikyoung Hur, University of Illinois at Urbana-Champaign.
6. DOUG ULMER is working with Alice Silverberg, from University of California, Irvine.
7. CHONGCHUN ZENG is working with Peter Bates, Michigan State University.
8. GREG BLEKHERMAN is working with Mauricio Velasco, Universidad de los Andes, Colombia.
9. EVANS HARRELL is working with Pawel Kröger, Technical University Federico Santa Maria, Chile.
10. CHRIS HEIL is working with Ursula Molter, Argentina.
11. HEINRICH MATZINGER is working with Fábio Machado, University of Sao Paulo (USP), Brazil.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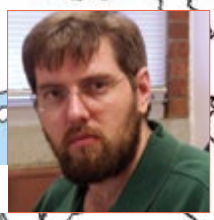
23.


24.

12. JOSEPHINE YU is working with Anders Jensen, Aarhus, Denmark.
13. ANTON LEYKIN is working with Jan Draisma, the Netherlands.
14. DAN MARGALIT is working with Tara Brendle, University Glasgow, Scotland.
15. SUNG HA KANG is working with Riccardo March, Rome, Italy.
16. MATT BAKER is working with Erwan Brugalle, Jussieu, France.
17. JOHN ETNYRE is working with Tobias Ekholm, Uppsala University, Sweden, and Mittag-Leffler Institute.
18. IONEL POPESCU is working with Mihai Pascu, from University Transylvania of Brasov, Romania.
19. WILFRID GANGBO is working with Yann Brenier, École Polytechnique de Paris, France.
20. HEINRICH MATZINGER is working with Raphael Hauser, University of Oxford, United Kingdom.
21. STAVROS GAROUFALIDIS is working with Rinat Kashaev, University of Geneva, Switzerland.
22. ROBIN THOMAS is working with Zdenek Dvorak, Charles University, Czech Republic.
23. ERNIE CROOT is working with Harald Helfgott, University of Bristol, United Kingdom.
24. CHRISTINE HEITSCH is working with Zsuzsanna Sükösd, Aarhus University, Denmark.

25.

26.

25. CHRIS HEIL is working with Ramazan Tineztepe, Turkey.

26. ERNIE CROOT is working with Vsevolod Lev, University of Haifa-Oranim, Israel.

27. WILFRID GANGBO is working with Joel Tossa and Aboubacar Marcos, Institute for Mathematical and Physical Science, Benin, and Diaraf Seck, Universite Cheikh Anta Diop, Senegal.

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28. JOHN MCCUAN is working with Manxi Wu, China.

29. RAFAEL DE LA LLAVE is working with Xifeng Su, Beijing Normal University, China.

30. YINGFEI YI is working with Min Ji (Chinese Academy of Science), China.

31. HAOMIN ZHOU is working with Wen Huang, University of Science of Technology of China (USTC), Hefei, China.

32. LIANG PENG is working with Deyuan Li, Fudan University, China.

33. EVANS HARRELL is working with Kazuhiro Kurata, Tokyo Metropolitan University, Japan.

34. ROBIN THOMAS is working with Ken-ichi Kawarabayashi, National Institute for Informatics, Tokyo, Japan.

35. MOHAMMAD GHOMI is working with Jaigyoung Choe, Korean Institute for Advanced Studies, Seoul, South Korea.

36. BRETT WICK is working with Jaydeb Sarkar, India.

37. STAVROS GAROUFALIDIS is working with Craig Hodgson, University of Melbourne, Australia.

37. 

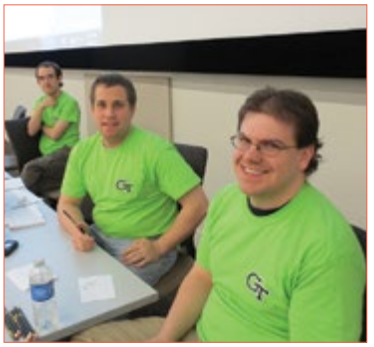
The Georgia Tech High School Math Competition

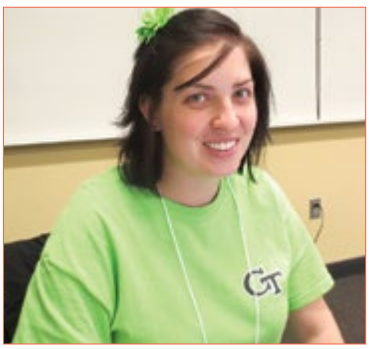
by Chris Pryby

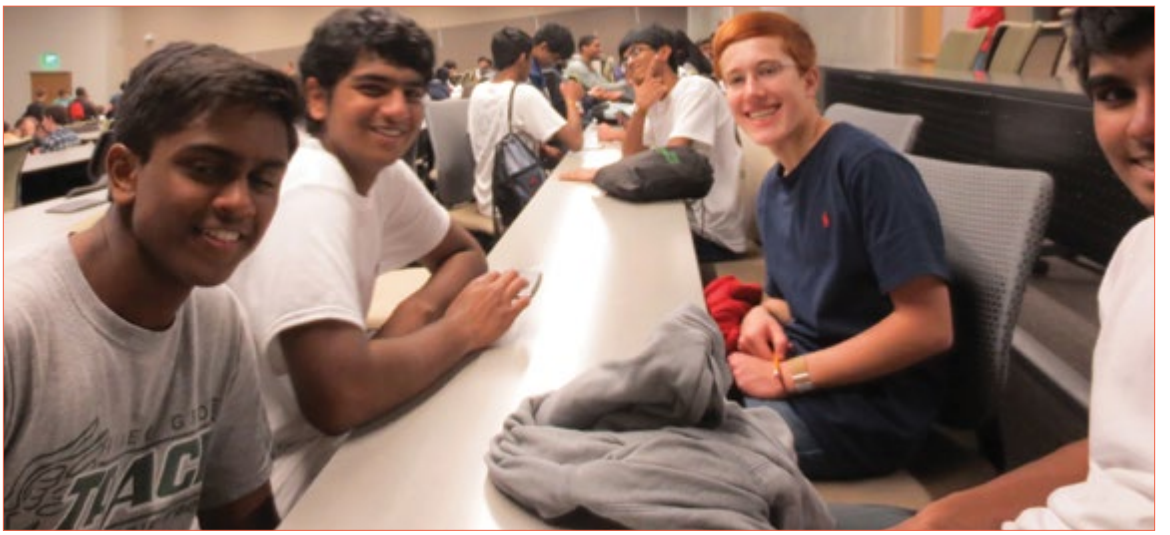
In March 2013, the School of Mathematics once again hosted its annual High School Mathematics Competition (HSMC). More than 300 students from 49 schools competed in exams testing their abilities in algebra, geometry, trigonometry, combinatorics, and mathematical reasoning. All the contestants took a 90 multiple-choice test as well as a 10 question ciphering test in which they had only three minutes to solve each problem. Fifty-nine contestants qualified to be semifinalists and took a proof-based exam to determine the final rankings.

The origins of the HSMC stretch back to 1958. The original competition consisted of a single, two-part exam lasting a total of three hours. First place was awarded a gold medal and $100 cash; second through fifth places received cash prizes ranging from $75 to $20. This year, the top three juniors and seniors winning scholarships to attend Georgia Tech were Gil Goldshlager ($1,500), Edward Park ($1,000), and David Xing ($750). (As you can see, the prizes have risen with the cost of tuition!) The competition's overall winner was David Stoner from South Aiken High School, but because he was a sophomore this year, he was not eligible to receive a scholarship. Needless to say, we certainly look forward to his participation in the future.

The School of Mathematics is proud to boast that the HSMC organizing committee is entirely student-run. This year's organizers were applied mathematics senior Martin Copenhaver (chairman), doctoral student Chris Pryby (co-chair and head grader), applied mathematics junior Peter Woolfitt (supplies coordinator), master's student Ashley Bentley (registration coordinator), and master's student Becky Maust (volunteers coordinator). The committee also owes a tremendous debt to staff members Christy Dalton, Sharon McDowell, and Annette Rohrs for all their hard work in keeping the competition running; faculty advisor Dr. Tom Morley; and all the undergraduates, graduates, faculty, staff, and alumni from the School of Mathematics who came to help out this year at the competition itself.







Georgia Tech News: Jilin University

The JLU-GT Joint Institute for Theoretical Sciences

For the past three years, SoM Professor Yingfei Yi has been charged with organizing the JLU-GT Joint Institute for Theoretical Sciences that promotes collaborative research and educational activities involving Georgia Tech, in particular the School of Mathematics, and Jilin University, one of the major national universities in China.

Physically located on the main campus of Jilin University, the Institute was officially established in 2012 under a Statement of Intent co-signed by both presidents of the two universities. Strong support for the establishment of the Institute was received from Georgia Tech administration at all levels: the President's Office, the Provost's Office, the Office of Vice Provost for International Initiatives, the Dean's Office of the College of Sciences, and the Chair's Office of the School of Mathematics.

Both Dr. Evans Harrell, associate dean of the College of Sciences, and Dr. Doug Ulmer, chair of School of Math, have visited Jilin University to discuss the plans in detail as well as other collaborations, and are among the main promoters of this Institute. Many School of Math faculty members including Professors Shui-Nee Chow, Rafael de la Llave, Luca Dieci, and Liang Peng have helped with the Institute's operation and activities to date.

During the past two years, the Institute has brought several visiting postdocs and exchange graduate students from Jilin University to the School of Mathematics and, last fall, it brought 26 Jilin University honors undergraduate students to participate in the School of Math Visiting Honors Student Program, which was also attended by 10 students from Xi'an Jiaotong University.

The Institute has invited a number of faculty members and students from the School of Mathematics to visit Jilin University for either long- or short-term visits. The Georgia Tech faculty members visiting the Institute have successfully organized a number of conferences and workshops, including the "International Conference on Quantitative Finance and Risk Management," held July 2–4, 2012; the "Forum on Nonlinear Science" held July 6–9, 2012; and the "Workshop on Dynamical Systems and Applications," held June 28–30, 2013. Later during summer 2013, Professors Federico Bonetto, Rafael de la Llave, and Luca Dieci worked at the Institute under a Tang-Aoqing visiting professorship and gave intensive courses for graduate students and honors students in the prestigious Tang-class.

Riemann-Roch for Graphs and Some Applications

by Matt Baker

The Georgia Tech School of Mathematics has recently built a vibrant group of researchers interested in algebraic geometry, including (in addition to myself) Doug Ulmer, Anton Leykin, Josephine Yu, Greg Blekherman, Joe Rabinoff, and Kirsten Wickelgren. The School of Math also has a long-standing strength in graph theory, with distinguished researchers such as Prasad Tetali, Robin Thomas, Tom Trotter, and Xingxing Yu. Several years ago Serguei Norine and I discovered a graph-theoretic analogue of the Riemann-Roch Theorem, which is one of the most celebrated results in algebraic geometry. I want to explain this result and how it came about.

1. The Riemann-Roch Theorem

The Riemann-Roch Theorem is an incredibly useful result about analytic functions on one-dimensional complex manifolds (now known as Riemann surfaces). Given a set of constraints on the orders of zeros and poles, the Riemann-Roch Theorem computes the dimension of the space of analytic functions satisfying those constraints. More precisely, if D denotes the set of constraints and r(D) is the dimension of the space of analytic functions satisfying those constraints, then the Riemann-Roch Theorem asserts that

$$r(D) - r(K - D) = \deg(D) + 1 - g$$

where g is the genus (= "number of holes") of the Riemann surface X, deg(D) is the total number of constraints, and K is something called the "canonical divisor" on X, which we won't get into (it's related to combing hairs on X). Originally formulated as an inequality by the great German mathematician Bernhard Riemann, it was strengthened in 1863 (150 years ago!) to an exact formula by the young mathematician Gustav Roch, who wrote his thesis on electromagnetism but then turned his attention to pure mathematics. (Both Riemann and Roch died of tuberculosis, Riemann at age 39 and Roch at age 26. Riemann—who discovered Riemann sums, Riemannian geometry, and the Riemann zeta function, among many other things—is considered one of the great mathematicians of all time; we will never know what might have become of Roch.) The proof of Riemann and Roch was in fact incomplete; a gap in Riemann's use of the so-called "Dirichlet principle" was found by Karl Weierstrass. The proof was finally made rigorous via the work of David Hilbert in the late 19th century.

The Riemann-Roch Theorem is a bit too technical to state in the *ProofReader*, but it is relatively straightforward to formulate the combinatorial analogue that Serguei Norine and I discovered. Before I do that, however, I want to briefly reminisce about how this result came about. In the summer of 2006, my Georgia Tech REU (Research Experience for Undergraduates) student Dragos Ilas worked on a graph-theoretic conjecture I had made. Dragos spent eight weeks working on the problem and compiled a lot of experimental evidence toward my conjecture. He gave a talk about the problem one Friday toward the end of the summer in an REU Mini-Conference that I organized here at Tech. Serguei Norine was in the audience. (I didn't know Serguei at the time, but he had received his PhD from Georgia Tech under the direction of Robin Thomas a couple of years earlier and then went to work for a hedge fund on Wall Street. However, Serguei decided to return to academic mathematics and was doing a one-year postdoc at Georgia Tech.) On Monday morning, Serguei knocked on my office door and showed me an extraordinarily clever proof of my conjecture. I told Serguei about my real goal, which was to prove a graph-theoretic analogue of the Riemann-Roch Theorem. I outlined what I had in mind, and within a week, we had exactly the kind of Riemann-Roch formula I had hoped for. Serguei's lightning-fast thinking and mathematical creativity really knocked my socks off...

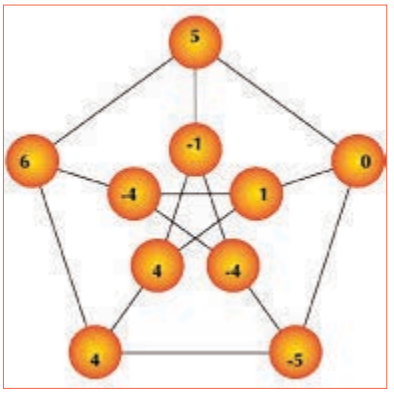
2. Riemann-Roch for Graphs

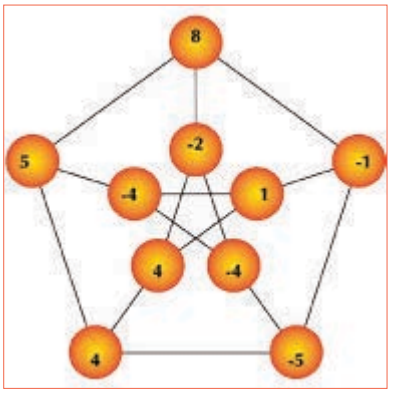
To explain our result, consider the following game of solitaire played on a (finite connected) graph G. The game begins with an initial configuration D, which is an assignment of some integer number of dollars (which could be positive, negative, or zero) to each vertex of G. A vertex with a negative number of dollars is said to be in debt.

There are two kinds of legal moves in the game. A lending move consists of selecting a vertex v and then moving one dollar across each edge adjacent to v in such a way that the money

flows from v to its neighbors. A borrowing move is similar, except that the money flows in the other direction. For example, below is an illustration of a borrowing move performed on the famous "Petersen graph." The picture on the left shows the starting configuration, and the picture on the right shows the new configuration after the top vertex performs a borrowing move.

The goal of the game is to get all the vertices of G out of debt by a sequence of legal moves.





I stumbled upon the idea that there ought to be a graph-theoretic avatar of the Riemann-Roch Theorem while investigating algebraic curves defined over the field of p-adic numbers. At the time I didn't know precisely how to formulate the combinatorial Riemann-Roch Theorem, but I knew that the following should be a special case (this was the REU problem mentioned above):

Conjecture: Let g = #edges−#vertices+1 be the genus (also called the Euler number) of G and let N denote the total number of dollars in the game at any time. If N is at least g, then the game is always winnable.

For example, in the Petersen graph game depicted above, we have g = N = 6, so the conjecture implies that the game depicted there should be winnable (which it is; see if you can find a winning set of moves).

We need just a little more notation. Let K be the canonical configuration K(v) = (#edges adjacent to v) − 2.

For each configuration D, define its degree deg(D) to be the total number of dollars in the game, and define its rank r(D) to be −1 if the game starting with D is not winnable, and otherwise to be the largest integer k such that the game is still winnable after subtracting k dollars from D in an arbitrary way.

Theorem 1 (Riemann-Roch Theorem for Graphs)

For any configuration D on any graph G,

r(D) − r(K − D) = deg(D) + 1 − g.

It is easy to deduce the conjecture above from this result. Riemann-Roch for graphs also shows that there is a duality present in the dollar game that is not readily apparent. For example, if D is a configuration of degree g − 1, then the game with initial configuration D is winnable if and only if the game with initial configuration K − D is winnable.

When we originally proved the graph-theoretic Riemann-Roch Theorem, I did not have any specific applications in mind, although I had a hunch that it would someday prove useful. This hunch turned out to be correct: Our result has been applied in algebraic geometry, combinatorics, and number theory. I'm optimistic that this point of view will continue to be fruitful for researchers in the future.

(See the blog post "Riemann-Roch for Graphs and Applications" at http://mattbakerblog.wordpress.com/ for more details on these applications.)

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School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160

Faculty Profile: Sung Ha Kang

by Cathy Jacobson

Born and raised in Korea by parents who were an architect and a high school music teacher, Professor Sung Ha Kang showed an early aptitude in both art and mathematics. In fact, because she excelled at painting and drawing, her high school art teacher assumed she would study art in college. However, Sung Ha's interest in science was clear, and she also shone in mathematics and physics classes, often being the top-ranked student.

So, although Sung Ha enjoyed art—and continues to this day to be an avid appreciator of all the fine arts—she ultimately found that math and physics "made the most sense to me, while languages, literature, and social science were not as appealing." And so she completed her first degree, a BS in pure mathematics at Yonsei University, Korea, in 1997.

Professor Kang said that as children, she and her older brother passed the time disassembling and reassembling old phones and other items for pleasure. She reports that "it was fun to see how things were made inside, and I enjoyed understanding the function of each of the small pieces." Ultimately, he became an engineer and she a mathematician!

Professor Kang's research interests center on image processing: denoising, deblurring, and decomposition, among others. She applies partial differential equations (PDEs) and the calculus of variations to image processing. Her work involves modeling and mathematical analysis.

On one hand, Professor Kang builds mathematical models to accomplish sophisticated goals. For example, she developed a high-level variational model based on Euler's elastica for a problem called inpainting, which aims to remove damage, such as scars or scratches, in an image and fill in appropriate information from neighboring regions. This problem finds many applications in art, computer graphics, and the military.

On the other hand, Professor Kang is an analyst. She studies the mathematical properties of the various image processing models to discover why and how a model works for image processing tasks. For instance, she is the first one who gave a rigorous proof showing that the famous total variation inpainting model works with a clear error estimate. Her result explains why the model works better for an inpainting region that is long and thin and not so well for large, fat regions, even though both have a similar area.

Here is an example of how software and mathematical analysis can take a partially colored image and fill in large regions of color:

For more complicated images with fine structures, one can imagine the colorization will not be very successful. For example, the image on the left is given, and on the right is the result (where not every part is colorized).

A more sophisticated reproducing kernel Hilbert space diffusion gives:

Notice the diffusion can go over edges and colorize all similar regions. The colorization is more natural, and the numerical method becomes simply solving a least-squares problem and gives explicit solutions.

Professor Kang's work and talks are always refreshing and creative, and her publications have generated large impacts. For example, her paper "Euler's elastica and curvature-based inpainting" (with J. Shen and T. Chan) has been cited over 400 times according to Google Scholar as of 2013.

Professor Kang is also known for effective teaching. Her sections always seem to cover more material than others do, and she is a clear and engaging speaker. In her research group, she is the most frequently sought-after speaker for domestic and international seminars and meetings.

Sung Ha never imagined that she would ultimately be an academic. "Growing up, I never saw a female math professor, and I thought I could never be a professor," she recalls. She takes teaching very seriously and believes that it presents an opportunity to have a positive impact on future generations. In the past, being a female who "looks young" has sometimes presented challenges in terms of student expectations and classroom realities, but experience has led her to describe herself as dealing with those realities as a tough but fair professor.

Sung Ha also likes going to random talks in the School of Math that are not in her area in order to be more aware of what is out there and what can be done in the world of mathematical research. "I think math is beautiful, and mathematical ideas are important," she says. Sharing that enthusiasm with her students is an important component of her instruction.

Having collaborators in interesting places is a benefit that Professor Kang enjoys. Her collaborations take her to both Europe and Asia annually, and she has noticed that interest in some topics is delayed or viewed differently from the interest she finds here in the US. She tries with each trip to learn more about the host country and culture through visits to the local museums and music halls and hikes in the countryside if time permits.

Back in Atlanta, Sung Ha treasures her time with her husband and friends and enjoys the many theatrical and classical musical offerings of the city. She is currently most interested in 20th and 21st century visual arts and tries to see the work of living artists whenever possible.

(Note from the Editors—Professors Luca Dieci, Yingjie Liu, Douglas Ulmer, and Haomin Zhou contributed to this article.)

Faculty Awards July 2012–June 2013

August 2012

Professor **Anton Leykin** was awarded an NSF CAREER grant. These grants are "the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research."

November 2012

Twelve faculty from Georgia Tech's School of Mathematics were named Fellows of the American Mathematical Society (AMS). The listing represents the society's inaugural class and includes 1,119 fellows from more than 600 institutions. (see page 5)

December 2012

For the second time in as many years, **Klara Grodzinsky** received the Class of 1934 Course Survey Teaching Award from the Center for the Enhancement of Teaching and Learning (CETL) in recognition of high Course/Instructor Opinion Survey (CIOS) ratings and high response rates. The award includes a monetary bonus and recognition at Celebrating Teaching Day in March. This most recent award was for spring and fall semesters 2012. The previous award was for spring and fall 2011.

February 2013

Professor **Haomin Zhou** was awarded a grant of about $600K from the Office of Naval Research for a project titled "Efficient Numerical Methods for Several Visibility Optimization Problems".

April 2013

Dana Randall, professor of computer science and adjunct professor of mathematics, has received the Institute's Outstanding Service Award. Randall has provided outstanding service to her schools, the Institute, and the profession. She focuses a significant portion of her energies on mentorship, with a major emphasis on promoting women in science. She recently organized the event "Connections for Women: Discrete Lattice Models in Mathematics, Physics, and Computing." She also created a task force on mentoring and transparency for the College of Computing, and she designed the Equity, Diversity and Excellence Initiative currently being launched.

Through events such as the ADVANCE Town Hall on Livability and Productivity, she contributes to the job satisfaction of Georgia Tech's entire faculty. Randall also initiated a groundbreaking multidisciplinary workshop with Jennifer Chayes of Microsoft Research that combined statistical physics with computer science. Along with serving on editorial boards across disciplines, she has also chaired program committees for prestigious conferences in mathematics and computer science.

May 2013

Professor Leonid Bunimovich was a guest of honor at the 109th Statistical Mechanics Conference that took place at Rutgers University, May 12–14, 2013. Mitchell Feigenbaum and Leo Kadanoff were also honored. A musical program was presented in honor of the guests. Professor Bunimovich joined a very distinguished list of previous honorees, including:

- Michael Fisher, Jerome Percus, and Ben Widom (December 2011)
- Eddie Cohen, Elliott Lieb, and Oliver Penrose (May 2012)
- John Reppy, Jan Sengers, and Harry Sweeney (December 2012)

June 2013

The Simons Foundation Collaboration Grants for Mathematics were awarded to faculty members Mohammad Ghomi, Plamen Iliev, and Sung Ha Kang. The goal of the program is to support the mathematical marketplace by substantially increasing collaborative contacts in the community of mathematicians working in the United States.

Professors Stavros Garoufalidis, Christian Houdré, and Zhiwu Lin have been selected as Simons Fellows in Mathematics. The fellow programs provide funds to faculty for up to a semester-long research leave from teaching and administrative obligations.

The following faculty members were recognized for their years of service to the School of Mathematics at Georgia Tech:

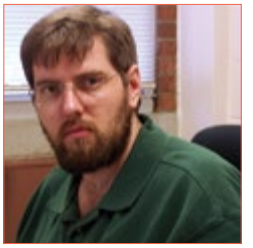
10 years—Ernie Croot, Igor Belegradek, Mohammad Ghomi, Plamen Iliev, Heinrich Matzinger, Ronghua Pan, Haomin Zhou

20 years—Chris Heil, Andrzej Swiech

25 years—Shui-Nee Chow, Michael Loss

Faculty Promotions

Igor Belegradek
Full Professor



Ernie Croot
Full Professor

Yingjie Liu
Full Professor

Anton Leykin
Associate Professor with tenure

Faculty News July 2012–June 2013

January 2013

Games Without Chance: Combinatorial Game Theory

Interested in learning the mathematics that governs games? Professor Tom Morley taught a course online via Coursera titled "Games Without Chance: Combinatorial Game Theory." This seven-week course covered the mathematical theory and analysis of simple games without chance moves.

So, if you are a fan of games, mathematics, or both, we hope you checked it out!

April 2013

The Georgia Tech Urban Honeybee Project

On Saturday, April 20th, mathematician and beekeeper Professor Stavros Garoufalidis helped the Georgia Tech Urban Honeybee Project install two nucleus colonies of bees from Jennifer Berry at Honey Pond Farms. The bees were moved into the new GT apiary set up on the roof of Clough Commons.

When asked by the Editors how he became involved in beekeeping, Stavros replied: "Five years ago my wife, Moira Bucciarelli, who is a master gardener, signed us up for a one-day course in beekeeping at the Atlanta Botanical Gardens. I attended the class and found it fascinating. Then, I researched the subject, read books, and got our first two hives that died the following spring. Beekeeping is a challenge nowadays, due to varroa mites, small hive beetles, and colony collapse disorder. Yet, the bees survive against all odds, and the reward is sweet honey. Three years ago one hive gave us 110 pounds of honey! Honeybees give me a connection to the land and the seasons, with spring being by far the most exciting one. I have lots of stories of catching swarms and driving around town with live honeybees in the car flying all around me, and windows down. But that's a story for another time!"

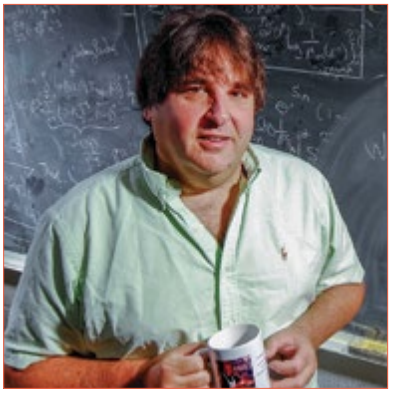
If you are curious and want to learn more about the project, please e-mail *jennifer.leavey@cos.gatech.edu* or *stavros@math.gatech.edu*. The GT bee research has begun!

May 2013

Georgia Tech School of Mathematics Ranking

Georgia Tech mathematics comes in at *#18 worldwide* in the latest QS World University Rankings. First compiled in 2004, QS World University Rankings were conceived to present a multifaceted view of the relative strengths of the world's leading universities. The research currently considers more than 2,000 universities and ranks more than 700.

Faculty News: Howie Weiss, Protecting Passengers...



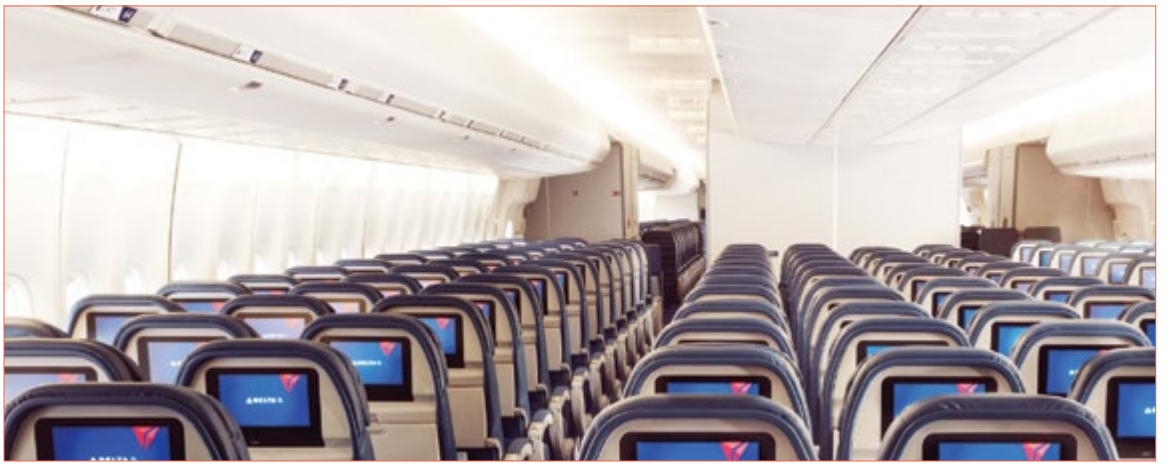
Professor Howie Weiss is currently the principal investigator of a $1.5 million Boeing-sponsored "Fly Healthy" research study, a collaboration between Georgia Tech and The Rollins School of Public Health at Emory University. Delta Airlines is facilitating several aspects of this project. For this work, Professor Weiss was honored during halftime at a GT football game as a Georgia Power Professor of Excellence.

The goal is to understand the rates and routes of transmission of infectious diseases in an airplane cabin during flight and to find strategies to mitigate transmission. Major research components are (1) chronicling the movement and interactions of passengers and crew, (2) characterizing the microbial communities throughout the cabin (cabin microbiome), and (3) studying the role of these microbes in the transmission of human disease.

The team recently completed its 10th and final research flight. Over the summer, the statistician members of the group are cleaning the movement data and creating the dynamic network of close interactions. The Hudson Alpha Institute for Biotechnology will be analyzing the environmental samples.

To record movement, the plane was segmented into virtual zones, one for every five rows in the economy cabin. Pairs of graduate student researchers from The Rollins School of Public Health were seated in aisle seats in the same row at the back of each zone. The 10 graduate students recorded all movements of passengers and crew in their zones using a specially designed iPad app while the aircraft was above 10,000 feet. Another researcher operated two air-sampling pumps that sampled the cabin air. One pump operated continuously while the other took samples during five stages of flight. Other researchers took surface swabs of lavatory door handles, tray tables, and seat belt latches before boarding and after deplaning.

Based on the measured levels of the pathogens, their estimated infectivity, and the observed contact patterns, Weiss and his team will construct mathematical models to estimate how infectious diseases may spread in the cabin during flight. This research will expand our fundamental knowledge of pathogen prevalence, transmission opportunities, and transmission frequencies in an aircraft cabin.



Graduate Awards

July 2012–June 2013

The 2013 CETL-BP campus-wide TA award for the Outstanding Graduate Teaching Assistant went to our SoM TA, **Ranjini Vaidyanathan**.

Congratulations also to **Albert Bush**, who was a CETL-BP finalist in the category of Outstanding Graduate Student Instructor.

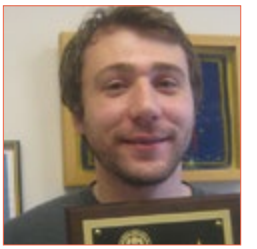
Festa Fellowship: **Meredith Casey**
The graduate committee awards this fellowship (with a $1,300 cash stipend) to the student who shows superior academic and leadership skills.

Best S-STEM Fellow: **Rebecca Maust**
The Best S-STEM Fellow is given to the STEM fellow who exhibits superior academic skills and who is contributing significantly to the STEM program and department. Stipend: $250

Bob Price Summer Research Assistant Award: **Peter Whalen**
This supports a Summer RA position plus a little travel to conferences or universities to enhance a research program.

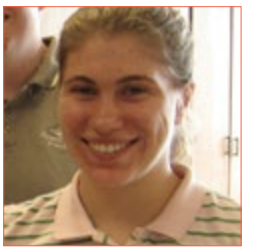
Bob Price Travel Awards:
Chun-Hung Liu, Tobias Hurth
These are larger travel awards than the department can usually give; amounts vary depending on each student's travel needs.

The following three SoM awards are $250 credits that can be used only to reimburse expenses.



Best PhD Thesis:
Luke Postle (Left: ACO, advisor Robin Thomas)
James Scurry (Right: advisor Brett Wick)

SoM award for evidence of superior academics and achievement.
Top Graduate Student: **Farbod Shokrieh**



SoM award for superior teaching assistance performance.
Outstanding Graduate TA: **Rebecca Winarski**

Undergraduate Awards

July 2012–June 2013

SoM Senior Prize: Given in recognition of outstanding academic accomplishments and excellence. Stipend: $200
Martin Copenhaver, Tyler Cox, Ross Granowski

School of Math Teaching Assistant Awards: At our awards ceremony again this year, our resident poet (and undergraduate coordinator), Professor Doron Lubinsky, recited his tribute to the SoM TA awardees:

Another year has passed.
The workload has left us aghast.
The TAs are slaving
to fulfill students' craving
for review sessions that last.

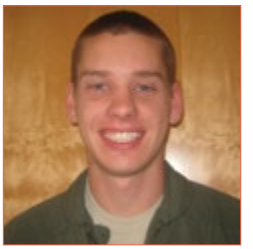
MyMathLab has surely become
a tool leaving some of us glum.
Which keystrokes to use?
Which options to choose?
lest we delete almost every one.

The School of Math has done very well.
Its prize haul doth annually swell.
Our survey course rating
proves extremely frustrating
to Institute rivals, so they tell.

So come let us celebrate now
students' teaching, research, and know-how,
Can we ever compete,
let alone beat,
our current graduates somehow?

SoM Outstanding Undergraduate TAs: Graduating seniors who have excellent evaluations from students and faculty and have been good departmental citizens. Stipend: $50
Renee Franklin (R), Santhosh Karnik(L)

SoM Outstanding Student Evaluations: These UTAs were judged by their recitation classes to be effective teachers as indicated by a response rate of at least 50% and a score of 4.9 or higher on the question "Considering everything, the TA was an effective teacher."
Cemre Berk
Ryan Kerns
Andrew McCullough
Ross Schlegel



Outstanding Undergraduate Teaching Assistant Award: The 2013 CETL-BP campus-wide recognition went to our SoM TA, **Travis Rogers**.

Please see the articles "SoM Undergraduate World" on page 36 and "Undergraduate Student Profiles" on page 37 to read more about our outstanding undergraduates.
—The Editors

Retiring Staff: Jan Lewis

by Sharon McDowell, editorial team

Jan Lewis is a native Georgian, originally from the city of Moultrie. She received a bachelor's degree from the University of Georgia in psychology and a master's degree from Georgia State University in human resource development. She began her career at Georgia State University in the College of Education as a human resources assistant. In 1985, Jan joined Georgia Tech as a human resources coordinator with Georgia Tech Research Institute (GTRI). She also worked for the Economic Development Institute as a program coordinator and project analyst. She came to the School of Mathematics (SoM) in 1999 as an administrative manager.

Jan said the most challenging part of her job was dealing with office space and facilities issues, and the most enjoyable part was interacting with faculty, staff, and students. She said she is amazed at how the campus has changed over the last 25 years. Jan remarked that there was a time when she knew the name and location of every building on campus!

Doug Ulmer, SoM chair, noted that Jan had been a cornerstone of the School long before he arrived. He said "I couldn't count the number of times in the last four years that she has helped us all out. She has incredible knowledge of every aspect of the campus—facilities, purchasing, HR, you name it—expert management skills, and unfailing charm and good humor. It has been a privilege and a delight to work with Jan."

Reading, movies, working out, and traveling are a few of Jan's many hobbies. She especially likes adventure travel (hiking, biking, etc.), where she can learn about the people and cultures of different regions. Jan has one additional hobby that makes her the envy of family and friends: She is a master Scrabble player who sometimes scores over 500.

Lew Lefton, SoM IT director, offered this about Jan: "I have had the pleasure of working closely with Jan Lewis for many years. She interacts with the computer support group as faculty, students, and visitors get set up in their new offices. She has saved me serious heartburn by being the person who deals directly with the wonderful folks in Asset Management, OHR, Facilities, and many other campus administrative and business services. Plus, she secures the special school-parking pass, which is true power. Jan has a great attitude, a great sense of humor, and is smart and sweet at the same time. I can safely say that working with her has been more awesome than drawing a "Q" and a "u" at the same time in Scrabble, which, as she knows, is really awesome! We'll miss you Jan."

Now that she has retired, Jan plans to do more traveling, take care of household repairs, and work with dog rescue groups. The School of Mathematics will truly miss its "chief of staff."

Retiring Staff: Genola Turner

by Sharon McDowell, editorial team

When the School of Mathematics graduate students searched for information, they turned to Genola Turner, academic assistant II for graduate programs. And with good reason: her broad experience and knowledge benefited all who needed advice on the working intricacies of Georgia Tech. Genola is a native of Shreveport, Louisiana. She attended Southern University (SUSBO), where she studied business administration. Before moving to Atlanta, she worked as a loan processor in Florida. She began at Georgia Tech in 1992, first working with the Bursar's Office, where she collected students' fees. During her tenure at Tech, she also worked in the Bookstore, the Office of Procurement and the College of Sciences Dean's Office. She came to the School of Mathematics Graduate Office in January 2002.

Dr. Evans Harrell, now the associate dean of the College of Sciences, recalls, "Although I knew Genola slightly for several years earlier, our real acquaintance began in 2002, when I took over the graduate coordinator role from Dr. Bill Green and she was the support staff for the graduate program. Genola was the first staff member I had supervised, and I rapidly learned that it is not always clear who is in charge of whom! She obviously knew the procedures and many details much better than I did, taught me many things, and kept me from getting the program off the track. I'll always fondly recall her helpfulness, her good attitude, and her support of the School of Mathematics, as well as her love of her family and her involvement in her church."

Genola said the best part of her job was interacting with diverse groups of students, where she learned to be more patient and understanding of people from other cultures, and the most challenging part of her job was completing her many tasks in a timely manner. Her most memorable experience at Tech occurred during the 1996 Olympics, when she attended several events and was fortunate enough to meet a few athletes and celebrities.

Genola also worked with Dr. Luca Dieci, graduate coordinator, for several years. He stated, "In an environment where people tend to lose sight of the right priorities, Genola represented a most solid reference point for me and for hundreds of graduate students. I enjoyed tremendously witnessing her quick wit and ability to counsel and listen to all, and always finding simple solutions to what, at times, appeared to be problems with no solution. She has been a great friend to me, and to many, and I am sure she will enjoy her well-deserved retirement days with her family. We will miss her."

Genola's hobbies are reading and gardening, and it's no secret that she has one of the greenest thumbs around. Her office was evidence—she had lemon thyme, a huge pothos ivy, a prayer plant, and a proliferation of African violets. In fact, were it not for Genola, the large plants in the chair's office would not have made it through a full semester! She attributes her horticultural talents to her mother, Ivory. During retirement, Genola plans to do more gardening, and travelling and to work with the seniors and children at her church.

Conferences and Events

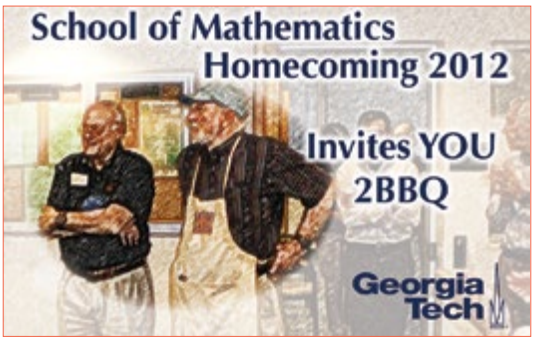
July 2012–June 2013

June 12–July 6, 2012
Algebraic Geometry for Applications: IMA Summer Graduate Program

(See article on page 30)

October 26, 2012
Homecoming 2012 Poster Session on Undergraduate Research and Reception

A barbecue hosted by the Friends of the School of Mathematics.



December 7–9, 2012
Tech Topology Conference

The second annual conference brought together established and young researchers from around the country for another weekend of mathematics. Sponsored by the NSF and Georgia Tech, the conference was organized by Professor John Etnyre and Associate Professor Dan Margalit. Among the featured speakers was Rebecca Winarski of Georgia Tech.

March 16–20, 2013
Inaugural International Conference on Dynamics of Differential Equations

Hosted by the School of Mathematics, the conference was held during spring break and included two Hale memorial lectures. (See article on page 27)

May 12, 2013
Southeast Geometry Seminar

This semiannual series focusing on geometric analysis was held this year at the University of Alabama at Birmingham. Among the organizers were Georgia Tech Professors Mohammad Ghomi and John McCuan. Professor McCuan was also a featured presenter on "The stability of cylindrical pendant drops."

May 13–17, 2013
The Quantum Topology and Hyperbolic Geometry Conference

Organized by Anna Beliakova from Universitat Zurich, and Georgia Tech Professors Stavros Garoufalidis and Thang T.Q. Le, the conference was hosted by Nha Trang College of Education and Hanoi Institute of Mathematics and was held in Nha Trang, Vietnam.

Dedicated to the Memory of Professor Jack Hale: The First International Conference on Dynamics of Differential Equations

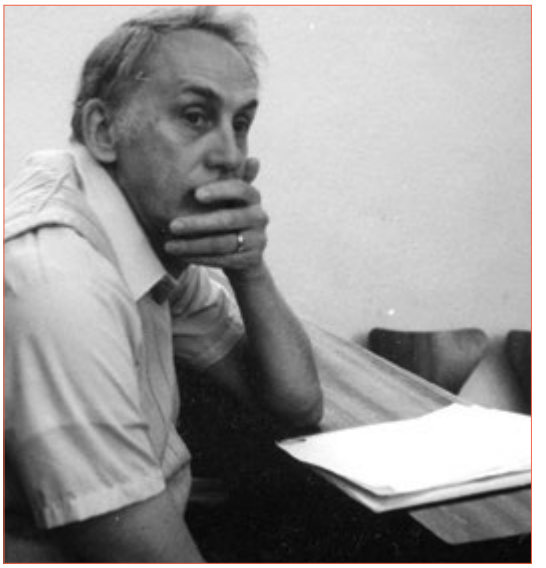
by Luca Dieci, Rafael de la Llave, and Yingfei Yi

On March 16–20, 2013, the School of Mathematics hosted the inaugural "International Conference on Dynamics of Differential Equations," the first in what will be a biennial series emphasizing research programs in dynamical systems worldwide and the training of doctoral students and young researchers. A world-renowned scholar and pioneer in many areas of dynamics of differential equations, our beloved colleague Professor Jack Hale was a true gentleman and a person of impeccable integrity whose human and scientific qualities are sorely missed by all of us. Thus, the first conference was dedicated to the memory of Professor Hale in acknowledgment of his influential role in research and training.

The scientific focus of the conference was centered on dynamics of ordinary, partial, and functional differential equations, as well as related modeling and computational methods. The main goals were to foster scientific exchange, promote interdisciplinary studies, enhance international collaboration, and train graduate students and young researchers in various aspects of dynamics of differential equations. To enhance the latter goal, four 2-hour tutorial sessions were held on the day before the conference began, and graduate students, advanced undergraduate students, and young researchers were especially invited to attend.

Attendees came from 27 different states in the USA and from 23 other countries, and virtually all had visited or studied at Georgia Tech sometime during the last quarter century. Many had come initially because of Jack's leadership at the Center for Dynamical Systems and Nonlinear Studies (CDSNS), during a time when the School of Mathematics at Georgia Tech had begun to emerge as one of the top places in the world where new mathematics in dynamical systems was being explored, a trait that continues to this day.

The conference itself included two Hale memorial lectures delivered by Professor Geneviève Raugel, 13 plenary lectures, four parallel themed sessions with more than 100 invited and contributed presentations of both theoretical and applied flavors, and a poster display. We took full advantage of the history of collaboration between Mathematics and Engineering at Georgia Tech, and our colleagues from the Engineering units delivered invited and contributed talks. Please refer to the website www.hale-conf.gatech.edu for a list of all presentations.



More than 250 people attended the conference, and that included over 100 graduate students, postdocs, and young researchers; they are, of course, the future of our field! Twelve former PhD students mentored by Professor Hale attended the conference and presented results of their research.

There were other memorable events. Evans Harrell (associate dean of the College of Sciences) gave a beautiful account of Jack's impact on mathematics beyond Georgia Tech. For many of us, a touching moment was when Hazel Hale, Jack's wife and his "center manifold," entered the banquet room to thunderous applause. Thanks, Hazel, we have

continued...The First International Conference on Dynamics of Differential Equations

missed seeing you around, and we were so happy that you could join us!

At the end of the banquet, it was also marvelous that people came up to the podium and shared their memories of Jack's impact on their lives, professionally and personally. Clearly Jack meant so much to all of us: he had this unique and marvelous personality whereby we all felt relevant in the grand scope of things, mathematical or otherwise.

Finally, it was great fun following the conference to have a barbecue at Luca's place with those still in town. (Thanks to our own alumni Erik Van Vleck and Sergio Oliva for putting it together.)

A conference of this size (large for a mathematics conference on a specific subject) would not have been possible without the support we received from several sponsors. In particular, we want to acknowledge the generosity of the National Science Foundation, Elsevier, the Institute for Mathematics and Its Applications, Springer-Verlag, and our own Georgia Tech College of Sciences and School of Mathematics. All support received was used to sponsor attendees, and all graduate students, postdocs, and junior researchers received some amount of support to help them attend the conference.

During the two years of planning, the local Organizing Committee (Professors Luca Dieci, Rafael de la Llave, and Yingfei Yi) was complemented by 29 scholars from around the world. It is therefore with gratitude that we hereby acknowledge their help as members of the Organizing Committee or of the Executive and Advisory Boards of the Conference Series, or all of the above; we are proud that many of them are former PhD students of ours! To these distinguished mathematicians, we add, with a deep sense of gratitude, our own Annette Rohrs, who was responsible for all of the logistics associated with the conference (website, registration, refreshments, e-mails, etc.), and Christy Dalton, who along with Annette, handled the reimbursements and the accounting.

By all accounts, the conference was a success. For us it was a lot of fun (and work!), and we now pass the baton to our friends in France, where the "Second International Conference on Dynamics of Differential Equations" will be held. For the time being, you may want to enjoy browsing through some of the photos taken during our conference. Chances are you will see some familiar faces; see http://hale-conf.gatech.edu/photo-gallery.

Finally, let us leave all of you "ProofReaders" with some memories of Jack. In many ways, Jack was living proof that there is more to life than mathematics, and without the "more" we are bound to lose sight of what it all means. Four key traits of his personality come to our mind and we gladly pass them along: never fail to encourage a young person, there is no job too humble, do not fear doing what no one else is doing, and always feel you are the luckiest person in the world. May we all benefit from Jack's wisdom.

IMA Summer Graduate Program

by Anton Leykin

Last June, 56 graduate students from around the world came to Georgia Tech for a three-week summer school in "Algebraic Geometry for Applications" organized by GT math professors Anton Leykin, Greg Blekherman, and Josephine Yu. The summer school was funded by the Institute of Mathematics and Its Applications and the National Science Foundation, with help from Georgia Tech's College of Sciences and School of Mathematics.

A diverse group of students from the US and abroad attended the program. Nine local students from Georgia Tech and Georgia State University attended and the remaining 47 student participants hailed from other states in the US as well as from Germany, Austria, Finland, China, and Korea.

The goal was to gather the next generation of applied algebraic geometers, provide them with advanced training, and introduce them to the community. The students received an invaluable opportunity to actively interact with and receive hands-on mentoring from leading experts. Five postdoctoral assistants provided additional help and mentoring.

The program consisted of daily lectures and exercise sessions in which students vigorously and enthusiastically participated. The lectures, given by the three organizers and seven prominent researchers in the field, covered basic and advanced material in three areas of applied algebraic geometry: polynomial optimization, computer algebra and numerical solving of polynomial systems, and tropical and discrete geometry.

The intensive study schedule was complemented with several social activities: a trip to Stone Mountain, rafting down the Ocoee River, a Fourth of July baseball game and a trip to watch the fireworks, and a good-bye dinner at the Shakespeare Tavern.

Running this summer program smoothly would surely have been impossible without the valuable support of the SoM staff, and we wish to thank them and acknowledge their very valuable contributions.

Faculty Profile: Stephen G. Demko

by Jeff Geronimo

Steve Demko was born in Kingston, Pennsylvania, and did his undergraduate work at Seton Hall University. He received his PhD from Kent State University in 1973 under the direction of Richard Varga. The subject of his thesis was interpolation by splines and L^p error bounds. Here we get a first glimpse into Steve's intellectual curiosity. Joe Diestel recently told Michael Barnsley that Steve "is a legend among the graduate students at Kent State" since while his thesis is in numerical analysis, he used abstract theorems he learned in his pure mathematics courses to help solve the problem he was studying for his thesis.

He joined the faculty of the School of Mathematics as an assistant professor in September, 1973, and in 1974 became the first member of the School of Mathematics to receive a personal NSF grant. He was promoted to associate professor in 1978 and to full professor in 1987. He held visiting summer positions at the University of Bonn in 1979 and 1981 and at the University of Bologna in 1990. He also was a visiting researcher at the Service de Physique Theorique CEA at Saclay, France, for the 1988–1989 academic year.

In 1990 he left Georgia Tech to join Iterated Systems, a company founded by School of Math colleagues Michael Barnsley and Alan Sloan and returned to the School of Mathematics in 2002 as an instructor.

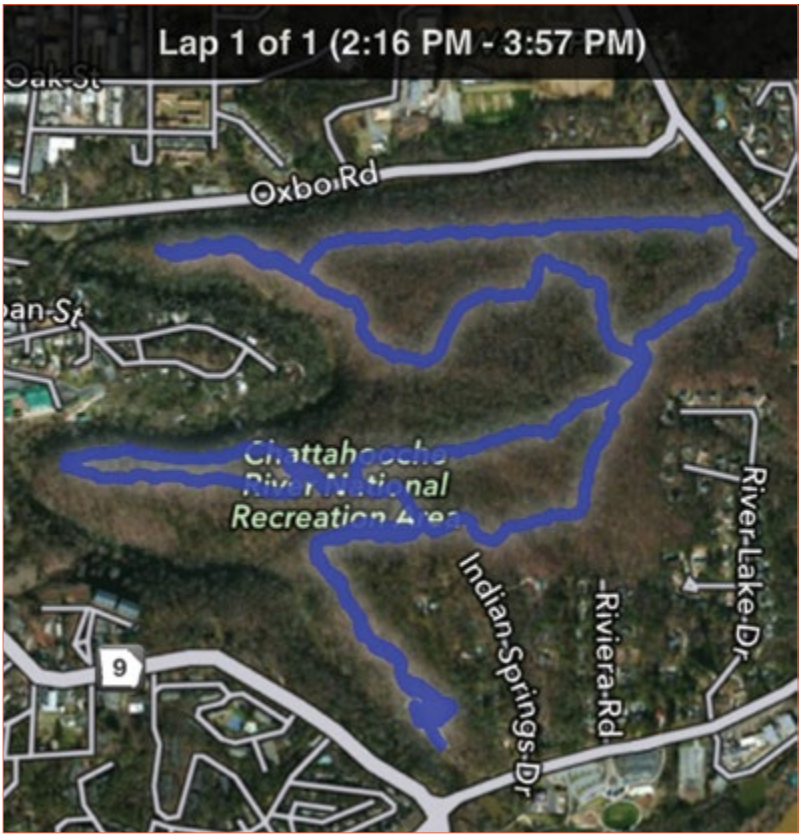
Gunter Meyer mentioned to me that Steve's "breadth of interests is quite remarkable." As a matter of fact, a look at Steve's publication list shows that his interests include approximation theory, probability theory, numerical analysis, Banach spaces, and fractals. Barnsley says, "Steve is courageous. I believe he could have been very successful by being a standard porcupine, amassing information and expertise in his thesis area, and steadily 'turning the handle.' Steve did not do that." Two of his most popular papers are "Decay rates for inverses of band matrices" with William Moss and Philip Smith, published in *Mathematics of Computation* in 1983, which gives a beautiful exponential bound on the matrix elements of the inverse of a banded matrix, and "Iterated function systems and the global construction of fractals" with Michael Barnsley, which appeared in the *Proceeding of the Royal Society* of London in 1985. The latter paper received the Georgia Tech Sigma Xi "Best Paper in Science" award in 1986. He also shared the same award with Michael Barnsley in 1985 for "Rational approximation of fractals," which appeared in the Lecture Notes in *Mathematics* in 1984.

Steve was instrumental in helping the School transition from a service department to a research department. He formed part of the group of mathematicians in the School of Mathematics that helped Michael Barnsley develop the theory and applications of iterated function systems. His work at Iterated Systems focused on image compression and content-based image retrieval and led to three patents and over $3 million dollars in grant money. Steve mentioned to me that while at Iterated Systems he had a chance to interact with engineers who had graduated from Tech and to see the fruits of our teaching effort. He said it was very gratifying.

Since his return to Georgia Tech, Steve has been very active in the Quantitative Computational Finance (QCF) program, teaching several courses. As Christian Houdré, says "Steve became 'a pillar of the QCF program.' He also taught several School of Math courses in numerical analysis. I always found Steve very willing to discuss mathematics, often offering interesting insights in unexpected directions. Above all, to many of us he has been and continues to be a friend and a mentor."

What I Did on My Summer Vacation

by Freddie Andrew



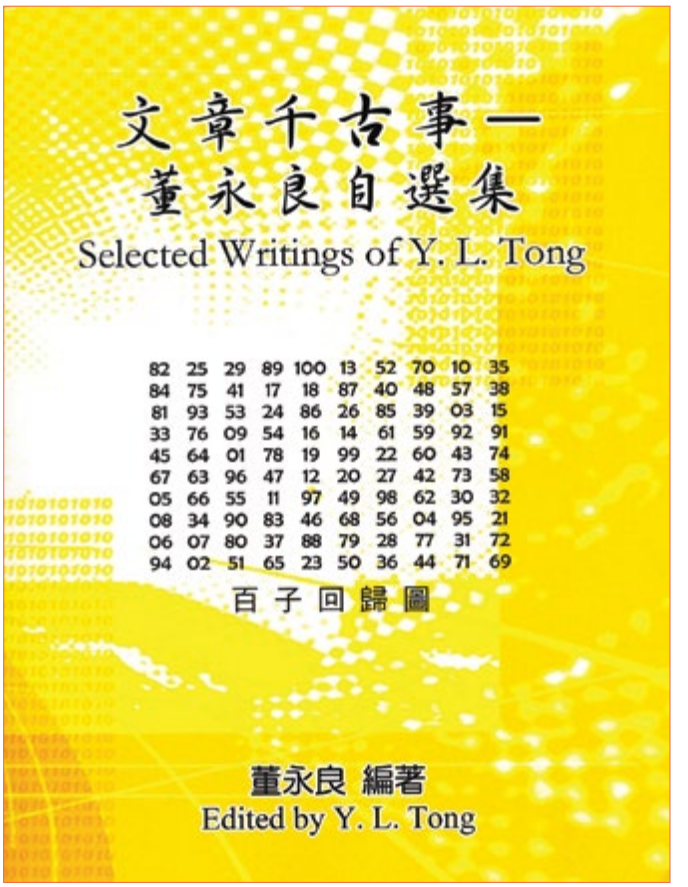
Since I retired at the end of 2011, I've spent much of my time doing two things I've enjoyed since childhood—hiking in the woods and watching birds. To date, since retirement I've walked more than 1,610 miles —in my neighborhood, various greenways, municipal and state parks, and the Kennesaw Mountain National Battlefield, but much of it (942.5 miles) in the Chattahoochee River National Recreation Area (CRNRA), where Ron Shonkwiler and I fished even before it was a National Recreation Area. Sometimes I walk with my wife, sometimes with Bill Green, but mostly by myself. I'm one of the CRNRA volunteers, but I leave the hard work of trail building and maintenance to the younger volunteers, devoting my time to walking the trails picking up litter, reporting trail damage and maintenance problems to the rangers and those younger and stronger volunteers, reminding dogs that their owners are supposed to be on leashes, and assisting with elementary school field trips. They are lots of fun. I think the Park Service has used some of the photographs I've taken on the field trips, and I make myself useful by identifying birds and counting the children. Naturally I'm happiest when the number of children I count at the beginning is larger than or equal to the number I count at the end and vice versa.

As for birds, my wife has said to me, "Some people travel to exotic places all over the world to watch birds, but you just stay here and watch the same d**n birds day after day after day." She's right, of course (I use nearly 200 pounds of sunflower seeds each year), and with a North American Life List of over 350, I don't often see a new bird near home. But this year I did—a yellow-billed cuckoo, which I saw in the (where else?) Chattahoochee River National Recreation Area. We'll go to the exotic places when she retires.

Life After Retirement

by Y. L. Tong

I have been busy working on a book; it has a Chinese title and an English title, and the English title is Selected Writings of Y. L. Tong. The first part of the book, written in Chinese, involves 13 articles and a few other items I was working on. The second part, written in English, contains information on two books I wrote previously in the area of stochastic inequalities and the reprints of 12 papers. Every one of the papers has a short story that I cannot forget, and three of them were co-authored with other people. For example, the first paper contains results in my 1967 PhD thesis, and the 1989 paper was written jointly with Ted Hill of SoM. We had a conjecture listed in that paper, and a referee suggested a proof in his report. I remember Ted was knocking on my door hard and yelling: "Yung, the referee's proof is incorrect!" He had already found an error in the proof. I also remember that we had a helpful discussion with John Elton concerning that paper. Other individuals in the probability and statistics group at that time include Jamie Goode, Bob Kertz, and Carl Spruill, all retired now. Oh, those good old days are gone forever.



The publisher of this book is EHG Books, ISBN 978-1-62503-025-2, and it's available via Amazon.com. Royalty derived from this book will be donated to a university library fund. Finally, there is a 10-by-10 array printed on the front cover of the book (please see photo at right). This is a solution for a mathematical problem: The one hundred numbers 1, 2, 3,..., 98, 99, 100 were arranged in such a way that the row sums, the column sums, and the two diagonal sums are all equal to 505. It was developed not long ago by a group of Chinese mathematicians.

Graduate Profile: Meredith Casey

by Alan Diaz

Meredith Casey came to Georgia Tech as a PhD student after finishing her BS in mathematics at the University of Georgia in 2008. This fall she'll defend her thesis in the field of contact topology, under the direction of Professor John Etnyre. Meredith and her husband Shaughn are also expecting their first child.

ProofReader: Since coming to Georgia Tech, you've been someone who wears a lot of hats. You've balanced research, teaching, organizing seminars, and helping with the annual High School Math Competition and had a leadership role in graduate housing. These efforts were recently recognized with a Festa Fellowship. How do you find time and energy for all of it?

Meredith Casey: I've always been better at running multiple projects than focusing on one thing; I think I get bored or distracted too easily. That does mean sometimes I'm working literally all day, but I try my best to work only on things I'm interested in or passionate about so it doesn't feel so much like work.

PR: *Out of all these accomplishments, which are you most proud of?*

MC: Ask me the same question in January and my answer will be "finishing the PhD." But right now, as I haven't done that yet, I'd say my teaching awards.

PR: *What is your advice to incoming grad students who want to be leaders as well as scholars?*

MC: First is not to take leadership positions just for the sake of a resume—get involved in things you really care about and it'll be easier to stay involved. Second, you have to remember that research comes first. Extra activities mean nothing if they cause you not to finish your research.

PR: *Let's discuss the two big milestones that you are approaching this year: finishing your PhD and having a baby. How long have these been goals for you?*

MC: I've wanted to do research and be a scientist since eighth grade in middle school. I learned in college that meant getting a PhD. I've always wanted kids, I suppose, but it's only been in the last few years that it's been something I really was planning and working toward and not an abstract "yeah, one day" kind of goal.

PR: *What are some of the things you've liked best about your time in grad school?*

MC: Working with John Etnyre has been awesome - he's a fantastic advisor. I was very lucky to also get to work with Prof. Jean Bellissard for a little while, which was a lot of fun and a great experience. I've enjoyed meeting people from all over the world. I really liked the travel and giving talks. And I love teaching.

PR: *What are you most looking forward to about being a PhD-carrying mathematician?*

MC: I like the flexible schedule, teaching, constant puzzles to solve. You never get bored. :)

Graduate Profile: Ruodu Wang

by Alan Diaz

Ruodu Wang completed his PhD at Georgia Tech in 2012, under the direction of Professor Liang Peng, focusing on probability and financial mathematics. He is now an assistant professor of Actuarial Science at the University of Waterloo in Canada, where he has been very active in research and traveled extensively.

PR: *What is the most interesting place you have traveled to in the past year?*

RW: Istanbul, Turkey: Petra, Jordan; and Rio de Janeiro, Brazil, are all interesting, but I would pick Jerusalem, Israel, even though I'm not religious.

PR: *Tell us about some of the projects you are working on.*

RW: I work mainly on risk aggregation with dependence uncertainty. This field deals with scenarios in which there are many risks, but it's unknown how the risks are related to each other. There are probabilistic and statistical open questions to study. I also work on statistical inference for high-dimensional data.

PR: *What are your goals as a researcher over the next few years?*

RW: Publish and publish some more! I'm making a transition to more financial/actuarial problems. Currently my work is too theoretical for my department.

I want to approach some big problems and become known by more people in my field. Being internationally active—that is, meeting and spending time with researchers from all over the world who work on the same problems as I do—is, in my opinion, the second most important feature of a successful researcher; the most important feature is one's research.

PR: *What are your goals as a teacher during the next few years?*

RW: Make students love me. Reduce the number of complaints!

SoM Undergraduate World

by Doron Lubinsky
SoM Undergraduate Coordinator

In the early years of Georgia Tech, mathematics students started learning calculus only in their junior year. Let's fast-forward about 130 years. More than 80% of our freshmen students now complete a calculus course in high school. Moreover, the biggest first-semester course is now Calculus II, since so many students already have credit from high school for Calculus I. With that in mind, our Undergraduate Committee has spent much of the past year carefully reviewing our early calculus sequence. Can we do a better job? Can we take into account that most students find the early part of Calculus I on differentiation too slow and the last part on integration techniques too rushed? Can we deal with the anomaly that two-thirds of our Calculus II course is actually linear algebra?

It's to be emphasized that most Tech students like the quality of instruction from the School of Mathematics. Our professors and teaching assistants regularly win Institute-wide teaching awards. Many receive "thank a teacher" certificates. Other Georgia Tech colleges express satisfaction with our offerings. So though some of us have argued, "don't fix what isn't broke", most felt that it was time for a change.

During this work in progress, we have considered the options forward and backward and created a proposal that would give more time to techniques of integration in Calculus I and take account of the fact that most freshmen are familiar with differentiation. It will offer a full-semester course in linear algebra and still allow credit for "B/C-level" high school calculus. We have had preliminarily positive input from other colleges at Georgia Tech, and we will be working with the rest of the Institute to refine and implement a reform. We hope that the proposed changes will offer a better, updated service to our undergraduates.

Speaking of updated tools, online homework has become a staple of our early calculus sequence. In spring of 2013, every Calculus II instructor used the Pearson platform "MyMathLab," with some help from Klara Grodzinsky. All found it useful for making students work harder, and—being an online generation—they very quickly learned how to use it. It makes economic sense too. Students purchase an online code that remains valid for their entire calculus sequence, at a price substantially less than that of the hardcover book. If they want to, they can print off an unbound copy of the textbook. Online resources include instructional videos, hints to problems, and a relatively unlimited number of exercises. Together with clickers and T-Square, online homework is taking us in a distinctly technological direction.

Our students won a bumper crop of awards in 2013. Two of our undergraduates, Martin Copenhaver and Eleanor Middlemas, received National Science Foundation graduate research fellowships. Gautam Goel was the only student at Georgia Tech to be awarded a prestigious Goldwater Scholarship. Ross Granowski won the Institute-wide Sigma Xi Award for Best Undergraduate Research, as well as the College of Science Research Award. Travis Rogers was named Georgia Tech's 2013 Outstanding Undergraduate Teaching Assistant. Santosh Karnik was ranked 39.5 out of about 4,200 students nationwide in a very tough Putnam competition.

Under the guidance of Undergraduate Advisor Dr. Enid Steinbart, the number of math majors continues to grow, reaching a total of almost 170 in spring 2013. In the previous academic year, 44 students graduated, with more than half attaining honors, high honors, or highest honors. Our students continue to manage Club Math and, together with graduate students, the annual High School Math Competition. They participate in the Putnam competition, and in a myriad of research conferences and competitions, and semesters abroad.

Clearly, our mathematics undergraduate program is thriving.

Undergraduate Profiles: Martin Copenhaver and Ross Granowski

by Doron Lubinsky

What is it that attracts a student to major in mathematics? In the case of two of our star students, Martin Copenhaver, and Ross Granowski, it has been a combination of excellent teachers, a chance pickup in a bookstore, and undergraduate research. Martin will study for a PhD at MIT, and Ross at Princeton—not a bad combination!

Ross completed an honors program in the middle and high school at St. Mark's School of Texas, and notes he was lucky to have had exceptional math teachers. At the time he was more interested in reading philosophy and playing the guitar. Neither music nor mathematics featured in his initial choice of a business major at Georgia State University. After a few semesters, just by chance, he picked up the book *Introduction to Analysis* by Maxwell Rosenlicht at a bookstore and loved it. He switched to a mathematics major, and then to Georgia Tech to be part of a larger department with a bigger curriculum.

Ross writes, "I had a fantastic experience at Georgia Tech. I know that the School of Mathematics teaches more students than almost any other department, but it felt very small and was very nurturing. I have always found the professors to be quite helpful and approachable. Several of them helped me significantly with my grad school applications. And whenever I have had a question about a book/paper/proof I am trying to understand (usually unrelated to a class), I have always found that faculty are more than happy to find time in their busy schedules to help and explain things to me."

Ross was remarkable in that he took so many advanced graduate courses in an undergraduate career. He particularly enjoyed real analysis courses at both undergraduate and graduate levels, taught by Professors Wilfrid Gangbo, Chris Heil, Christine Heitsch, and Wing Li, and found Christian Houdré's graduate probability courses to be very interesting. Two graduate reading courses offered by Dr. Dan Margalit on geometric group theory and mapping class groups were very valuable and challenging.

Ross's undergraduate research experience included working with Dr. Michael Lacey on discrepancy theory, and with Dr. Wilfrid Gangbo on the Michell Truss Problem. The latter is a variational problem about the construction of minimal-mass weight-bearing structures. Ross made a breakthrough in the Truss problem, leading to a paper, with Ross as sole author, in the distinguished French journal *Comptes Rendus*. This yielded two Georgia Tech awards this year—the Sigma Xi Award for Best Undergraduate Research and the College of Sciences Research Award.

Martin's path to mathematics started in sixth grade at Dent Middle School in Columbia, South Carolina, while attending a magnet program known as The Learning Collaborative. When Martin's family moved to Johnson City, Tennessee, he skipped seventh grade so he could continue with his desired math curriculum at the Science Hill High School. His math teacher encouraged him to get involved in math competitions, and he did so in eighth and ninth grades. He enjoyed the challenging problems and interaction with other students. His participation in math tournaments continued through another family move to Marietta, Georgia, again with encouragement from his teachers.

Initially, Martin leaned toward biochemistry as his college major, but math was a natural alternative to long and tedious labs. Several prestigious schools accepted him, but luckily for Georgia Tech, the Hope Scholarship made all the difference. Martin writes: "In the end, I have been incredibly happy with my decision to attend GT. So much of a person's experience and growth as a student is driven by individual relationships. I have been able to combine my classroom experiences at Georgia Tech with other experiences outside the classroom. This interaction has ultimately helped me to grow substantially as a mathematician and as an individual.

"One of the best aspects of the GT math community is that there are so many professors who keep their doors open to students (physically and metaphorically). I have had many engaging conversations with faculty, and these have often been the most stimulating (and scariest!) of my life. Several of these encounters have arisen because of classes, and others because of my responsibilities in Club Math and the GT High School Math Competition. Finally, I have been very fortunate to have had Dr. Heitsch as my research advisor and mentor, and to have been able to work with her for several semesters."

Martin especially enjoyed Dr. Wing Li's Honors Calculus II class, which he took during his first semester of college: "This class was simultaneously overwhelming and exciting. I also began to appreciate the importance of rigor driven by an underlying set of core ideas and principles." Perhaps his most important undergraduate class was Dr. Ernie Croot's Honors Probability and Statistics: "I began to interact frequently with Dr. Croot during his office hours. He shared with me his perspective on the things we were learning in class and helped foster in me a curiosity for seeking out new knowledge. Dr. Croot guided me to supplementary material for the course and introduced me to other faculty with whom to discuss research."

As with Ross, research has been essential in shaping Martin's interests. His first program, in summer 2011 at Central Michigan University, focused on finite-dimensional frame theory, with Dr. Sivaram Narayan as supervisor. His second program, at Pennsylvania State University, involved convex function approximations in discrepancy theory. This very serious exposure to Fourier analysis inspired a passion for analysis. Another foundational experience for Martin was his participation in the Math Advanced Study Semester at the Pennsylvania State University in fall 2012. Martin is one of a very few students nationwide to be awarded both the NSF and NSDEG postgraduate research fellowships, and it is instructive that the frame theory of his undergraduate research was the basis of both applications.

The School of Mathematics can take pride in the progress of such talented students!

Alumni News

EMANUEL INDREI (BS 2007)

I graduated from GT in May 2007 with a BS in Applied Mathematics and completed my doctoral studies under the direction of Alessio Figalli at the University of Texas at Austin in May 2013. In 2012, I was awarded an NSF EAPSI fellowship to conduct research at the Australian National University under the supervision of Neil Trudinger. In 2013, I was awarded the Frank Gerth III Dissertation Award for my thesis work.

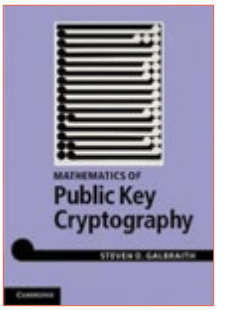
My job placement is as follows:

- June 2013–August 2013: Postdoctoral Fellow, Australian National University
- August 2013–January 2014: Postdoctoral Fellow, MSRI
- January 2014–December 2016: PIRE Postdoctoral Associate, Carnegie Mellon University

Best wishes,
Emanuel

STEVEN GALBRAITH (MS 1991)

Brief bio: I did a Master of Science at GT from 1989–1991. My supervisor was Stephen Demko and the topic was complex dynamics. After that I did a doctorate with Bryan Birch at Oxford on computational number theory (elliptic curves and modular forms). During my first postdoc I became interested in applications of number theory to cryptography, and this has been my main research area. In particular, I have published many papers about elliptic curve public key cryptography. After working as a lecturer at Royal Holloway University of London from 2002–2009, I returned to New Zealand and am now at the University of Auckland. In 2012 I published my first (and likely only!) book:



BECKY UPCHURCH STARK (MS Math 2004, MS ECE 2005)

Becky Upchurch Stark is a senior research scientist at a small technology company, 2ICT, located in Austin, Texas. Becky is currently the principal investigator for a multimodal affect classifier software program for the Defense Advanced Research Projects Agency (DARPA). Ingesting data from unobtrusive, inexpensive sensors (such as a webcam and computer mouse) while a person is participating in any type of interactive computer program, her program processes this data using a myriad of machine learning techniques to robustly classify a person's affect in real time. She is currently applying her research to a pilot training program in order to detect appropriate pilot reaction to dangerous situations, and to a virtual 3-D environment with an avatar designed to assist in the detection and treatment of post-traumatic stress disorder (PTSD).

DARSHAN BRYNER (MS 2008)

After graduating from GT in 2008, I began my full-time position as a mathematician at the Naval Surface Warfare Center in Panama City, Florida. While at work, I was introduced to an independent research project in statistical shape analysis, where I began collaborating with the Statistics department at FSU. In fall 2010 I decided to enroll in the Statistics PhD program while simultaneously holding my job with the Navy. It has been an extremely busy and productive past few years traveling between Panama City for work and Tallahassee for school as well as to various conferences and seminars. If all continues to go well, I will complete my PhD in December 2013. Also while at FSU, I met my wonderful wife, Gretchen, who just graduated with her PhD in biostatistics, and I could not be more proud of her! We recently got married in Puerto Rico and are extremely happy and excited to start our lives together.

-Darshan

ZIXIA SONG (PhD, ACO 2004)

Zixia Song has been promoted to associate professor with tenure since August 2011 in the Department of Mathematics at the University of Central Florida. After completing her PhD, she spent one year (2004–2005) at the Ohio State University as a Zassenhaus Assistant Professor before joining UCF.

HUA XU (PhD, 2008)

Hua Xu joined the casino video games company GimmieGames, in Decatur, Georgia, as a game design mathematician. He had been working on probability theories and applications with Professor Christian Houdré since 2003. In the new position, Hua is responsible for the math-related designs, including probability model proving, new game concepts designing and implementing, and game simulation and data mining. You will soon see the games that Hua designs in casinos, both online and in the major land-based ones around the world.

Thanks.
Best wishes,
Hua

BULENT TOSUN (PhD 2012)

Right now, I am a CRM postdoctoral fellow in Montreal, Canada. Starting August 2013, I am going to be a Whyburn Instructor at the University of Virginia. This position will be for three years. The summer of my first year I will be visiting the Max Planck Institute in Bonn, Germany for three months.

Montreal is a great city in many ways. Even the very long and cold winter we had here this year didn't change my opinion much about this fact. Mathematically it also has been great. I have the chance to talk to some great minds and many postdocs around my research area here. Last semester I taught a Linear Algebra course at McGill University to math majors, which was very enjoyable, and I am glad to learn/see that it was also received really well.

I miss my fellow graduate students and many other things about Atlanta and Tech, but I think I miss most the nice and long discussions we had with my advisor, John, mostly on Friday mornings in Skiles 005.

Obituary

Mrs. Lorraine Nash Ruff, 90, of Lilburn, Georgia, passed away on January 10, 2013. The mother-in-law of former Georgia Governor Sonny Perdue, Lorraine was living at the Sunrise assisted living home at the time of her passing.

Lorraine was born on February 4, 1922, in Nash, Kentucky. The only child of the late Oscar and Iva Nash, she was a talented violinist in her youth and an accomplished student throughout her school career. She retired from Emory University but continued working part time at the School of Mathematics' Center for Dynamical Systems and Nonlinear Studies from March 1992 until August 2003 as a mathematical secretary until the age of 79. When she retired, Professor Tom Trotter wrote, "Lorraine Ruff came to work at Georgia Tech in 1993, after completing one full career at Emory University. She has worked in the Center since then, providing assistance with technical reports and mathematical journals. Lorraine has enjoyed her years at Georgia Tech, but she tells us that now is the time to devote her energies to family and friends."

Married to Edgar Weston Ruff Jr. for 59 years, she is survived by five children: Sandra Ruff Hughes, Edgar W. Ruff III, Mary Ruff Perdue, Carol Ruff Franza, and Susan Ruff Jones. She had 15 grandchildren, 22 great-grandchildren and one great-great-grandchild. Her grandson, the Rev. Jim Perdue, officiated at her memorial service.

Notes from the ProofWriters

Dear Readers,

This is now the sixth edition of the Proofreader *and we still have not run out of material and stories to present to you.*

The main reason is, presumably, that the university environment constantly renews itself. The recent news, of course, is how the new MOOCs (massive open online courses) will revolutionize teaching, and it is so exciting that even the cows shout it from the pastures. This may well be deserved.

For us, though, the main news comes from people, from our students, faculty, and staff, who create what is truly a community with their lively interaction. And it is this exchange of ideas that creates knowledge and understanding. I think very few of us who teach have the illusion that students will understand what we are explaining to them at the first go. Most of the students initially cling to well-rehearsed procedures, like doing rote computations. While this is not a bad reaction, it surely cannot be an end in itself.

Eventually students must come to an understanding of why certain problems are solved in a particular way and why they are worth solving in the first place. Moreover, they need to be able to determine whether their answer is indeed the right one. Students usually get nervous if the solution to a homework problem is not given at the end of their textbook. They almost think of this as a betrayal by the author or instructor. How could they have not included the solution? How else could they know that their solution is correct? Of course, they can check with classmates whether they got the same result—a kind of democratic approach to problem solving. Ultimately, however, they are on their own.

It is our responsibility as teachers to provide the students with tools that allow them to judge the accuracy of their own or others' work. Does a given result fit with known facts? If the problem is computational, an important check is whether the result's order of magnitude is right. Can the problem be solved in a different way?

At times it may help to reorganize the computation and thus avoid making the same computational mistakes. These are examples of little steps that increase the credibility of a result. If we succeed in instilling in students this kind of skeptical attitude, then we not only teach them sound judgment but we also endow them with the ability to think independently. This is the source of a well-grounded confidence.

We also have the well-grounded confidence that you liked this Proofreader, *otherwise you would not have arrived at this page. This issue has been a team effort, and we are grateful to all our many contributors—faculty, staff, and students.*

As always, we thank Janet Ziebell for the superb layout. Just looking at the Proofreader *is a great joy. Without Chris Heil we would never have gotten all the material together; a huge thank-you goes to Chris. We are grateful to Douglas Ulmer, our chair, for his strong overall support of this project. Without him there would be no* Proofreader. *Thanks go to Michael Loss for initially proposing this project, for helping it develop over time, and for writing the editorials. Last, but certainly not least, we thank Cathy Jacobson. She skillfully edited all the many contributions, and whatever pleasures you might draw from reading it, you have Cathy to thank.*

As always, we love to hear from you, about you, and any stories related to the SoM. Just write to editor@math.gatech.edu.

—The Editorial Team

Why Make a Gift?

The short answer is this: Your gift can have a large impact on the education and research efforts of the School of Mathematics. Below are some of the many ways this can happen.

The High School Mathematics Competition is an inspiring event where students gather with others interested in mathematics and compete for scholarships. It is run entirely by undergraduate and graduate student volunteers, with scholarships supported by corporate and private donations as well as a federal grant. Contributions toward prize money or operating expenses would help to continue this event and inspire the next generation.

(See http://www.math.gatech.edu/outreach/hsmc/georgia-tech-high-school-mathematics-competition)

Everyone knows that college affordability is a serious issue for many families. Funds for undergraduate scholarships would help support deserving students as they work toward a very valuable degree.

Teaching is a central part of the mission of the School of Mathematics, and we have a very talented and dedicated teaching staff. Recognizing the best of them through prizes for excellent teaching and mentoring would underline the importance of these efforts and encourage even more excellence. A named prize would be a great way to remember an alumnus or former faculty member who had a big impact on your life.

Our graduate students are integral to all the efforts of the School—from teaching to research to outreach. They are also the future of the discipline. Supporting them with scholarships, thesis prizes, travel-and-professional-expense funds, or other small gifts would have a large impact on the School and the discipline.

Finally, a long-standing goal of the School is to have a program of named postdoctoral fellows. These positions are the route to a permanent appointment at a top department (such as at Georgia Tech). We've made a good start toward such a program, but there is more to do. Securing sufficient funds to sponsor a permanent program of postdocs will be a long-term project requiring significant effort, but it promises to contribute greatly to the School's progress into the top ranks worldwide.

We're very grateful for the help of our friends in all its forms, both large and small. If you would like to contribute to any of the efforts mentioned above or discuss other possibilities, please get in touch.

Doug Ulmer, Chair

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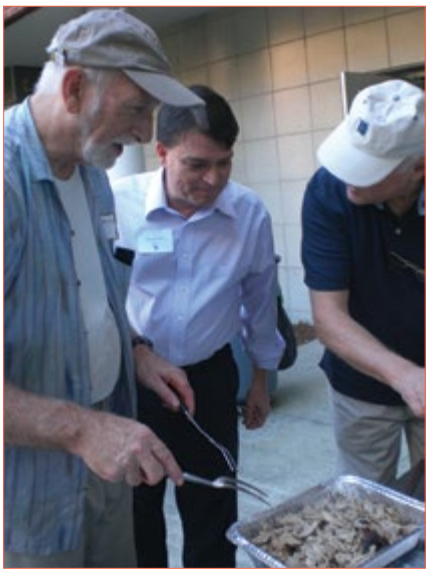

Alumni Classnotes Information Needed

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Or e-mail the same to editors@math.gatech.edu and attach your photo.

If accepted, we reserve the right to edit your submissions for length and style. We hope to hear from you soon!

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