Departmental *F*(u)nctions

The newsletter of the Department of Mathematics, University of Alabama

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Notes from the Chair

2016-2017 was a busy but important year for the Department of Mathematics. We had our external review, which is an opportunity for the department to assess where it is and to plan for the future. We were ably assisted by the UA review committee—Claudia Mewes, Physics; Silas Blackstock, Chemistry; and Alberto Perez-Huerta, Geology. We also had two outstanding external reviewers: Rodolfo Torres, Professor of Mathematics and Associate Vice Chancellor at the University of Kansas, and Alejandro Aceves, Professor and Chair of Mathematics at Southern Methodist University.

Here are some highlights from our self-study (with some updates to reflect our recent hires and enrollments)

- The department has 28 tenured/tenure-track faculty, including five women, one Black and one Hispanic.
- We have 11 FTTIs who teach in the MTLC and in the department.
- We have 400 undergraduate majors; about 40% are women.
- We have 37 PhD students, including 14 women and 5 Black students. Since 2000, 37% of our PhDs have gone to women, and 7% to Black students. Both of these numbers are well above the national average. Our incoming graduate class has 12 students.
- There are 20 students in the Accelerated Masters Program (a program for top students that lets a student earn a bachelor's and master's simultaneously, often in only four years). We are the third largest department (in terms of enrollments) participating in the program.
- In the Fall, 2016, the Department taught 35,855 credit hours, 16% of the total credit hours taught in the College of Arts & Sciences.
- The Department has approximately $2,570,000 in endowed funds, producing an annual income stream of about $150,000. This money is primarily for graduate student scholarships, with the bulk coming from the Edith & Richard Ainsworth Scholarship Fund.

Going forward, the department would like to expand the faculty to strengthen its research program focusing on our applied math group and on our harmonic analysis group. We want to expand the graduate program to at least 50 PhD students, and the undergraduate major to 600 students. This last would be 1.5% of all undergraduate degrees, 50% higher than the national average at research universities. We want to revamp the undergraduate major to make it more attractive and more useful for students interested in many different fields.

The Jacobson Prize Fund Arguably the greatest mathematician to graduate from the University of Alabama was Nathan Jacobson, Class of 1930. He went on to get his PhD at Princeton and then to teach at Yale for more than 30 years. He was a leading authority in abstract algebra, publishing nine books and dozens of major articles. He was a member of the National Academy of Sciences, and

served as president of the American Mathematical Society and vice-president of the International Mathematical Union.

In honor of Nathan Jacobson, an anonymous donor has pledged $10,000 to the department to establish the Jacobson Prize fund. Moreover, Dean Robert Olin has generously matched this pledge, bringing the total expected endowment to $20,000 and allowing the department to begin awarding the prize immediately. Every year a cash prize (starting at $500) will be given to the top senior in the department. This prize will replace the B.B. Comer medal for excellence in mathematics, which will now be awarded to the top junior in mathematics.

The Department is very grateful for this gift. If you are interested in donating to the Department, you may give to the Mathematics Gift Fund (shortly, you will be able to do this through our website). If you are interested in making a targeted gift to the department, please contact the Chair, David Cruz-Uribe. The Department is currently considering various projects to increase the number of women studying mathematics at the undergraduate and graduate levels.

The Math Sculpture Project Last year the Math Department undertook a joint project with the Studio Arts Program. David Cruz-Uribe and Craig Wedderspoon organized a group of students in math and sculpture to brainstorm ideas for a large public sculpture that involves math. After several rounds of designs, they selected one proposal by Paget Kern, to build a 14' sculpture involving three Mobius strips inter-locked as Borromean rings. Nucor Steel of Tuscaloosa has donated much of the steel being used. The photos show Paget hard at work welding one of the rings and a scale model currently on display in the Department office. Dean Robert Olin has provided space for the sculpture in the Woods Quad, and the Department hopes to unveil the finished sculpture this fall.

Additions

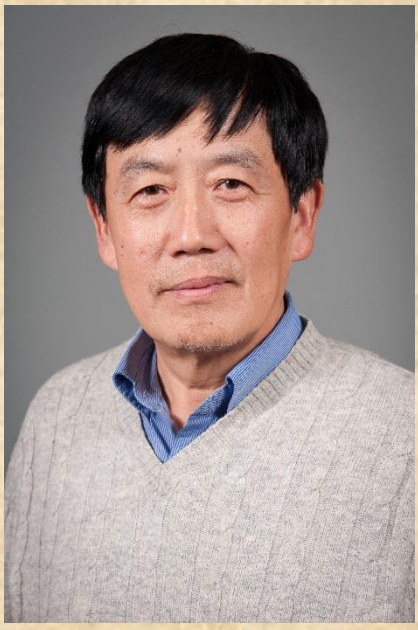
The latest addition to the applied mathematics group is Associate Professor **Shibin Dai**, who comes to us from New Mexico State University. Dr. Dai received his early education in China, earning a Bachelor's degree in Mathematics from Peking University in 1997, and a Master's degree in Mathematics from the Chinese Academy of Sciences. He came to the United States to work on his Ph.D. degree, which he gained in 2005 from the University of Maryland. After obtaining his degree, Dr. Dai was employed as a Computational and Applied Mathematics Assistant Professor at UCLA for three years, and then went to Worcester Polytechnic Institute for another three years as a Visiting Assistant Professor. He held the same rank at Michigan State University for two years before accepting a position at New Mexico State. Dr. Dai works in the areas of applied analysis and nonlinear differential equations. He is the current holder of a National Science Foundation grant for work in diffusion in amphiphilic network structures. Dr. Dai has published numerous scholarly articles and is very active in the mathematical community. He is a review panelist for the National Science Foundation and a referee for many journals. In his spare time, he enjoys swimming. We are very excited to have Dr. Dai join us at U. of A. Welcome!

Martha Makowski is our newest expert in the field of Mathematics Education, joining Jim Gleason in that group. She received her Bachelor's degree in Mathematics from the very prestigious Grinnell College in Iowa. Her graduate work consists of a Master's degree in the Teaching of Mathematics from the University of Illinois in Urbana-Champaign, and a Ph.D. from the same institution in Curriculum and Instruction, with specializations in elementary and developmental mathematics and teacher preparation. Dr. Makowski has also published a number of reports concerning the role of underrepresented groups, including women and English-learners. She has taught mathematics at South Suburban College and at the College of DuPage, and was a full-time faculty member at Kankakee Community College, all in Illinois. We are very pleased to welcome Dr. Makowski to the faculty.

Also joining us this year **is Mojdeh Rasoulzadeh.** Dr. Rasoulzadeh has a somewhat different background from many of the current faculty, in that her degrees are not all from mathematics departments. She was born in Iran and received her Bachelor of Science in Mechanical Engineering from Tehran University. She earned a Master's degree in the same subject from Sharif University, also in Tehran. For her Ph.D., she chose University of Lorraine in France, a relatively new academy formed from combining several other institutions. Her dissertation, entitled Non-Local Models of Flow in Multi-Scale Porous Media, was accepted in 2011 and she was awarded the Ph.D. in Mechanics and Energetics. She has held several positions as a post-doctoral fellow in various locations in France: at Lemta Lab (University of Lorraine), Schlumberger SRPC (Clamart) and Total E&P Research Center CSTJF (Pau). Her research program centers on flow and transport in porous media. Since 2008, she has also conducted lectures in reservoir engineering at the National Geology School at Lorraine University. She has co-supervised several master's degree candidates. Dr. Rasoulzadeh is an avid hiker, a movie buff, and guitar player. We know that Dr. Rasoulzadeh's varied background will strengthen our programs in applied mathematics, and we are very glad to welcome her to the University!

Subtractions

Leaving us this year is Professor **Pu Wang**. Professor Wang was one of the stalwarts in the applied mathematics group. He received his Bachelor's degree in 1982 from the Fushun Petroleum Institute in China. He then arrived in the United States to finish his Master's degree at Lehigh University in Bethlehem, Pennsylvania in 1986, and received his Ph.D. from the same university in 1990. He works in the area of stochastic processes and has professional affiliations with the Institute for Operations Research and the Management Sciences and the American Geophysical Union. Dr. Wang has received funding from several federal agencies, including the National Science Foundation, the U.S. Navy, the Department of Defense, the Department of Energy, and the Environmental Protection Agency, and has also been awarded funds from the Research Grants Committee and SOMED here at the University. He is the author of over fifty research publications, with articles appearing in such journals as the Journal of Probability and Statistical Science and the Journal of Operational Research, and in the proceedings of conferences such as the IEEE Globecom Communications and Information Security Symposium. His quiet demeanor and ever-present good humor were an asset to the Mathematics Department. Dr. Wang is not leaving mathematics altogether, since will still be teaching in his homeland. He has accepted a position with SCUPI, a new academic facility established jointly by Sichuan University (that's the SCU part) and the University of Pittsburgh. SCUPI is in Chengdu, Sichuan province, described by Dr. Wang as the home of spicy food and pandas. He says that, the next time we are in Chengdu, we should stop by! Bon voyage, and good luck!



Unfortunately, the Math Department also had to say goodbye to **YangYang Xu**, who left us this year to take a position at Rensselaer Polytechnic Institute. Dr. Xu was with us for only a short time, and we are sorry to see him go.

High School Students Compete in Math Tournament

The annual High School Mathematics Tournament was held on November 5, 2016, presided over by the redoubtable **Dr. Kabe Moen.** 17 schools from around the state participated, including over 120 participants. Schools are separated into three divisions, depending on the size of the school, with Division I consisting of the larger schools. Students take a written test in the morning sessions, followed by the fast-and-furious ciphering competition in the afternoon. The team winners in each division were:

Division I: **Bob Jones High School** took first place, with **Altamont School** in second, and **Hewitt-Trussville** in third.

Division II: First place went to **Jefferson County International Baccalaureate**, followed by **Arab High School** in second and **Montgomery Catholic** in third.

Division III: **Section High** was number one, with **Valley Fellowship** taking second place and **Pickens Academy** in third.

Bob Jones was the overall team winner in the competition. The top individual scores were from these terrific students:

1. **Joey Li,** Bob Jones High School
2. **Jacob Glidewell,** Jefferson County International Baccalaureate
3. **David Li,** Bob Jones

The Math Department extends its congratulations to all the participants and to the top scoring students!

CONGRATULATIONS TO THE WINNERS AND TO ALL THE PARTICIPANTS!

Putnam Exam Contestants Excel

The 2016 Putnam Team from U. of A. competed in the annual exam, sponsored by the MAA, consisted of **Connor Malin, Calvin Bryant, and Qiangang Fu.** Three other students took the exam as non-team members. The team score this year was 13 points (national individual median score: 0), more than twice our total from last year. Many of the new contestants are freshmen and sophomores, and several of them scored positively on the Exam. The future looks bright for the Putnam Team!

On a related note, the first **Alabama-Auburn Putnam Preparatory Seminar** took place in November, here at the University. Several members of the Auburn team attended, along with many of the contestants from U. of A. Many thanks go out to **Professor Andras Bezdek** of Auburn, who presented two days of Putnam problems, solutions, and useful points of view (example: sometimes a two-dimensional problem can be more easily solved if you think of it in three dimensions. Who knew?) Professors **David Cruz-Uribe** of Alabama and **Tin-Yau Tam** of Auburn were instrumental in arranging the meeting and providing refreshments. The joint project will continue next year, with a small grant from Auburn University.

New Degree Recipients

The Mathematics Department conferred a number of advanced degrees during the past year:

Master's Degrees:

Lemar Copeland, working with Dr. Belbas, received the Master's degree in August.

Channing Hucks received the Master's degree in May under the direction of Dr. Halpern.

Kaitlyn Stephens, working with Dr. Gleason, was awarded the Master's degree in May.

Qing Xiao also worked with Dr. Halpern and received the Master's degree in May.

Tyler Williams was the recipient of the Master's degree in May, working with Dr. Moen.

Jordon Jones worked with Dr. Pu Wang and was awarded the Master's degree in May.

Liet Vo, supervised by Dr. Hadji, earned the Master's degree in May.

David Neal earned his Master's in May, working with Dr. Ames.

David Lass was awarded the Master's degree in May, working with Dr. Sidji.

Ph.D. degrees:

In May, **Noufe Aljahdaly** defended her dissertation, *Linear and Nonlinear Convection in an Infinitely High Cavity in the Presence of Rotation,* written under the direction of Prof. Layachi Hadji. Dr. Aljahdaly is now an Assistant Professor at King Abdulaziz University in Saudi Arabia.

Also in May, **Cong Hoang** presented work on *Sparse Technology in Weighted Harmonic Analysis*, written with Dr. Kabe Moen supervising. Dr. Hoang will be the Math Coordinator at James Madison University in Harrisonburg, Virginia.

Bryan Sandor earned his Ph.D. working with Professor Evans and presented his work *On Finitely Generated Nilpotent Groups and Their Subgroups.* Dr. Sandor has accepted a position as Assistant Professor at Bethel University in McKenzie, Tennessee.

In May, **Huy Duc Vo** received the Ph.D. for work on *Krylov Approximations and Model Reduction Methods for the Chemical Master Equation.* Dr. Vo worked with Prof. Sidje and will be a postdoctoral fellow at Colorado State University in the fall.

Laura Watley received the Ph.D. in May for her work with Prof. Gleason, *Structural Validity and Reliability of Two Observation Protocols in College Mathematics.* Dr. Watley will continue in the fall as an instructor here at the University of Alabama.

Finally, in August of 2017, **Xin Luo** presented work done with Prof. Sun entitled *Development of Modal Interval Algorithm for Solving Continuous Minimax Problems.* Dr. Luo will be an Assistant Professor at Wilkes University in the fall, in Wilkes-Barre, Pennsylvania.

Honors, Recognition, and Activities

Transitions

Dr. Kabe Moen was promoted to Associate Professor on the strength of his teaching, research, and commitment to the University and the community.

Awards

The B. B. Comer/Nathan Jacobson Award for the outstanding undergraduate in the department went to **Tyler G. Williams**. Way to go, Tyler!

Bryan G. Sandor received the 2017 award for Outstanding Teaching by a Graduate Student.

Cong Hoang earned the award for Outstanding Dissertation by a Doctoral Student.

These awards are all given to extremely worthy candidates. We are proud of you! Kudos to all these winners!

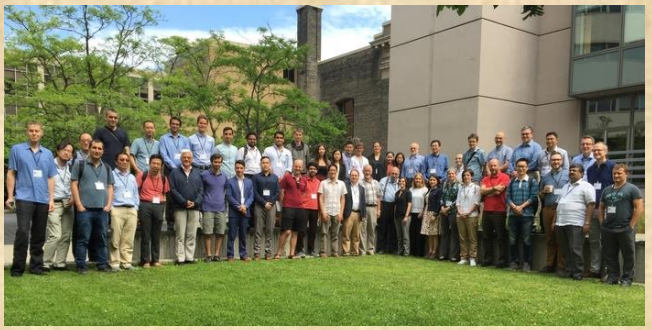
Two incoming graduate students, **Ricky Dixon and Alexander Jefferson**, have been awarded two-year Bridge to Doctorate Fellowships from the National Science Foundation. These grants are designed to aid underrepresented STEM students in their graduate programs.

Current graduate student **Phylisicia Carter** is the recipient of dissertation writing fellowship from the Southern Regional Education Board.

Simons Foundation grants were announced this year, and both **Lawrence Roberts** and **Shan Zhao** are recipients. Congratulations, guys, and keep the bucks rolling in to the U. of A.!

Since 2015, researchers from the U. of A. education school and the Mathematics Department, including **Dr. Jim Gleason**, have worked with nearly thirty teachers from eight Tuscaloosa county elementary schools to implement some of the foundations of co-teaching in their classrooms. Co-teaching emphasizes collaboration of teachers and specialists to increase content knowledge and provide engaging instruction. The project is funded by a grant from the Math-Science Partnership through the United States Department of Education. Dr. Gleason has also been recognized as the **Outstanding Faculty Advisor** for 2017 by the University of Alabama's Academic Advisors Association.

Activities



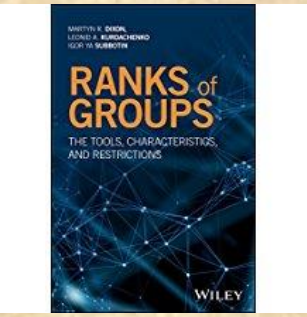
Dr. Brendan Ames was invited to lecture in July at the Fields Institute in Toronto as part of their workshop on Modern Convex Optimization and Applications, held to honor the 70th birthday of Arkadii Nemirovski. Brendan is in the second row near our right side.

Dr. Ames and his partner also announced the birth of their son **Harrison** in September. Harrison looks ready to go to Toronto with his Dad for the next conference! Congratulations on the new arrival!

In addition, **Dr. Oleksandra Beznosova** was very happy to welcome the newest addition to her family, **Alice,** born on March 8, 2017. Congratulations!

Nathan Jackson's daughter **Brianna Kate Jackson** was born on November 12, 2016. She sure looks happy to be a new member of the Math Department!

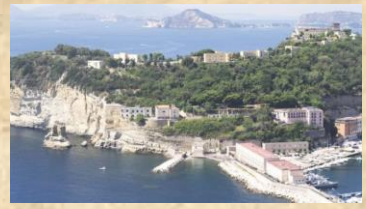
Another one of the newest members of the Math Department family is **Aaron Ferguson**, the son of **Tim** and **Paige Ferguson**. Aaron was born in December and enjoys spending time with his mentor, three-year-old Simon, as you can see from the photo! Looks like Simon is a great teacher, who already has taught Aaron to sit upright. Next week, trigonometry! Congratulations to the Ferguson clan!



Martyn Dixon's new book *Rank of Groups: The Tools, Characteristics, and Restrictions* was featured in the Cover to Cover Faculty Book Exhibit at the Dinah Washington Cultural Arts Center in August.

David Cruz-Uribe's son **Nico** was the star on the local newscast *Local Powerlifter Defies Expectations*. Nico took up the sport only recently but he has progressed remarkably fast!

Early last summer, **Dr. Martyn Evans** spent a month at Università degli Studi di Napoli Federico II. He was there to work with his hosts, Maria de Falco, Francesco de Giovanni and Carmen Musella, on a project involving uncountable groups with certain restrictions on their small subgroups. Dr. Evans also presented a series of ten lectures at the same university, *A Crash Course in Group Representation Theory with an Eye on Schur-Weyl Duality*.



on the lighter side

Infinitesimals

1. The difference between the Weak Law of Large Numbers and the Strong Law of Large Numbers:

In his 1978 book, Feller says:

[The Weak Law of Large Numbers] is of very limited interest and should be replaced by the more precise and more useful Strong Law of Large Numbers.

In [Wae71, p. 98], van der Waerden writes:

[The Strong Law of Large Numbers] scarcely plays a role in mathematical statistics.

Okay, then, should we just give them some boxing gloves and let them fight it out? The outcome might depend on who is (ahem) stronger…

2. In a related note, has everyone heard of the Frivolous Law of Large Numbers? According to Steinbach (1990) the law says:

   Almost all natural numbers are very, very, very large.

3. A corollary, propounded by Gardner in 1980, says that

   There aren't enough small numbers to meet the many demands made of them.

4. Another obvious corollary is this: Choose a natural number at random. Then, with probability 1, that number is larger than any natural number you have ever thought of before. In fact, it is larger than any natural number that anyone has ever thought of before.

5. In the same vein, we have Littlewood's definition of "surprising." A surprising event is one which occurs once in a million times. Taking this definition, close to 100,000 surprising events are expected each year in the United States alone, and, in the world at large, "we can be absolutely sure that we will see incredibly remarkable events."

6. Actual applications of the Frivolous Law and its corollaries can be found at the website https://hbfs.wordpress.com/2009/11/24/the-frivolous-theorem-of-arithmetic/ .

Now, for the arachnophiles among our readers….

7. Headline from the Washington Post, March 28:

Spiders could theoretically eat every human on earth in one year.

This is a theorem, and we can provide the proof: The world's spider population weighs a total of about 29 million tons and consumes somewhere between **400 million and 800 million tons** of prey every year. The total biomass of all the humans on earth, man, woman, and child, is estimated at about **350 million tons**. Q. E. and D.

Don't take my word for it, you can look all these figures up on the (chuckle) Web.

Martin Nyffler and Klaus Birkhoffer estimate the average density of spiders on land at 131 spiders per square meter. I think there are more than that in my attic…

Think of that, as you fall asleep tonight…