



COLLEGE OF SCIENCE | THE UNIVERSITY OF UTAH
Department of Mathematics

Aftermath

Biannual Newsletter | Fall 2016 | Volume 16, Issue 1



REMEMBERING JOSEPH L. TAYLOR
page 5

ALSO INCLUDED:

2

OPENING DOORS OF
OPPORTUNITY

3

NEW DEPARTMENT
MEMBERS

6-7

AWARDS &
DISTINCTIONS

8

SUMMER PROGRAMS



MESSAGE FROM THE CHAIR

With the semester in full swing, I'm once again reminded of a very positive recent trend: while the number of our majors has increased significantly, the *proportion* of really excellent majors – ones who would excel in any top mathematics department in the country – is also up significantly. It's hard to know exactly what's driving this change. Certainly more local students are discovering us as a highly rated research department in their own backyard. But I'd also guess that our undergraduate scholarships are steering outstanding students to the department, and helping them complete their majors. In any case, it's a welcomed trend and one we aim to continue.

Peter E. Trapa
Professor and Chair, Department of Mathematics

Photo Credit: Mike Schmidt



OPENING DOORS OF OPPORTUNITY

Each year we aim to increase funding for existing scholarships and to create more endowed scholarships for students. By supporting scholarships, donors empower students to discover their passions and reach their potential with less financial constraints on their progress. Our students have frequently reported that scholarships serve as a catalyst to continue their studies and earn a degree in mathematics. Without the generosity of our donors, some of our students would never have been able to attend college. We are asking you to get involved in our mission to raise funds for the following:

Undergraduate Scholarships:

Each year the department solicits applications for departmental scholarships. Selections are based on recommendation letters, grades, contributions to the department, and ACT and other competitive test scores. Recipients will be expected to perform with distinction among the undergraduate students majoring in mathematics.

Don Tucker Endowed Postdoctoral Fellowship:

This award supports the research of outstanding postdoctoral instructors in the Department of Mathematics. The fellowship was endowed by an anonymous donor and is named for our longest serving faculty member, Professor Don Tucker.

By giving any amount, you are making a difference and opening doors of opportunity for our students. For more information, to donate, or to establish an endowed scholarship, please contact:

Office of Development
332 South 1400 East, Suite 150
Salt Lake City, UT 84112-0300
Phone: 801-581-6825

OR visit umarket.utah.edu/ugive and in the search box type "mathematics" to make a donation.

NEW ASSOCIATE CHAIR AND ASSISTANT CHAIR



This summer, Nick Korevaar stepped down as Associate Chair of the Department. Nick has done a fantastic job in this role, even with the growing demands placed on this position, and we would like to thank him for his years of hard work. Stepping into to this position is Nathan Smale and Kelly MacArthur taking on the dual roles of Associate Chair and Assistant Chair.



Nat Smale has been with the department since 1990 (although he was also a postdoc here in 1988/89). His work has mostly been in geometric analysis, although in recent years he has been working in an area involving analysis and topology of metric spaces. In his free time, Nat enjoys rock climbing (especially bouldering), other outdoor activities like hiking, canyoneering, and trail running.

Kelly MacArthur has been working in the department for 22 years in one capacity or another – first as a graduate student, then adjunct instructor, and now as Career-line faculty. She has taken on many additional responsibilities along the way, such as N'dahooah, TA training, undergraduate advising, and taking charge of the State Math Contest for the three years it was our turn to host. She even instituted an outreach math volunteering program at the Utah State Prison. In her free time Kelly enjoys road cycling, Bikram yoga, hiking, gym classes, etc.

PEOPLE WHO JOINED THE DEPARTMENT 2016 - 2017



Sean Lawley
Assistant Professor
PhD May 2014 from Duke University

Sean has been here as a postdoctoral research assistant for two years, but now is full-time tenure track.

Research Interests:
Probability Theory & Stochastic Processes



Akil Narayan
Assistant Professor
PhD June 2009 from Brown University

Akil is working with the SCI Institute as well as math and was hired last year, but took a leave and started this year.

Research Interests:
Numerical Analysis

GRADUATE STUDENTS

New Ph.D. Students:

- Xuesong Bai (U. of Utah)
- Yen-An Chen (National Taiwan U.)
- Dihan Dai (Zhejiang U.)
- Ryan Dickmann (Georgia Tech)
- George Domat (Tufts U.)
- Cody FitzGerald (U. of New Hampshire)
- Matthew Goroff (Bowdoin College)
- Hyunjoong Kim (Yonsei U.)
- Kristen Lee (Weber State U.)
- China Mauck (Grinnell College)
- Thuong Nguyen (Ho Chi Minh City School of Ed.)
- Sergazy Nurbavliyev (Bogazici U.)
- Conor Tillinghast (Bowdoin College)
- Nathan Willis (U. of Utah)

MStat & MS Teaching:

- Sterling Blood
- Bryan Cook
- Zachary Coleman
- Yeon Jung Jo
- Siben Li
- Brandon Lui
- Premkumar Narayanan
- Ashley Rowland
- Breckell Soifua

VISITORS

Postdoctoral Research Associate:

- Benjamin Fogelson
Courant Institute

Scholars:

- Boris Sirola
University of Zagreb
- Shmuel (Michael) Ryvkin
Tel Aviv University

Postdoctoral Scholars:

- Ornella Mattei
Università degli Studi di Brescia

Graduate Student:

- Rankeya Datta
PhD expected in 2019 from the
University of Michigan



FOLLOW US:



FAREWELL EMINA ALIBEGOVIC



Emina Alibegovic, a valued member of our Mathematics Teacher Education Program, has decided to make a career switch and become a high school teacher herself.

Emina received her doctorate in geometric topology under Mladen Bestvina at the University of Utah in 2003. She returned to the U of U in 2006 after a postdoc at the University of Michigan, Ann Arbor. Besides its prominence as a center for mathematical research, a collaboration between the UM College of Education and the UM Mathematics Department has made Ann Arbor a national leader in mathematics education over the last couple of decades, especially mathematics teacher education. During her postdoc years Emina became gradually more and more interested in that collaboration to the point that it became her primary career focus. When Anne Roberts retired in 2005, a leadership position in the U of U's math teacher education program came open and Emina accepted the offer to return to Utah in that role.

Highlights of her tenure with us include the new MS in Mathematics Teaching program, her development with Brendan Kelly of our Department's updated Math 1010 course, and her leadership (and teaching) in the Foundations of Algebra (Math 4030) and Foundations of Geometry (Math 3100) for our math teaching majors. With Hugo Rossi and Maggie Cummings, she co-founded the Utah Math for America program and organized its Teacher Math Circle component. All of this enabled Emina to connect with our secondary teachers not only in their preservice years but also in their subsequent work in the classroom.

Emina, we wish you all the best! We hope that your new career goes very well for you, and that the insights and first-hand experience you gain deepens and broadens still further the scholarship and articulate leadership that you have brought to our teacher education program over the last decade.

REBECCA BURNS RETIRES



We are saying a warmhearted farewell to Rebecca Burns who will be retiring in October. She has worked at the University of Utah for over 31 years and has been with the Department of Mathematics since 2009. Rebecca has done an excellent job as our Grants/Contracts Officer during her tenure. She has managed over 80 grants and millions of dollars for our faculty. She is meticulous and accurate in all aspects of her work and her expertise is nothing but superb.

Rebecca loves to travel, bike, and hike; and she doesn't hesitate to do almost any activity that takes her outdoors. We wish her all the best in the years that are ahead. Enjoy the relaxation and freedom that a leisurely life of retirement brings as you begin the next chapter of your life. Good luck Rebecca - we will miss you!

ALUMNI SPOTLIGHT: BRENDAN KELLY



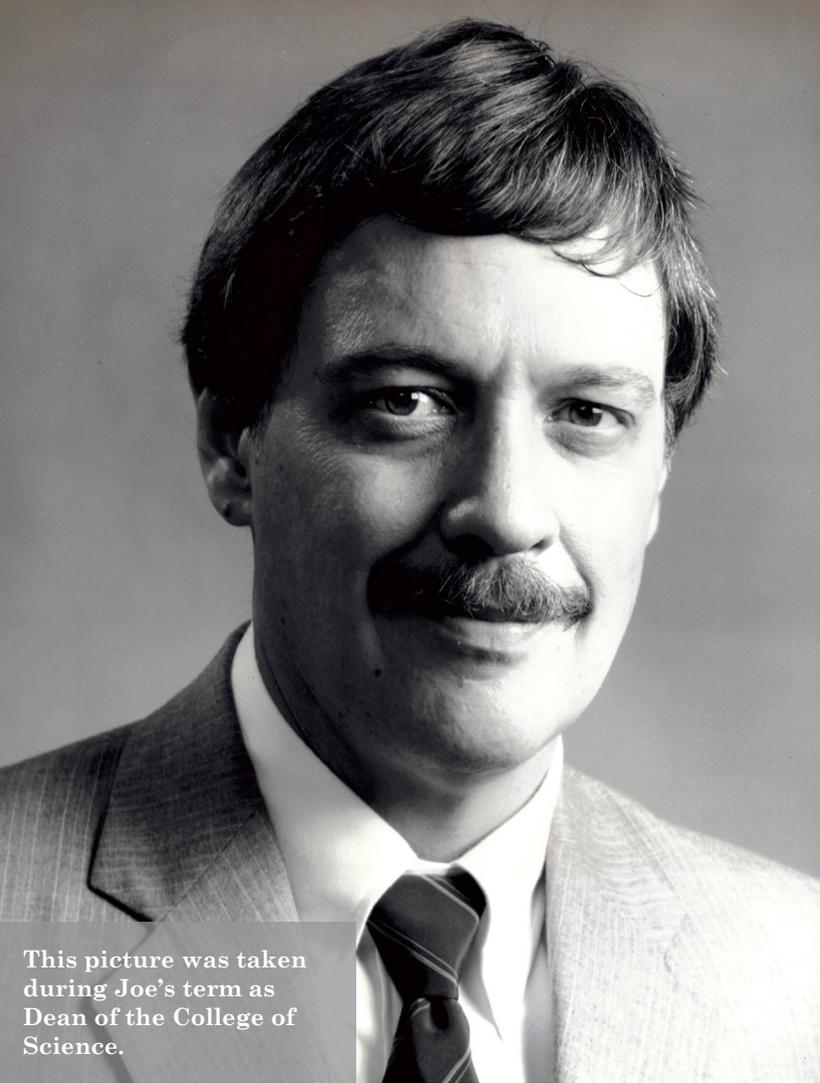
Brendan Kelly entered our PhD program in 2009 after receiving his Bachelor of Science in Mathematics from The College of New Jersey. He soon began studying geometric group theory under Kevin Wortman, who he would like to thank for his dedicated guidance and encouragement.

Soon after beginning our program, Brendan discovered that he was fascinated by the many complexities of teaching mathematics. He began to work closely with the department to improve the level of instruction to our undergraduates; in particular, he was instrumental in helping to redesign our MATH 1010 materials and curriculum and spent several years instructing incoming graduate students on various methods of effective teaching. Brendan received his PhD in 2014 after defending his thesis, *A Finite Index Subgroup of $B_n(OS)$ With Infinite Dimensional Cohomology*.

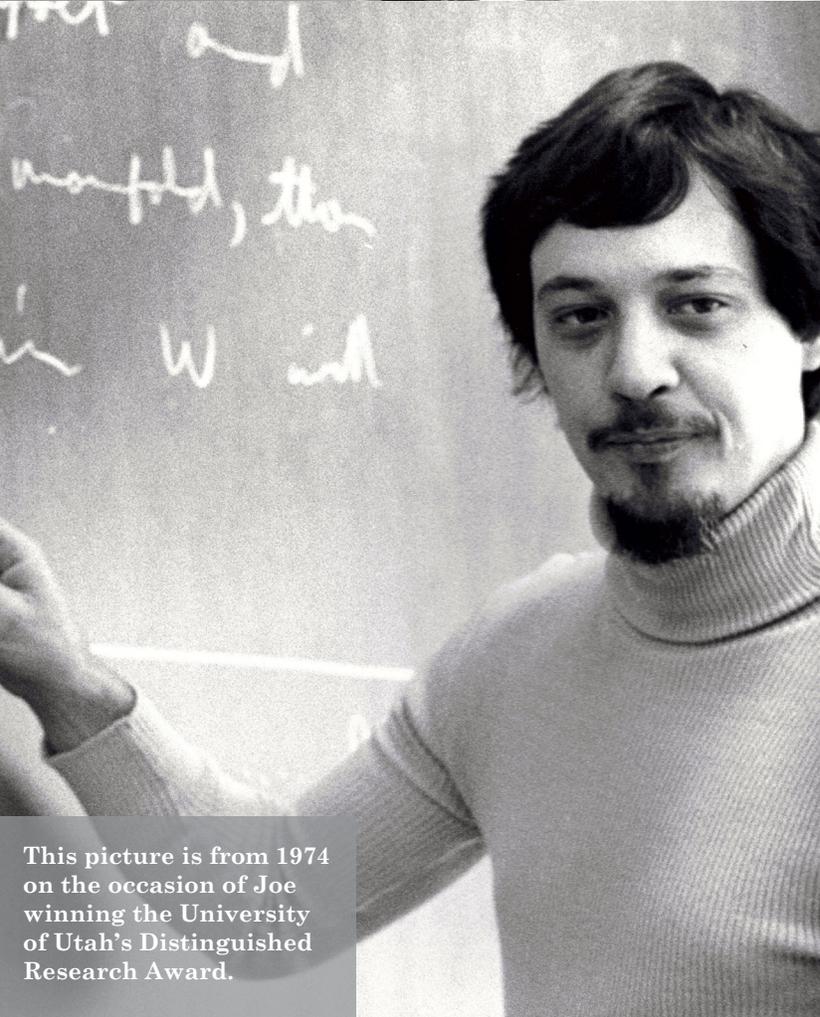
After graduating, Brendan was offered a job at Harvard University as Preceptor in Mathematics, a position he still holds today. He manages a team of faculty members and graduate students to assist students in a year long course that intertwines calculus and precalculus. Many of the students in this course come from under-resourced high schools or are first generation college students; his position allows him to reach his goal of providing access to quality mathematics instruction in a broad context. In addition to this work, he continues to develop good instructional habits in graduate students by teaching a course titled, Teaching Undergraduate Mathematics. He is also active in the Boston area, organizing a math Teacher's Circle at local public schools.

We applaud Brendan for his accomplishments and wish him luck in his future work! When asked if he had any advice for current students pursuing a degree in mathematics, his reply was this: "Grit is the key to success; your potential is unknowable without putting in the effort."

REMEMBERING JOSEPH L. TAYLOR 1941 - 2016



This picture was taken during Joe's term as Dean of the College of Science.



This picture is from 1974 on the occasion of Joe winning the University of Utah's Distinguished Research Award.

On July 28, 2016, our friend and colleague, Joseph L. Taylor, passed away. Joe had a long history in the Department of Mathematics, and left an indelible imprint on it.

After graduating from Olympus High School in 1959, Joe took a job at Litton Electron Devices (now L3 Communications). In the 1960-1961 academic year, he began taking math classes at the University of Utah. In the summer of 1961, he moved to Baton Rouge, Louisiana, and enrolled directly in the graduate program at Louisiana State University. Joe completed his thesis work by 1963, but discovered he could not officially receive his PhD without first completing an undergraduate degree. He set about finishing his bachelors degree later in 1963, and finally was awarded his PhD in 1964. He then became a Benjamin Peirce Instructor at Harvard. He stayed at Harvard just one year before returning to Utah in 1965, where he spent the remainder of his career.

Joe served as Chair of the department from 1979-1982, as Dean of the College of Science from 1985-1987, and as Vice President for Academic Affairs from 1987-1990. He retired as Professor Emeritus in 2012. He was instrumental in supporting first-rate mathematical research in the department.

Joe specialized in Banach algebras and non-commutative harmonic analysis. Among his many mathematical distinctions he was a Sloan Fellow from 1967-1971, an invited speaker at the International Congress of Mathematicians in 1974, and he received the American Mathematical Society's highest research award, the Steele Prize, in 1975 for his influential monograph, "Measure algebras." Later in his career, Joe turned to authoring a number of important textbooks, including "Several complex variables with connections to algebraic geometry and Lie groups" (2002), "Complex variables" (2011), and "Foundations of Analysis" (2012).

Joe's passing marks the end of an era in the Department. He will be deeply missed.



STAFF AWARDS

Tiffany Mendenhall-Jensen and Della Rae Riker are the well-deserved recipients of the 2015-2016 Department of Mathematics Staff Awards.

Tiffany, our Department Accountant, is very friendly, conscientious, and always has a smile on her face. She manages and tracks our departmental budgets and she is very meticulous in her work. She is always positive and doesn't hesitate to find the information that is needed to ensure that our department is following university and budgeting guidelines. Tiffany is always the first to jump in and help wherever needed. She is passionate about her work and you can tell she loves her job.

Della Rae, Executive Secretary, is always prepared for anything that comes through the door of the main office and keeps a smile on her face. She has a very calming influence for those of us who can be over-stressed at times. She is very talented when thinking outside "the box" and troubleshoots quite effectively all issues that arise relating to our classrooms, copier/printers, and of course, our beloved coffee machine. She is constantly on the move and when you do see her at the front desk, she is patient and always showing great posture while sitting on her yoga ball.



GRADUATE STUDENT AWARDS



Thomas Goller

Award: University Teaching Assistantship

From: The Graduate School, University of Utah

Description: For full-time graduate teaching assistants. Departments may use the University teaching assistants in a variety of ways to enhance undergraduate teaching and graduate student development.



Bhargav Karamched & Qing Xia

Award: Outstanding Graduate Student of the Year

From: Department of Mathematics, University of Utah

Description: Gives students financial compensation to support their academic pursuits.



Daniel Lee

Award: Company Launch Award

From: Lassonde Entrepreneur Institute, University of Utah; sponsored by Zions Bank

Description: Gives student companies dedicated space at the Lassonde Studios, individualized business/finance mentoring, legal services, and company launch support.



Anna Miller

Award: Graduate Research Fellowship

From: The Graduate School, University of Utah

Description: For full-time graduate students who are conducting research or creative projects and who are pursuing the terminal graduate degree in their departments.



Laura Strube

Award: Nomination for Faculty Recognition Program (did not win, but was the only graduate student to get nominated).

From: Career Services, University of Utah

Description: Recognizes faculty members who are contributing to students' career development and exploration.

FACULTY DISTINCTION

Congratulations to **Graeme Milton** who was awarded the 2015 prize, "Tullio Levi-Civita," for the Mathematical and Mechanical Sciences. This prize is awarded by the International Research Center on Mathematics and Mechanics of Complex Systems at the Universita dell'Aquila. The Tullio Levi-Civita is an international prize and is awarded to at most two scientists per year, "to recognize the high quality and undisputed originality of the scientific research of eminent Italian or foreign scientists" (quoting the foundations' website).





GOLDWATER SCHOLARSHIP

The Barry M. Goldwater Scholarship awards scholarships to outstanding undergraduate students who intend to pursue research careers in mathematics, natural sciences, or engineering. The University of Utah nominates four students each academic year and for 2016-2017, two students from our University were selected as recipients. The Department of Mathematics is proud to recognize both of these students as our own majors.

Ethan Lake is a double major in Physics and Mathematics. He has been working on research problems in theoretical physics since Summer 2015. His first project concerned p-wave superconductivity in a spin-imbalanced system of two-dimensional electrons interacting with each other via a weak repulsive contact interaction. The goal of the study was to find how spin-orbit interaction, which is ever present in every practical realization of two-dimensional electron gas, affects the superconducting pairing. Ethan was able to tackle this technically challenging problem in just a few weeks, surprising his advisor, Physics and Astronomy Professor Oleg Starykh, with his intuition, technical skill, and clarity of writing. Since then, in just over a year, Ethan already has two research papers written: one, with his advisor, published in Phys. Rev. B, and a preprint on a different topic, where he is a sole author. Ethan is an exceptionally talented individual of amazing intellectual power.

Michael Zhao is majoring in Mathematics. Michael has been doing research on the subject of quaternion algebras under the supervision of Mathematics Professor Gordan Savin. Classically, quaternion algebras are obtained by doubling quadratic fields. It is a process analogous to creating complex numbers from real numbers – one doubles real numbers to create complex numbers. Similarly, one doubles complex numbers to create Hamilton's quaternion algebra. Thus, a quaternion algebra is naturally a two-dimensional space over a quadratic field and that space is equipped by a hermitian form naturally furnished by the norm map. In his research project, Michael is looking at an integral version of these objects, where fields are replaced by rings of integers in local and global fields. In this setting there are natural invariants called discriminants. The principal result is a formula that expresses the discriminant of the quaternion algebra in terms of the discriminant of the quadratic field and the discriminant of the binary hermitian form. This is analogous to a well-known formula in number theory which says, given a chain of extensions of three number fields A, B and C, the discriminant of C over A can be expressed in terms of the discriminants of C over B and B over A. Mike is one of the strongest undergraduate students we have had, and he already has an incredible level of maturity and mathematical knowledge.



Photo Credit: Mike Schmidt

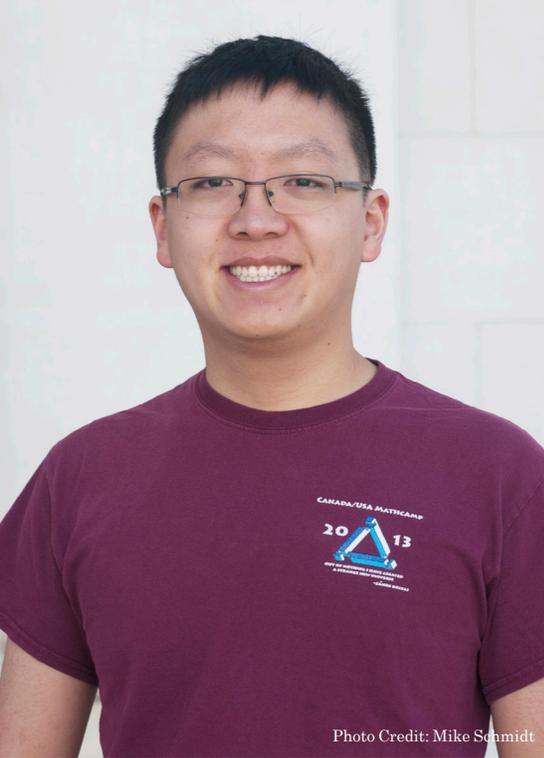


Photo Credit: Mike Schmidt

SERVICE AWARD

Congratulations to Aryn DeJulis for receiving the University of Utah's 5 years of Service Award. She has been a part of the Department of Mathematics for 4 years working as the Director of Undergraduate Services. As the Director her primary responsibilities include running the T. Benny Rushing Mathematics Student Center. Also, she serves as an editor for the department newsletter, coordinates the Summer Mathematics Program for High School Students, and oversees other activities and events for our undergraduate math majors.

Before starting employment at the University of Utah, Aryn received a Bachelor of Science in Mathematics from our department. She is currently working on an MBA through the David Eccles School of Business at the University of Utah. She and her husband are expecting their first child in January 2017. Congratulations again Aryn!





SUMMER MATH PROGRAM FOR HIGH SCHOOL STUDENTS

This June, Karl Schwede directed the summer high school mathematics program here at the University of Utah with the classroom assistance of Mike Bolton, Leonard Carapezza, Victoria Farrimond, and Chung Ching Lau. Aryn DeJulis ran the logistics for the nineteen students who attended this three-week camp.

The focus was hands-on elementary number theory and cryptography, both modern and historical (from the Scytale and Caesar Shift to RSA, Miller-Rabin primality testing and beyond). You may have seen the participants running around campus on scavenger hunts (with encrypted clues which might require solving a mathematical problem to decrypt), carrying orange cones.

The students were remarkable! They quickly mastered and applied numerous new mathematical techniques. Their enthusiasm was the driving force behind the program.

Besides number theory and cryptography, the camp had daily colloquium lectures on topics ranging from medical imaging to sea ice to the concept of infinity. These engaging lectures were generously given by Fred Adler, Peter Alfeld, Aaron Bertram, Adam Boucher, Brian Chapman, Ken Golden, Christel Hohenegger, Jenny Kenkel, Kelly MacArthur, Peter Trapa, and Kevin Wortman. The remainder of the afternoons were spent writing cryptographic algorithms in Sage.

The final day of the camp included a wrap up scavenger hunt, a game of jeopardy, and a chance to try to break the public key encryption of other groups of students. It was an exciting three weeks!

ACCESS PROGRAM FOR WOMEN IN SCIENCE

AFTERMATH

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The ACCESS Program for Women in Science and Mathematics has been going strong since 1991. It was created as a way to give women new opportunities in these areas. The math department is proud to continue our involvement with this fantastic program, and this year Alla Borisyuk and Yekaterina Epshteyn each led one week of study for these amazingly bright young women.

Week 1: Alla Borisyuk

Following tradition, the first Math week of ACCESS was devoted to learning about modular arithmetic, its applications in cryptography, and finally, the cryptocurrency. The students worked in groups through sets of problems building up necessary theory. Then, using python, they encrypted and decrypted texts about famous mathematicians and notes to each other. Finally, on the last day they used their new knowledge to participate in a lively ACCESS cryptocurrency market: mining and spending coins, trading chocolates and charms.

Week 7: Yekaterina Epshteyn

Everyone has encountered waves, whether as sound waves (for example a ultrasound wave), ocean waves, or even seismic waves during an earthquake. The concluding week of ACCESS was dedicated to learning about mathematical and computational modeling of wave phenomena and their applications in science and technology. First, through a series of lectures students were introduced to one and two dimensional wave equations as well as to their numerical approximations using finite differences. After that, students worked in groups on simulating different aspects of wave propagation phenomena in Matlab. As a final task, each group of students wrote a short research report about waves and their applications. This week-long ACCESS course was very intense and required a lot of work from everyone who participated in it. But all in all, the course was great fun and a valuable adventure into research in an important area of modern Applied Mathematics.



As part of the ACCESS program, each participant will take part in undergraduate research during spring semester, and we wish them luck as they continue further in their mathematical and scientific studies. Hopefully, the excitement of their ACCESS classroom can carry over to these women in their other mathematical explorations.

