NC State Undergraduate Mathematics

Fall 2016

Newsletter

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SUM CLUB
NC STATE

Mathematical Contest in Modeling

Jaye Sudweeks, junior studying applied math, and Graham Pash, junior studying mechanical engineering and applied mathematics, participated in the Mathematical Contest in Modeling (MCM) in the spring semester of 2016, along with Ken Jutz who graduated in May 2016. The MCM is a five day, international math competition that challenges undergraduate students in teams of three to apply their mathematical knowledge to real world problems. Past competition questions have included modeling potential interventions to the 2014 Ebola outbreak and assessing the potential damage done by an asteroid striking Antarctica.

Jaye and Graham studied and modeled the movement of refugees in Eastern Europe and the Middle East with the intent to inform policy on how to best support and protect those parties. The five day period can be very challenging. Jaye shares that "the most challenging part of this competition is staying motivated. Five days is not a lot of time, but it's simultaneously the most torturously long period of time on this Earth. It's very hard to work on one problem for five days, Especially when that problem is unwieldy."

Despite the incredible challenge, the reward is well worth it, as Graham describes, "You spend five days working around the clock and absorbing all of the material that you can on the topic that you chose, so it's extremely rewarding to see it all culminate in this nice paper that you feel proud of and can show off." For both students, MCM

was a valuable self-learning experience as well:

"The most important thing that I've learned about myself by participating in MCM is that I can do difficult things - there's so much power in being able to say that. I also learned that I can be creative and innovative, and those skills are not reserved for other people." - Jaye

"I learned that mathematical modeling is something that I'm really passionate about and would love to continue doing in the future. I think that there is a place for informed policy like this, and it's a great way to make a difference in the world while doing something that I love." - Graham

Jaye and Graham intend on competing in the MCM again this year, and the Math Department is interested in sponsoring more teams for the contest in January 19-23, 2017. Interested students should contact Jaye (jcsudwee@ncsu.edu) or Graham (gtpash@ncsu.edu).

Association for Women in Mathematics

The Association for Women in Mathematics' (AWM) mission statement is to *encourage women and girls to study and to have active careers in the mathematical sciences, and to promote equal opportunity and the equal treatment of women and girls in the mathematical sciences*. Their local chapter here at NC State follows the national mission statement while pushing to promote interest among young girls in the local community. Every Wednesday during the school year, AWM hosts *Weekly Brown Bag Lunches* where students, faculty and staff of all genders gather to socialize. Attendees are encouraged to bring their own lunch and AWM brings a delicious treat. This is hosted in SAS 4104 at 12:00 p.m. Anila Yadavalli, the president of AWM, describes these lunches as "providing a great network" as first year students can benefit from meeting older students and professors.

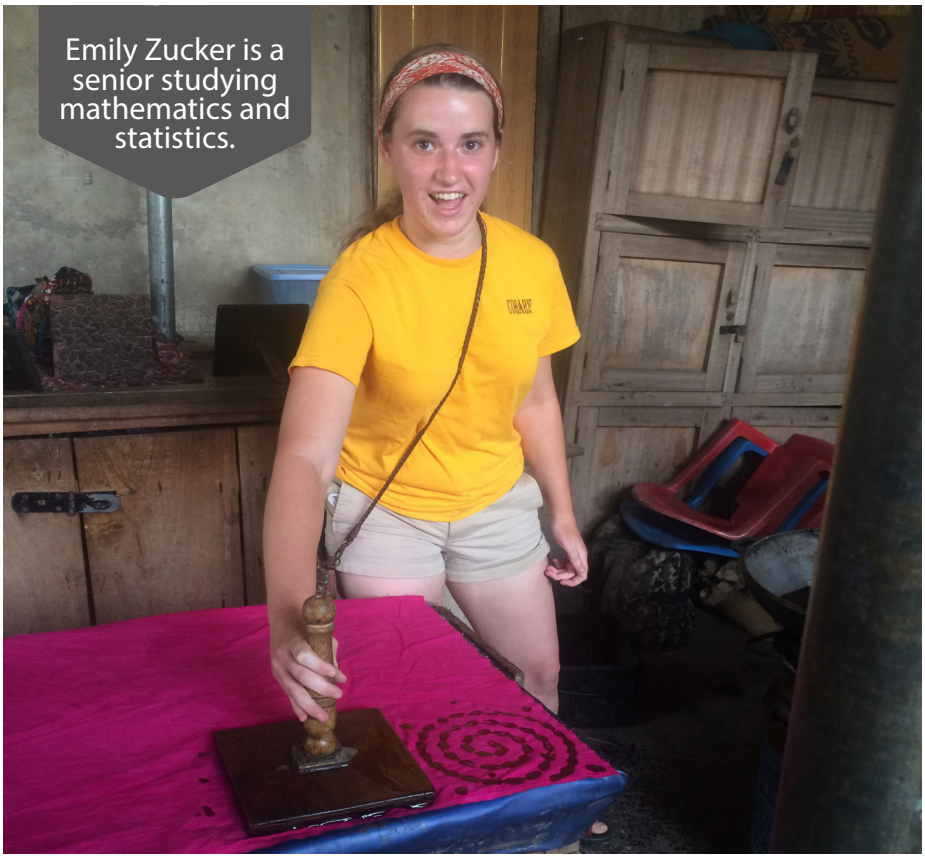
AWMs across the country hold their biggest event of the year in April—SK Day. SK stands for Sonia Kovalevsky, the first female to obtain a Ph.D. in mathematics. Sonia was responsible for some of the most important contributions to analysis, partial differential equations and mechanics. During SK Day, our local chapter hosts seventh and eighth grade girls from schools in the Raleigh area to visit our mathematics department for a morning filled with math workshops, activities and talks.

Math Honors Program

In Spring/Summer 2016, Yvonne Chazal, Robert Baraldi, Ryan Cinoman, Mia De Los Reyes, Robert Gentry, Alexander Hazeltine, Samuel Loomis, Tyler Maltba, Andrew Marquis, Anthony Powell, Joel Ruble, Michael Rose, Georgy Scholten and Monica Wang graduated, completing the Math Honors Program. New students who joined the Math Honors Program include Ephraim Bililign, Colton Bradley, Christopher Cardullo, Joshua Cook, Rachel Hamrick, Daniel Harper, Andrew Hensley, Lamecca Knoll, Joseph Meyers, Marvin Newlin, Graham Pash, Alysia Promislow, William Reese, Prem Shah, Brandon Summers and Isaac Sunseri. Currently we have 28 students participating in the Math Honors Program and we will extend our invitation to more students during this semester. Every year about 20 percent of math graduates complete the Math Honors Program and about 80 percent of those students go on to excellent graduate schools. Schools they have attended include Berkeley, Princeton, Stanford, MIT, Cornell, NYU and UCLA. Math honors students have received 22 NSF Fellowships AND three DoD Fellowships for graduate school as well as nine Goldwater Scholarships, one Churchill Scholarship and three Gates Fellowships. Besides taking a number of challenging advanced mathematics courses, Math Honors Program students also do research either at NC State or in a summer REU Program (Research Experience for Undergraduates) nationwide. More than 30 students have completed a study abroad program focusing on mathematics, either at the BSM Program (Budapest Semesters in Mathematics) or the MiM Program (Math in Moscow Program). Participation in REUs, BSM, MiM and other similar programs has helped greatly the success of honors students getting accepted into numerous excellent graduate schools. Dr. Min Kang is happy to talk to any student interested in participating in the Math Honors Program – stop by her office in SAS 4114 or email her at kang@math.ncsu.edu for an appointment. More information about the program can be found on the Math Honors website at http://www.math.ncsu.edu/honors

A Semester Abroad: Emily Zucker

Emily Zucker, a senior at NC State studying in mathematics and statistics, is spending her 2016 fall semester studying abroad in Accra, Ghana at the University of Ghana. Below, she shares a few of her many experiences with her math professor and courses in Ghana.



Math is definitely a universal language. Although everything is different here, the math isn't. My professor for both Discrete and Complex Analysis, Dr. Acquaah, is one of the best professors I've ever had.

In the beginning weeks of classes, I ended up in Dr. Acquaah's office reviewing a Complex Analysis class I had missed. Upon my entrance to his office he instantly handed me a marker and said, "I'll teach by having you do it". Next thing I knew I was in a race to complete the proofs faster than his standards. This didn't suck. This was bliss.

Math is beautiful. And maybe it took being in a third world country for me to see it's pureness and importance in society. That change can happen, so long as someone is standing for it.

"What's the most powerful country in the world?" Dr. Acquaah once asked my 60 person Discrete Mathematics class. "The U.S.," the room of all-black students responded in unison. I can't express how I felt being American in that moment. "Yes. And why is the U.S. Powerful?" He answered something along the lines of "Because they know math."

Are you kidding me? No offense, but there is nothing that separates what I learn in the U.S. to what Ghanaian students are learning here. So why do I have the opportunity to work for big companies? Have a six-figure job with a nice apartment and an air conditioned work environment? To go eat sushi, chicken, burritos, burgers, pizza, cookie dough or any other food I can think of whenever I want. And them? They're using composition notebooks in a humid classroom and they're trying to become an actuary to make the money needed to survive. Working for a company in the U.S, any company, is so much of a dream to them that it's impossible to obtain.

The classrooms and study rooms here have piles of broken chairs and desks in them. At night their only option to study is in their room or their hall reading room… both of which get old quickly. Their only fast food options consist of Jollof rice, chicken and beans. Also obtaining food, even snack food, by themselves at night isn't a possibility. For the few women who study math at the University of Ghana, they experience unnecessary flirts and mansplaining from their classmates. Needless to say my experience as a white American woman studying math in this country is not easy. In fact, at some points it has REALLY sucked.

Studying here sucks. It sucks really bad. It sucks so bad that I've grown substantially. I've seen beautiful people trying harder than anyone I've ever seen in the U.S to make a difference for themselves and their country. I've seen an importance for diversity in mathematics, and the difference that I make for other women by simply being a woman in math. I've seen the importance of resources in education, and I've gained an appreciation for rules and structure. This experience, though hard at times, is something I would recommend for anyone, especially math majors. Talk to the study abroad office and do consider coming to meet Dr. Acquaah in person.

If you would like to follow Emily's story and journey, visit her blog: www.emilyexplorer.com

Puzzle Page

Serpent Sorter

		snakes				countries				colors			
		ash python	pygmy racer	tawny cobra	winged snake	Australia	Cambodia	Spain	Uganda	black & red	black & white	green & white	green & red
lengths	12 inches												
	18 inches												
	24 inches												
	30 inches												
colors	black & red												
	black & white												
	green & white												
	green & red												
countries	Australia												
	Cambodia												
	Spain												
	Uganda												

Lengths	Snakes	Countries	Colors
12 inches			
18 inches			
24 inches			
30 inches			

Goal:

Steve is a world-renowned herpetologist and today he's been asked to bring a small collection of snakes in for a class demonstration. Help him prepare his notes by matching each snake he's bringing to its home country, length and color pattern.

Clues:

1. The animal from Austrialia is six inches shorter than the black and white serpent.
2. Of the animal from from Spain and the tawny cobra, one is green and white and the other is 24 inches long.
3. The winged snake is either the animal that is 18 inches long or the green and red snake.
4. The green and red serpent is longer than the pygmy racer.
5. The black and red serpent is longer than the animal from Cambodia.
6. The reptile that is 30 inches long is not green and red.

KenKen

How to play:

1. You must fill in the numbers from 1 to 5 (for a 5x5 grid) in each row and column. Do not repeat a number in any row or column.
2. The areas of the grid with dark outlines around them are called cages. At the top left of each cage is a target number and operation. If the cage says "4+". That means the two numbers that go in that cage must add (+) up to 4.
3. Look for any cages that are around just one box. The target number will have no math operation symbol. Simply write the target number in that cage.
4. Look for other cages, rows, and columns where there is only one possible solution.
5. Keep going until you've completed the whole puzzle!

30×		3÷	11+		
3—			1—		2÷
	3÷	24×		4—	
7+		2÷			3+
	12×	1—	5—		
			1—		5

Solutions to puzzles on next page.

Career Ambassador Program

The NC State Career Development Center offers a multitude of resources to students on professional development topics like resumes, interviewing, the job search and others. One unique opportunity that the Career Center offers is the Career Ambassador Program. Prem Shah, senior studying math and statistics, has been a Career Ambassador (CA) for three semesters now and shares his experience in the CA program:

As a Career Ambassador, I am present on professional development topics for student organizations, classes and other small programs. We are also presenting in the big LAUNCH Professional Development Workshop Series each semester.

What I love the most about the CA program are our advisors/mentors, who play a huge role in creating a supportive and challenging environment that has helped me grow as a student and as a professional. Through working with the friendly and amazing ambassador team, I have developed my presentation, communication, and leadership skills and any other buzzword you can think of. Each semester, I am challenging myself to accomplish something new and try to grow in areas that I haven't already. This semester, as one of the "older" ambassadors, I find myself tackling issues like arranging social gatherings, mentoring the new CAs and evaluating the progress of my peers.

This experience has been an integral component of my professional development, and I would not have made as much progress as I have had without the help of the Career Ambassador Program.

If you are interested in becoming a Career Ambassador, contact Ben Dictus, Career Ambassador Coordinator, at bjdictus@ncsu.edu.

Job and Internship Search Workshop

Do you want to get an internship or find a job but are worried or unsure about where to start? The Career Development Center and the Math Department are hosting a workshop on the Job and Internship Search on Wednesday, Oct. 26 in SAS 2229 from 6-7pm. The workshop will be lead by Career Ambassadors and math majors Prem Shah and Neal Hairston. Come to learn more about how to start your search and what you can be doing now to lead into more job opportunities in the future.

UUG
Undergrads
under Grads

Undergrads Under Grads

Undergrads Under Grads (UUG) is now starting their second year at NC State in the math department. It is an organization intended to help math undergraduates complete their BS degree and get plans ready for after graduation. UUG focuses on a mentoring experience made up of monthly short, informal meetings throughout the school year. During these, undergraduates can talk about their current courses, goals or professional experiences with their graduate mentors.

UUG also organizes informational sessions and workshop events on a regular basis. Topics to be covered include:

- Undergraduate research at NC State
- Applying to graduate school
- Summer research and internship opportunities
- And career paths after graduation

This semester UUG will be focusing on a grad school application workshop and an event to help students applying to internships or REUs next semester. For more information on UUG, visit its website at web.math.ncsu.edu/uug

Puzzle Solutions

Serpent Solver

Lengths	Snakes	Countries	Colors
12 inches	tawny cobra	Australia	green & white
18 inches	pygmy racer	Cambodia	black & white
24 inches	winged snake	Spain	green & red
30 inches	ash python	Uganda	black & red

KenKen

30× 6	1	3÷ 3	11+ 5	2	4
3− 2	5	1	1− 3	4	2÷ 6
5	3÷ 2	24× 4	6	4− 1	3
7+ 3	6	2÷ 2	4	5	3+ 1
4	12× 3	1− 5	5− 1	6	2
1	4	6	1− 2	3	5 5

Society for Undergraduate Mathematics

SUM Club is NC State's premier student organization for those with a passion for math. We help bridge the gap between undergraduates and the rest of the university, providing opportunities for growth in academics, service and leadership. This is accomplished through mathematics presentations at meetings, career events, social get-togethers and other college- and university-wide involvement. Led by President Shane Finkel and Vice President Prem Shah, the club is open ot any student and meets on the first Thursday of every month. The club hosts a variety of events, including collaborations with the Career Development Center. We wish to impact the community as well by volunteering and tutoring at local schools and STEM programs. Email us at sumclub@math.ncsu.edu to get involved!

Advanced Math Electives

MA 518: Geometry of Curves and Surfaces
Instructor: Andrew Cooper (andrew.cooper@math.ncsu.edu)
"Draw a vertical line in the air with your left index finger. Do the same with your right index finger. Are your lines parallel? Congratulations, you believe the earth is flat!" -- Eugenio Calabi
Differential geometry is the business of describing and detecting shapes using the tools of calculus (differentiation and integration). MA 518 focuses mainly on different ways to quantify the fundamental idea of curvature. We will see many interesting interactions between geometry and physics, as well as several surprising and beautiful theorems about which shapes are possible.
Prerequisites: MA 242 and 405. This class seeks strong undergrads.

BMA 772: Stochastic Models in Biology
Instructor: Ruian Ke (rke2@ncsu.edu)
An inherent property of our finite world is stochasticity. From disease outbreaks and extinction at the population scale to protein interactions and genetic mutations in the intracellular scale, randomness and stochastic variations play important roles in all realms of biology without exception. BMA772 will cover mathematical theories, tools and techniques that are essential to understand the role of stochasticity in biological populations. Topics of the course include probability theory, Markov chains, branching processes, birth and death processes, diffusion processes, stochastic differential equations and their applications to a selected set of biological problems.
Prerequisites: Previous exposure to probability (e.g. MA 421) and differential equations (MA 341). Note that this 700 level course is designed to be accessible to advanced mathematics undergraduates.

SUM Club at an Escape Room.