CAL POLY POMONA
Mathematics and Statistics

Volume 19/20 Issue 1 Fall 2019

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## Message from the Chair

Berit Givens

Welcome back to Fall at Cal Poly Pomona. I hope that all the Math & Stats faculty, staff, and students had a relaxing summer and are hitting the ground running this term.

The department is continuing to make changes to the curriculum after the conversion to semesters. Notable changes include a change to the science requirement. The Degree Progress Report (DPR) also continues to be inaccurate. Don't panic! In some cases, your DPR won't be corrected until your graduating term.

The department is lucky to welcome another new tenure-track faculty member this year. Dr. Lily Silverstein is joining us after completing her PhD from UC Davis. Dr. Silverstein will be teaching MAT 4170 (Algebra) and MAT 3250 (Number Theory) this year.

Did you know that the Department has an institutional membership to the Mathematical Association of America (MAA)? Because of this, any undergraduate can get a free membership. If you are interested, please talk to Dr. Ioana Mihaila. Membership includes free access to some great journals, including *Math Horizons* and the *College Math Journal*, and of course the *MAA Monthly*.

Finally, I always like to close with a math problem. This one is a classic of combinatorics. Suppose people wearing different hats go to a fancy restaurant. They all drop off their hats at the hat check. When they leave, the hat check clerk has confused all the tags. The clerk ends up just passing back the hats randomly. What is the probability that every single person gets the wrong hat? For example, if $n$=3, then there are 6 ways to pass back hats and 2 ways that the hats could be passed back so that nobody gets the correct hat. The probability when $n$=3 is *1/3*. What number does this probability approach as $n$ approaches infinity? I love this problem, because the answer is so surprising.

Have a great semester and may the mathematics and statistics you are thinking about always be just hard enough to be interesting!

## Jenny Switkes

### Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics Recipient

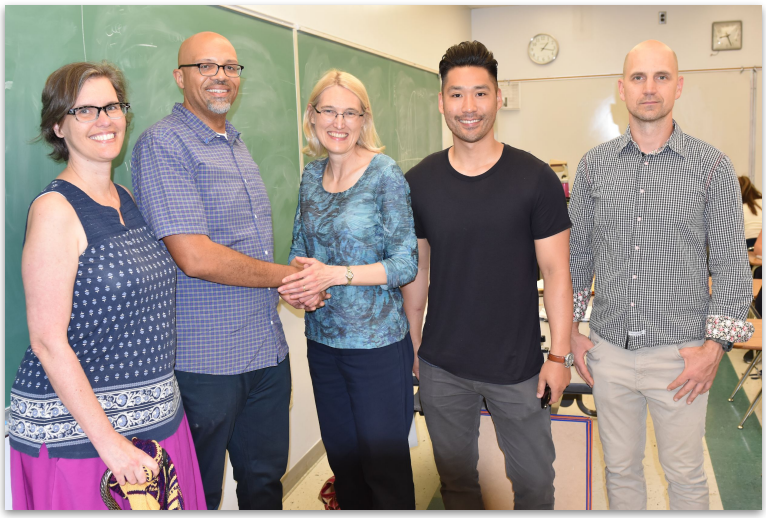
Prof. Jenny Switkes was one of three recipients of the national Haimo teaching award this year. The MAA presented the awards at the 2019 Joint Mathematics Meetings in Baltimore in January and held a presentation session where recipients shared the secrets to their success. Prof. Switkes' talk, *When a Mathematics Department Connects,* highlighted many inspiring stories of students she has worked with at Cal Poly Pomona and abroad in Uganda. An impressive number of CPP students, faculty, and alumni made the journey to the east coast to join Prof. Switkes in celebrating!


*Clockwise starting at bottom left: (a) Prof. Switkes accepting the Haimo award. (b) CPP family with Prof. Switkes after her talk. (c) Teaching and mathematics award recipients with the presidents of the MAA and AMS. Photo credit: Kathleen Wong and Polly Ng*

## Moriya Armstead

### Department of Mathematics and Statistics Teaching Award Recipient

In the words of some of the students who nominated Lecturer Moriya Armstead for the Mathematics & Statistics Department Teaching Award, Moriya is known for being "super energetic," "patient and attentive," and "approachable." Students also said that she is always available and fair, and that she puts "so much effort into teaching and you can really tell." We thank Moriya for all her hard work and for providing such a positive learning experience for our students.



*Prof. Robin Wilson being notified of his receipt of the College of Science Distinguished Teaching Award, together with Berit Givens, Alison Baski, and members of the award committee. Photo credit: Dan Griggs*

## Robin Wilson

### College of Science Distinguished Teaching Award Recipient

Professor Robin Wilson was awarded the College of Science Distinguished Teaching Award. Prof. Wilson has distinguished himself by actively participating in projects that aim to improve the student experience, whether it be through changing his own instructional approach with the First in the World grant, working with local teachers through the Algebra Project and California Math Project, or connecting CPP undergrads with local K-12 students via the Pomona Hope project. During his award ceremony, Prof. Wilson gave an inspiring history of his journey as a mathematician, highlighting the many people who have supported him along the way. He encouraged those in the room to stay vigilant in the effort to re-humanize mathematics and support students who are historically underrepresented in the field. We thank Robin for all of his fantastic work, and his inspiring call to action.

# BAMM! Grant

John Rock, Robin Wilson

Three CSU campuses (Fresno, Pomona, San Francisco) were recently awarded the collaborative grant *BAMM! Bolstering the Advancement of Masters in Mathematics*. This 5-year project will recruit and support Master's students to matriculate and thrive in doctoral programs in the mathematical sciences.

All three campuses included in this proposal are a part of both The National Alliance and the Pacific Math Alliance (PMA) and are working to collaborate on one program that can provide a systemwide model for success. This program will build on past successful models for increasing access for underrepresented groups in the mathematical sciences, incorporating facets of these programs into a two-year intensive Master's degree program with a research focus. There are five main aspects of the BAMM! Program:

1) Strengthening academic preparation through intensive research and special topics courses beyond the Master's program requirements;
2) A robust mentorship program, with intentional community building within and among cohorts at different institutions;
3) Providing a structured trajectory with benchmarks to facilitate successful transition into a Ph.D. program;
4) Preparation for the GRE and GRE Subject tests, support for writing graduate school statements of purpose, and connecting students with opportunities to apply for additional graduate fellowship support;
5) Travel support for students to attend the annual PMA conference to present their research and participate in community building activities.

Thirty students will receive scholarships of up to $10,000 per year for up to two years to enable their participation in this program. The thirty scholarships are to be spread over the five-year life of the grant and split across three campuses. Hence, at CPP will be awarding roughly two scholarships per year only. BAMM! will begin accepting applications sometime in Spring 2020 from students who plan to start a master's program in Fall 2020.

Congratulations to Dr. Wilson and Dr. Rock!

# Welcome to a new member of our community!

Lily Silverstein was born in Boston and received her B.S. in Mathematics at the University of Massachusetts, Boston in 2011. Growing up, Lily enjoyed mathematics but was more strongly drawn toward "creative" fields like literature, art, and music. It wasn't until she took a course in modern algebra that she realized just how much creativity and beauty exist in abstract mathematics, and fell in love with the subject. After college, Lily started studying computer programming on her own, and decided to go back to school with the aim of working in a computational field. She did a master's degree at Claremont Graduate University, just up the road from Cal Poly Pomona, graduating in 2015. Her biggest project at CGU was developing software for discrete optimization problems on local utility networks. While in California, Lily learned about a mathematician at UC Davis, Professor Jesús A. De Loera, whose research interests include algebraic and geometric methods for nonlinear optimization and other hard computational problems. Recognizing a kindred spirit, Lily headed off to UC Davis to study with Dr. De Loera, finishing a Ph.D. in computational commutative algebra in 2019. A theme of her research, both previous and planned, is creating combinatorial algorithms for solving very large polynomial systems, which existing methods cannot handle.

While at Davis, Lily fell in love again: with teaching! Her goal as a teacher is to show the creative, surprising, experimental, fun, and even silly aspects of mathematics that accompany its rigor and rigidity. Lily is excited to be at Cal Poly Pomona where the class sizes are small, the major is thriving, and---hopefully---she may entice some of our excellent students to do research with her.

The two most reliably attention-getting facts about Lily are: (1) she once rode a bicycle across the United States, and (2) the New York Times has published two of her crossword puzzles.

*Lily biking on the GMR - Mt. Baldy Loop*

# On Sabbatical: Studying STEM Teacher Attrition

Laurie Riggs

A sabbatical is defined as a break or change from a normal routine. It gives faculty a chance to pursue professional interests, and in my case, it gave me the opportunity to reconnect with some research I had done in graduate school that is now very relevant to current events in our state. My sabbatical involved a lot of reading, writing, research, and connecting with institutions that had data. Let me provide some background.

There is a critical need for math and science teachers in the state and teacher attrition plays a prominent role in teacher shortages. Studies have shown that teachers with experience are more effective, and experienced teachers are inequitably distributed across subgroups. It has been documented that there are proportionally more math and science teachers in high poverty and high minority schools that are novices. It seems some of our schools have a revolving door when it comes to STEM teachers. Having a qualified and stable teaching force for all students is especially critical in closing achievement gaps at high needs schools.

I started my sabbatical with a class (systematic reviews and meta-analysis) and I was able to complete a literature review on STEM teacher attrition. I then designed a research project and submitted a National Science Foundation grant aimed at studying teacher attrition in the state and its relationship to teacher preparation. We worked out agreements with three statewide institutions to gain access to longitudinal data on STEM teachers, their assignments, and their preparation.

If funded, some of our faculty and students will get the opportunity to use a comprehensive dataset and robust statistical methods to investigate the statewide attrition rates for STEM teachers, and then tie the rates back to teacher preparation programs. The goal is to identify programmatic components of teacher preparation programs that support resilient teachers and to share the results with credential programs. I will be working with Co-PIs Dr. Adam King, and Dr. Michael Giang from Cal Poly, as well as Dr. Fred Uy from the CSU Chancellor's Office.

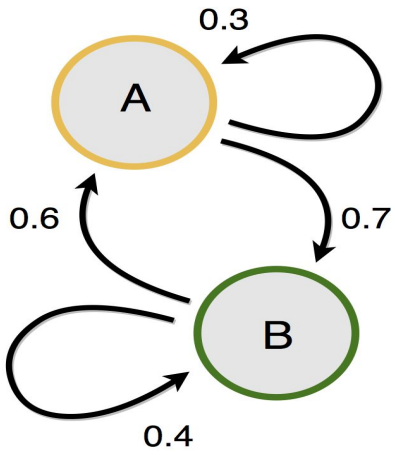
# Research on Probability Theory and Stochastic Processes

By Alan Krinik. Edited by Fernando Lopez-Garcia

**Research Group on Markov Models and Matrices**: It was once again been a busy year for Prof. Krinik's group. Seven members of this group, consisting of over 20 current and former CPP students, graduated in Spring or Summer 2019: Saif A. Aljashamy (MS, 2019), Adam T. Castillo (BS, 2019), Mark Dela (Ph.D. 2019, from UC Santa Barbara), Malachi C. Demmin (BS, 2019), Christine C. Hoogendyk (BS, 2019), Brittney A. Marian (MS, 2019), and Jeffrey Yeh (MS, 2019).

We are also very excited that three members of the group have been accepted into a doctoral program:

- Malachi Demmin: Polytechnic Institute Rensselaer in Albany, New York, starting in August, 2019.
- Christine Hoogemdyk: Oregon State University, Corvallis, Oregon, starting in September 2019.
- Brittney Marian: USC's Keck School of Medicine, starting fall 2019.




**Publications:** The first publication is a book co-edited by Krinik, which grew out of an international conference that took place at Cal Poly Pomona in August 2015. The second publication, part of the mentioned book, is a research article that has evolved from a talk co-presented in 2015 by Krinik and David Nguyen, a former Cal Poly Pomona student.

- *Lattice Path Combinatorics and Applications*, Development in Mathematics Series Volume 58; Editors: G. E. Andrews, C. Krattenthaler and **A. Krinik**; Springer; 2019.

- *Explicit Formulas for Enumeration of Lattice Paths: Basketball and the Kernel Method;* C. Banderier, C. Krattenthaler, **A. Krinik**, D. Kruchinin, V. Kruchinin, **D. Nguyen** and M. Wallner; Lattice Path Combinatorics and Applications, Development in Mathematics Series Volume 58, Springer, 78-118 pages, 2019.

# Celebrating Our 2019-20 Scholarship Recipients!

Jillian Cannons

On Thursday, October 24th, the department came together to celebrate our 2019-20 student scholarship recipients. Congratulations to all of our recipients!

**John and Rosetrina Flaig Mathematics Scholarship Recipients:**
Thuy Lu
Masato Terasaki

**Stuart Friedman Memorial Scholarship Recipient:**
Yuying (Bella) Guan

**Samuel Gendelman Memorial Scholarship Recipient:**
Fredy Soto

**Kenneth B. Kriege Mathematics Department Scholarship Recipients:**
Eric Golden
Calvin Thach

**Dr. Emil R. Herzog Department Scholarship Recipients:**
Noha Abdulhadi
Tanya Benitez
Thuy Lu
Calvin Thach
Masato Terasaki

**Mr. and Mrs. Keith Soon Kim Mathematics and Science Scholarship Recipients:**
Rui Bautista
Jeremy Lin

**Armando Gallegos Memorial Mathematics Endowed Scholarship Recipient:**
Eric Golden

*From left to right: Rui Bautista, Yuying (Bella) Guan, Masato Terasaki, Fredy Soto, Tanya Benitez, Thuy Lu, Noha Adbulhadi, Calvin Thach, Jeremy Lin. (Recipient Eric Golden was unable to attend.) Photo credit: Dan Griggs*

# Sophie's Circle

Kesh Weinstein

Sophie's Circle is the upcoming women and mathematics club that is dedicated to supporting everyone in mathematics. The purpose of the club is to provide a space to discuss underrepresentation of women in mathematics and other fields, and ways to change that.

This year, Sophie's Circle will: be the main club to help with Sonia Kovalevsky Day, start a mentor/mentee program, organize speakers to come talk about their careers in math, go to the Joint Mathematics Meetings and other conferences, and create the necessary space to talk about the problems college students face. Sonia Kovalevsky Day is a day where we have female middle school and high school students participate in different activities involving math. The goal of the event is to give the girls equal ground to learn about math, and encourage them to continue their study of mathematics. Additionally, Sophie's Circle will host a resume/CV workshop, interview workshop, stress management workshop, create study groups, and be a part of many social events on and off campus.

Through Sophie's Circle, we hope to foster a supportive mathematics community on campus and beyond. We aim to serve the STEM community (particularly mathematics) and hope everyone who wants to become a part of a community that will help them succeed throughout their college career and beyond.

If you have questions or would like to join, please email cpp.sophiecircle@gmail.com.

*Members of Sophie's Circle e-board. From left to right: Keshet Weinstein, Alexandra Castelazo, Kelynne Burns, Marion Farschman, Patricia Ornelas, Noha Abdulhadi, Thuy Lu, Yifei Li, Evelyn Guerra, and Jeanette Medrano*

# PMA 2019: Empowerment through Information and Advocacy

Ryan Flynn

**...so what happened?**

Along with a subset of the student (& faculty) body from Cal Poly Pomona, I was given the opportunity to attend the Pacific Math Alliance Conference at CSU East Bay as an Applied Mathematics & Statistics undergraduate in my senior year. Through this experience I felt empowered by fellow peers and faculty members to continue pursuing post-graduate education despite the mental and physical roadblocks that face me.

**...so how do I feel?**

To say the least, I struggle on a regular basis with feelings of impostor syndrome that often prevent me from advocating for my own wants and needs in the academic environment. Through my experience at PMA I was able to connect with other Broncos who were similarly situated, feeling left out in the post-graduate dust by a system which rewards immediate success (or raw genius) over failure, or some other series of unfortunate events which eat away at potentially strong applicants. This connection renewed my sense of belonging and reaffirmed my confidence that I had made the right decision in becoming a math major.

It should also be noted that the industry panels also brought a sense of ease to the agitation I had surrounding previous failures and the resultant low GPA. Throughout my educational career I have been too often reminded that GPA was the end-all-be-all to success in the future, so when life started to beat me down, I would often spiral out of control and make things worse. But with the encouragement I received from peers and mentors from the department I also felt more comfortable in pursuing a future directly into industry.

**...so moving forward?**

I would say that I am going to apply to 3-7 post-graduate programs as per the recommendations given in the panels for attending undergraduates and continue applying to positions in industry, ith the hope that I can continue to pursue education and apply my learning to industry, or perhaps to the classroom as an educator.

*Cal Poly Pomona students and faculty in attendance at the Pacific Math Alliance conference*

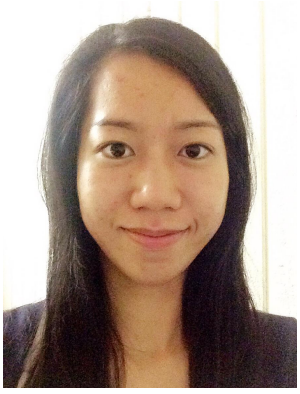
# Grad School

Fernando Lopez-Garcia

We asked some of our former students who have just finished their first year of a Ph.D. program to write a short paragraph telling something that they like of being a Ph.D. student and/or a word of advice for future applicants, and this is what they said:

### Juan Salinas, Ph.D. student at the Univ. of Washington

"A few things I like about being a Ph.D. student at the University of Washington are my cohort, being a Teacher's Assistant, and having a shared office. I can work with any of the talented graduate students here on problems that interest me, regain confidence in my problem-solving skills by solving and explaining easier calculus problems, and have a designated place to study and put all my (the library's) books."



### Van Tran, Ph.D. student at the Univ. of Montana

"What I like about being a PhD student is my advisor allow me to work on some small projects based on my interests before diving into my real research. I got to work with other people from different backgrounds such as business, computer science, biology which is a great way to learn from each other. … My future plan is to get a master in Data Science while pursuing a doctoral degree in Applied Math."

### Lori Lewis, Jacky Alvarez and Ashley De Luna, Ph.D. students at UC Merced

"We are just finishing our first year and it has been an interesting but worthwhile ride. Some advice we would like to give to those interested in pursuing a Ph.D. in mathematics:

*From left to right: Lori, Jacky and Ashley.*

1) Find an institution that will guarantee funding. 2) Find an institution that has a great community inside and outside the department. 3) Be prepared to study! We have never learned so much mathematics in such a small amount of time. 4) Make friends! Graduate students love to be together. We eat, talk and do math together. 5) "Adventure is out there!" Do not be afraid to leave the comforts of home. In the end, you have to remember the overall goal is worth it. Cal Poly Pomona definitely prepared us for our time here at UC Merced. Congratulations and good luck Broncos!"

# Apollo 11: The Immersive Live Show

Karen Vaughn


I still remember vividly where I was when astronaut Neil Armstrong took those historic first steps onto the lunar surface. The Sony color television set was perched upon my parent's tall dresser. I stood transfixed in front of it. I stood close so I didn't miss a thing. "One small step for man…. One giant leap for Mankind." Wow!

I also said "Wow!" when my hubby Jeff got me a terrific gift: tickets to Apollo 11: The Immersive Live Show, in the Lunar Dome at the Rose Bowl in Pasadena. The 50th Anniversary of the lunar landing prompted lots of celebrations around the country, including dozens of showings of old and new movies and documentaries. But none compared to the production I saw on Saturday, July 20!

This dramatization was based on the actual events and took us on a journey with present-day Ben (Pop-Pop) and his granddaughter Sydney interjected with the story fifty years ago of Ben becoming a NASA flight systems engineer and his wife Elizabeth with her "green binder."

All the actors were veterans of their craft. Of particular note was David Edelstien, an aerospace engineer who worked for Bell Helicopter, eventually segued into marketing, and worked on the National Tour for the U.S. Space Camp. He eventually became an actor in 2003. Edelstien played the part of Ollie, a Junior flight systems controller (EECOM).

On the creative end was astronaut Charlie Duke, the youngest man to set foot on the moon. For the real Apollo 11 flight, he was CapCom (Capsule Communicator), the astronaut at mission control communicating with the astronauts in space. His first words to the crew on the lunar surface were, "Roger, Twank…Tranquility, we copy you on the ground. You got a bunch of guys about to turn blue. We're breathing again. Thanks a lot!" Duke served as the show's ambassador.

Especially for those who are too young to understand the significance of Apollo 11 on a personal (Man) or global (Mankind) level, this event was great! Techies will enjoy the immersive effects of sound, feel, smell, and sight of the launch of the Saturn V carrying the CSM (Command Space Module) Columbia and the LM (Lunar Module) Eagle.

*Personal note:* My retired mechanical engineer dad-in-law worked on every Apollo mission, and he's noted in the Space Coast Workers Walk of Fame!


# Gift of Numbers

Ann Shedden

Every semester, the Liberal Studies majors enrolled in our mathematics education classes (MAT 1940, 3940, and 3950) participate in a Gift of Numbers event at a local elementary school. This Spring semester, we held two of these successful events, one at Vejar Elementary School and the second at Lexington Elementary School; both schools are in Pomona Unified School District.

For this event, the students plan and prepare a mathematics game or activity based on the California State Common Core Standards. Then they set up learning stations at the elementary schools and have a chance to work with the elementary students. The games cover every aspect of elementary mathematics from number concepts to geometry, probability, and algebra. The Liberal Studies Club adds an element of fun by sending club members to judge the activities and award prizes for creativity, fun, and appeal of the games. Elementary and college students alike have a great deal of fun doing mathematics!

Cal Poly students report that this experience reinforces their calling to become elementary school teachers; elementary school students often do not want to leave when the Gift of Numbers is over. At Lexington Elementary, one teacher mentioned that this event gave her new ideas for her classroom! We appreciate the enthusiasm of the elementary schools who host this event. Thank you to all of the instructors who guided and encouraged their students in this endeavor: Dr. Greisy Winicki-Landman, Dr. Cristina Runnalls, Mr. Jesus Magana, and Mrs. Ann Shedden

The Gift of Numbers has been an ongoing field experience for many years. It may have been started by our department's own professor emeritus Dr. Carol Smith a couple of decades ago. It continues to be an inspiring and successful event for Cal Poly students and the elementary schools that participate!

# Commencement 2019

Congratulations to all the math majors who graduated in Spring 2019! Graduates, friends, family, and faculty celebrated with a potluck before commencement, complete with a watermelon slicing by Prof. Krinik. The rain cleared just in time for the ceremony on the university quad. This year's Department of Mathematics and Statistics banner carriers for commencement were Josh Kiernan and Dylan Patterson. We caught up with them to find out their favorite memories of being a math major at CPP and their plans for after graduation:

*My favorite memories in the math department are probably just being in Ivan or Dr. Rock's classes, because it's always entertaining to see them get so excited about what they're teaching. After graduation I'm going to Claremont Graduate University to get a master's in Math and a teaching credential so I can be a high school teacher.—Josh Kiernan*

*I have enjoyed the unfamiliar, challenging problems of higher mathematics, and I have appreciated the many learning opportunities from my professors. After I graduate, I plan to go to Cal State University Northridge for the teaching credential program, with my goal of teaching math to elementary and high school students.—Dylan Patterson*

# Fall 2019 Conferences

### AMS Fall Western Sectional Meeting
### UC Riverside, November 9-10, 2019

Many CPP faculty and students participated in the AMS Special Session entitled *Probability & Integration Theory: Celebrating MM Rao's contributions as he turns 90 Years Old*. The session was co-organized by J. Goldstein (University of Memphis) and our own Professors M. Green, A. Krinik, R. Swift and J. Switkes. Several faculty and students of Cal Poly Pomona were invited to give presentations in this AMS Special Session. Topics included probability, random processes, integration theory, functional analysis, and applications.

For the full program, visit the special session page.

### California Mathematics Council - South Annual Conference
### Palm Springs, November 15-16, 2019

Visit http://www.cmc-south.org/conference.html for more information as it becomes available.

# SIAM 5th Annual Science Conference

The Cal Poly Pomona student chapter of the Society for Applied and Industrial Mathematics (SIAM) held their 5th Annual Science Conference on Saturday, April 20, 2019. The program consisted of five talks by CPP undergraduate and graduate students:

**Julius Premdas**
*Pascal's Triangle*

**Calvin Thach and Jeremy Lin**
*A Bi-criteria Mixed Integer Linear Programming Model for Load Balancing and Chemical Saving in Wafer Cleaning Processes*

**Jeffrey Yeh**
*Optimal Vehicle Fleet Size and Routing of a Fleet of Electric Vehicles for Ride-Sharing*

**Esteban Escobar**
*Enhancing the Detection of Atrial Fibrillation from Existing Models using Persistent Homology-Based Features*

**Saif Aljashamy and David Perez**
*Generalized Ballot Box Problem*

# Joint Mathematics Meetings

Stacy Musgrave

Every January, the Mathematics Association of American and the American Mathematical Society join forces and host the Joint Mathematics Meetings. In 2020, the conference will be held in Denver, CO. Cal Poly Pomona will have a strong showing, with the following talks and events:

**Thursday, January 16, 2020, 2:30 p.m.**
AMS Special Session on Outreach Strategies for Reaching Underrepresented Students at the Pre-College Level, II
*Lessons from A Multi-Tiered Approach to Mathematics Enrichment.*
Emily Cilli-Turner* (University of La Verne), Robin Wilson, and Gail Tang (University of La Verne)

**Friday, January 17, 2020, 8:00 a.m.-10:40 a.m. (Part I) and 1:00pm - 5:50pm (Part II)**
AMS Special Session on Markov Models and Matrix Properties, Parts I and II
Organizers: Alan Krinik and Randall J. Swift

- 9:30 a.m.: *Closed form expressions for powers and exponentials of tridiagonal Toeplitz matrices.*
  Hubertus F von Bremen*, Alan Krinik, Saif A Aljashamy, Aaron Kim, Jeremy Lin, Thuy Vu Dieu Vu, David Perez, Mac Elroyd Fernandez, Jeffrey Yeh
- 2:00 p.m.: *Finite birth-death-like Markov chains with generalized catastrophe transitions.*
  Alan Krinik*, Hubertus von Bremen, Saif A. Aljashamy, David Perez, Jeremy Lin, Thuy Vu Dieu Lu, Jeffrey Yeh, Aaron Kim, Mark Dela
- 4:30 p.m.: *Numerically Solving a Rank-Based Forward Backward Stochastic Differential Equation by Applying the Least-Squares Monte Carlo Method.*
  Mark D. Dela

**Friday, January 17, 2020, 1:00 p.m.-2:20 p.m.**
AMS-MAA Panel on "*Living Proof: Stories of Resilience Along the Mathematical Journey*"
Robin Wilson is a panelist

**Saturday, January 18, 2020, 8:00 a.m.-11:50 a.m.**
AMS Special Session on Fractal Geometry, Dynamical Systems, and Applications, I
**John Rock** is one of the organizers

- 10:00 a.m.: *A local-to-global technique for inequalities in spaces of functions.*
  Fernando Lopez-Garcia

**Saturday, January 18, 2020, 8:00 a.m.-11:50 a.m.**
AMS-MAA-SIAM Special Session on Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs, IV

- 8:00 a.m.: *Particle Swarm Optimization-Based Source Seeking with Obstacle Avoidance.*
  Jillian Cannons, Jeremy J. Lin*, Thuy Lu

## Model United Nations

Denise Munguia

Known in the Political Science department to hold up its prestigious title, the National Model United Nations (NMUN) program on campus once again proved its dedication. This program consists of 20 students who represent a country (member state of the United Nations) and are sent to the largest conference, held in New York, where they practice diplomatic teamwork, research, and public speaking. Countries from all over the world attend the conference, but only few of these universities earn recognition. The 2019 Cal Poly Pomona delegation representing Argentina earned the highest honor of "Outstanding Delegation" and one of our very own, Denise Munguia, a graduating Applied Mathematics major, was proud to be a part of this outstanding NMUN 2019 delegation!

**We welcome news from faculty, students, and alumni.**

Please contact
Dr. Cristina Runnalls at
ccrunnalls@cpp.edu
for information on how to be included in upcoming issues.

## Twelve Plus One

Arlo Caine

An anagram is a word, phrase, or name formed by rearranging the letters of another. For example EVIL, VILE, and VEIL are anagrams of the word LIVE, but they describe very different things. DIRTY ROOM is an anagram for DORMITORY and is (often) an apt description of the same thing. One of my favorite examples is the amazing fact that TWELVE PLUS ONE is an anagram for ELEVEN PLUS TWO and they both describe the same thing: the number 13. Are there any other examples of a mathematical phrase which is an anagram of another mathematical phrase and which describe the same number?

*Editor's note: Abstract algebra enthusiasts might enjoy finding permutations that transform the original word or phrase into its anagrams!*

This issue was produced by the Spring 2019 and 2019-2020 Newsletter Committee:
Briana Foster-Greenwood, Fernando Lopez-Garcia,
Cristina Runnalls, and Stacy Musgrave