The Mathematical Association of America
New Jersey Section Meeting

held in conjunction with

Garden State Undergraduate Mathematics Conference

MATHEMATICAL ASSOCIATION OF AMERICA

MAA-NJ

Virtually (via Zoom)

Saturday, April 17, 2021

8:30 – 9:00	**Networking**
9:00 – 9:15	**Welcome.** *Paul von Dohlen, Chair of MAA-NJ.*
9:15 – 10:05	**Distributed Multi-Armed Bandits with Cost Constraints.** *Sarah Charlton, Applied Mathematics Development Program, NSA.* Presider: Grace Cook, Bloomfield College.
10:15 – 11:05	**Workshop: Undergraduate Research in Math: Collaboration between Two- and Four-Year Schools.** *Hieu Nguyen, Rowan University and Jonathan Weisbrod, Rowan College at Burlington County.*
11:10 – 12:30	**Lunch, Networking, GSUMC Poster Session**
12:30 – 1:30	**Paper Sessions**
	Online Teaching
	Mathematics and… Social Justice, Inclusion, Ethics
	General Contributions
	GSUMC Student Presentations
1:40 – 2:30	**Get in the Game: Math and Sports Analytics.** *Tim Chartier, Davidson College.* Presider: Ik Jae Lee, Rowan University.
2:30 – 2:35	**Closing Remarks.** *Paul von Dohlen, Chair of MAA-NJ.*

Abstracts and Biographies of Plenary Speakers

Distributed Multi-Armed Bandits with Cost Constraints

Sarah Charlton
Applied Mathematics Development Program, NSA

Abstract: In this talk we discuss a project from the Graduate Mathematics summer internship program at the National Security Agency (NSA). The students combined methods from reinforcement learning and linear programming to solve a real-world problem. First, we introduce the concept of multi-arm bandits (MAB) and explore-exploit algorithms for reinforcement learning. Then we focus on a Bayesian MAB strategy called Thompson Sampling. We discuss the implementation of Thompson Sampling and how to adapt this strategy to handle real-world constraints by inserting a linear programming step between each round of sampling. We give an overview of the advantages of our approach, such as interpretability for human operators and scalability. Finally, we mention how Thompson Sampling can be extended from a Bernoulli payout system to a multinomial.

Sarah Charlton joined the NSA in 2010 as a member of the Applied Mathematics Development Program. During the program, she worked on projects in cryptography, machine learning, statistical modeling, and image processing. In 2013, Sarah transitioned to the VISTA (Video, Image, Speech, and Text Analytics) Research Group. Sarah holds four patents in image processing technology. She has been recognized with several internal awards, notably, as a member of the 2015 NSA Research Team of the Year. Before NSA, Sarah earned Bachelor's degrees in Math and Economics from Syracuse University and a PhD in Statistics from Rice University.

Get in the Game: Math and Sports Analytics

Tim Chartier
Davidson College

Abstract: Sports analytics has gathered tremendous momentum as one of the most dynamic fields. Diving deep into the numbers of sports can be game changing or simply a fun exercise for fans. How do you get in the game with numbers? What questions can be explored? What actionable insights can be gleaned? From March Madness to national media broadcasts, analytics are becoming increasingly indispensable. Dr. Tim Chartier will discuss outlooks that help with successful analytics, and the variety of questions that can be tackled. He will also share how he leads students to dig into sports using math and computer science, and their great success across the NBA, NFL, NASCAR, ESPN and his own college teams. Learn how to get in the game — as a sports analyst!

Tim Chartier is a professor of mathematics and computer science at Davidson College who specializes in data analytics. He consults with ESPN, the New York Times, the US Olympic and Paralympic Committee and teams in the NBA, NFL and NASCAR. Tim also oversees over 70 student researchers who supply analytics to Davidson College sports teams. He has authored Math Bytes: Google Bombs, Chocolate-Covered Pi, and Other Cool Bits in Computing, When Life is Linear: from Computer Graphics to Bracketology, and X Games in Mathematics: Sports Training That Counts! Tim has also worked on Google and Pixar educational initiatives. Tim's authorship, research, and scholarship have been recognized with national leadership positions. He is currently Chair of the Congress for the Mathematical Association of America. He has also received multiple awards including an Alfred P. Sloan Research Fellowship, and the Mathematical Association of America's Euler Book Prize and Beckenback Book Award.

Workshop

Undergraduate Research in Math: Collaboration Between Two- and Four-Year Schools

Hieu Nguyen (Rowan University) and
Jonathan Weisbrod (Rowan College at Burlington County)

Description: This workshop will help faculty from two- and four-year schools to build an undergraduate research program at their institution. Undergraduate research is considered a High-Impact Educational Practice (HIP) by the Association of American Colleges and Universities (AACU). Both two-year and four-year institutions should provide opportunities for students to conduct research both early on and late in their undergraduate years. While undergraduate research projects at either type of institution are conducted similarly, the impact of research programs as part of an institution's strategic plan can vary widely. We plan to discuss our experience merging the differing strategic goals of two-year vs four-year institutions when conducting undergraduate research and share tips for success in recruiting students, formulating research projects suitable for undergraduates, and obtaining seed funding.

Hieu Nguyen is Professor of Mathematics at Rowan University in Glassboro, NJ. He received his PhD in mathematics at the University of California Berkeley. He has served as Chair, Governor, and Section Representative of the MAA New Jersey Section. His research interests lie in coding theory, in particular error-correcting codes, and their applications to areas such as DNA barcoding and machine learning. He has supervised over 30 research students (high school, undergraduate, and graduate) on a variety of pure and applied math projects. He has collaborated with Professor Jonathan Weisbrod at Rowan College at Burlington County on a grant from the Center for Undergraduate Research in Mathematics (CURM) to expose undergraduate students from their institutions to mathematical research and build bridges between two-year and four-year schools.

Jonathan Weisbrod is an Assistant Professor of Mathematics at Rowan College at Burlington County. As a current doctoral student in New Jersey City University's Educational Leadership department, he is studying undergraduate research in the community college sector of higher education. He has mentored 10 undergraduates in undergraduate research and/or capstone projects. Recent programs he has participated in include Research Experience for Undergraduate Faculty (REUF) and the Center for Undergraduate Research in Mathematics (CURM). In 2019, as part of a one-year CURM grant, Mr. Weisbrod and Dr. Nguyen formed a partnership between RCBC and Rowan University to jointly lead a group of undergraduate researchers composed of mathematics students from both institutions.

Abstracts of Contributed Paper Sessions

Session 1: Online Teaching

Organizer and Presider: Kathy Turrisi, Centenary University

12:30 – 12:48: **Differential Equations Come Alive with GeoGebra and OneNote**
Revathi Narasimhan, Kean University

Abstract: Leveraging dynamic graphing utilities such as Desmos and GeoGebra, we illustrate how differential equations are brought to life through engaging models and visualization with OneNote as the content platform for activities and assessments.

One of the main issues when incorporating technology for a subject is the effort involved in managing multiple resources on the web and weaving them into a coherent narrative. We will illustrate the use of OneNote as a central repository for our web-based resources. The book-like structure of OneNote will aid in organizing the material into a live, interactive eBook. We will show how to incorporate Desmos and GeoGebra activities into the notebook, as well as relevant videos and open source textbooks. We will illustrate how one can easily organize and content and embed the resources necessary, and emphasize topics in differential equations which are enhanced by the use of technology.

12:50 – 1:08: **Assessing Outside of the Box in Discrete Math**
Grace Cook, Bloomfield College

Abstract: As more of our upper level mathematics classes at Bloomfield College have moved to hybrid or online formats, I have been investigating different ways to measure student learning outcomes. One such mathematics course is our 300 level Discrete Mathematics. This course is taken by students in the majors of Mathematics, Mathematics Education, Computer Science, Network Engineering, and Game Program as well as students pursuing a minor in Mathematics. In this presentation, I will discuss my experiences with designing and implementing alternative forms of summative assessment in the course. These alternative assessments have been used in both an onsite and online version of the course. All assessments are submitted online through BlackBoard or a shared Google Drive folder. I will share student work that covers a multitude of Discrete Math topics in a variety of formats such as videos, computer programs, slideshow presentations, and interpretive dance. Students are very much

involved in the design of their assessments and have provided valuable feedback to the process. I will discuss the pros and cons of such assessments and share the student feedback.

1:10 – 1:28: **Open Educational Resources for college STEM courses**
Krassi Lazarova and Kathy Turrisi, Centenary University

Abstract: There is a trend in higher education to reduce or eliminate textbook costs to students. Higher education institutions are looking for more affordable and easily accessible learning resources. Using such resources removes price barriers, and assist in student retention and graduation. One open education resource, OpenStax, is assessed. Tips for its implementation in the classroom are presented. Additional resources are also reviewed and recommended.

Session 2: Mathematics and… Social Justice, Inclusion, Ethics

Organizer and Presider: Dawn Nelson, Saint Peter's University

12:30 – 12:48: **JUSTFAIR: JUdicial System Transparency for Fairness through Archived/Inferred Records**

Rebecca Santorella, Brown University

Abstract: The US public has a constitutional right to access criminal trial proceedings. In practice, it is difficult to exercise this right as well as to quantitatively study federal sentencing disparities. We have assembled a public database of criminal sentence decisions made in federal district courts called JUSTFAIR. This large-scale database links information about defendants with information about their federal crimes and sentences, and, crucially, with the identity of the sentencing judge. In this talk, we discuss challenges associated with assembling this database as well as preliminary work and observations from studying sentencing equity and patterns of individual judges.

12:50 – 1:08: **Want more women in math? Here are some ideas….**

Amanda Beecher, Ramapo College of New Jersey

Abstract: The Mathematical Contest in Modeling (MCM) and Interdisciplinary Contest in Modeling (ICM) have a larger proportion of women participants than in other mathematics contests. This talk will discuss structural reasons for this increased participation. Moreover, we hope to encourage dialogue about ways these strategies can be brought into the classroom to encourage more inclusive participation in mathematics.

1:10 – 1:28: **Promoting Inclusivity through Alternative Assessments**

Sheila Tabanli, Rutgers University - New Brunswick

Abstract: It is well documented that active learning increases student performance and active learning narrows achievement gaps for underrepresented students[1]. To promote students' engagement and inclusivity in her Calculus I for the Life and Social Sciences course during Fall 2020 semester, the author designed and offered alternative assessments. These assessments were in the form of peer and self-evaluation surveys, as well as, midterm exam corrections that were assigned instead of weekly quizzes. During the weekly 80-minutes recitations, students were placed in groups of 4-6 to work on the

worksheets prepared by the author utilizing Pearson©'s e-text. At the end of the weekly recitations, student were provided a Canvas assignment as an ungraded, informal assessment to evaluate their own contributions, their group members' participation, and to identify a "muddy point". Students were being held accountable for reflecting on their own contributions, as well as, setting a personal goal for accuracy. Students responded to these alternative assessments well and these contributed to a more engaging, socially active but physically distant online learning environment during the pandemic.

In addition to the surveys, students were also assigned midterm exam corrections. It was observed that the students who reflect on and analyze their own mistakes, discover common patterns of mistakes earn (on average) more than eight percent higher final course grade than their peers who did not participate in the exam corrections activity. The exam correction activity was offered as a substitute to weekly quizzes and was made available for about a week after the midterms were released and the solutions were posted by the course coordinator. Clear instructions, visual aids and a rubric were provided to guide students for this alternative assessment. When students were asked which type of assessment they prefer, more than 80 percent of the students prefer midterm exam corrections over the weekly quizzes consist of 4-6 math problems.

During Spring 2021 semester, the author has incorporated (*Values Affirmation Intervention*)[2] strategy in her Calculus II for the Life and Social Sciences course. As a next step in this research, the author plans to incorporate a variation of the *Values Affirmation Intervention* strategy which aims to bring more inclusiveness and sense of belonging by relating the math experiences to life skills. The eight standards for mathematical practice (*SMPs*)[3] and the standards for mathematical content constitute the framework of the New Jersey Student Learning Standards for K-12 Mathematics Education with the aim of preparing students adequately for mathematics in college, career, and life. Perseverance in problem solving is an important mathematical practice standard coupled with being an independent problem solver. As a final exam extra credit opportunity, students will be asked to reflect on the question of "how perseverance help you with your success in this course? how will you connect this important math skill (and personal value) to a life decision you made or you will make?" The important take-away from incorporating such a unique interpretation of the *Values Affirmation Intervention* to her class has several advantages such as strengthening the sense of belonging, offering alternative ways of submitting the same assignment content (in the form of video, essay, audio), relating students course experiences to life experiences such as employability skills. By incorporating such an assessment, students will be inspired and empowered to see the bigger picture in mathematics.

Designing assessments with a variety of response types and using various student participation opportunities are considered as teaching practices to support diversity and inclusion[4]. By offering multiple ways of contributing to the learning environment and

enhancing students' unique learning experience, the author aims to promote diversity, inclusiveness and sense of belonging to her classes. After all, education is not “one-size fits all”.

1 http://people.math.harvard.edu/ community/inclusive-classrooms.html
2 National Science Foundation DUE-IUSE Award 2013315
3 http://www.corestandards.org/Math/Practice/
4 https://blogs.ams.org/matheducation/2017/03/06/six-ways-mathematics-instructors-can-support-diversity-and-inclusion/

Session 3: General Contributions

Organizer: Kathy Turrisi, Centenary University
Presider: Elizabeth Uptegrove, Felician University

12:30 – 12:48: **Generating Pythagorean Triples in Three Different Ways**
Jay L. Schiffman, Rowan University

Abstract: This hands-on presentation illustrates three methods to generate Pythagorean Triples. All PPT's (Primitive Pythagorean Triples) can be generated using three standard equations. In addition, we show how Fibonacci-like sequences where one considers any four consecutive terms in such a sequence and performs three simple tasks generates some (but not all) Pythagorean Triples. Finally, we consider the sum of two unit fractions with consecutive even denominators or consecutive odd denominators and demonstrate how this process likewise generates some (but not all) Pythagorean Triples. Please join us to view the marriage of discrete mathematics, history and number theory in one tidy package.

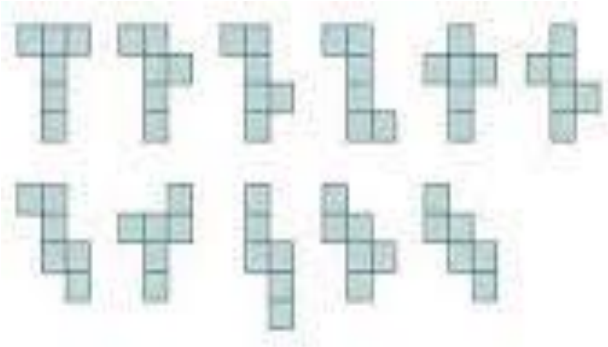
12:50 – 1:08: **How a River's Length and Discharge Relate to the Precipitation in its Basin**
David DiMarco and Ryan Savitz, Neumann University

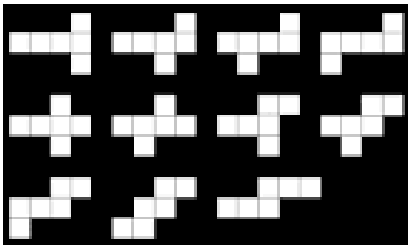
Abstract: The authors selected 14 representative world rivers. The authors wish to find out how a river's length and basin's precipitation relate to its discharge. This will be accomplished by dividing the discharge rate at its mouth by its length, generating the river's discharge gain per kilometer (DGPK), basically how rapidly the river gains flow as it progresses to its mouth. Then the Pearson product-moment correlation coefficient (PCC) will be used to measure to what degree the DGPK correlates to the mean precipitation over the river basin over the 14 rivers studied in this paper. Since the correlation turns out to be significant, the corresponding regression line will be generated. As will be seen, a significant contribution of this paper is a *simple and easy to use* model that allows us to predict river discharge based on precipitation over the river's basin.

1:10 – 1:28: **Cube-Nets as a Student Mathematics Research Project**

Reginald Luke and former students Mara Olivares and Sidhu Murthy, Middlesex County College

Abstract: Before I retired, I had spent over 40 years teaching mathematics and statistics at the NJ community college level. Occasionally enterprising mathematics students would ask me to suggest mathematics research projects for them to undertake to order to gain experience in more intense math problem-solving and be able to cite the effort on scholarship forms or transfer documents. Since these students were still at the lower undergraduate level, the math problem could not be expected to involve original research, but certainly had to be beyond the typical homework variety. One of the more interesting topics we encountered was that of Cube-Nets, the unfolding of the three-dimensional cube into different connected planar polyhedra. The NCTM site (nctm.org/Classroom-Resources/Illuminations/Interactive/Cube-Nets/) provides an interactive graphic puzzle for elementary and middle school students to determine the Cube-Nets among the displayed hexominoes. Parenthetically the site states that there are 11 non-identical (non-isomorphic) configurations. What I asked my mentored students was to determine why there were 11 such configurations and to catalogue the ways they could "unzip" the 3d cube into a particular Cube-Net form. This presentation shows how we collectively proceeded over the years gathering insights and results, what the present literature says about the solution, and what the students learned from this process. The journey led to an excursion into geometric visualization, counting and combinatorics, minimum spanning trees and other graph theory concepts, including Kirchhoff's Matrix-Tree Theorem, and, eventually, a final accounting of which "cuttings" lead to which Cube Net configurations.





2021 Sr. Stephanie Sloyan Award for Distinguished Service

New Jersey section of the Mathematical Association of America

The recipient of the 2021 Sr. Stephanie Sloyan Award for Distinguished Service from the New Jersey section of the Mathematical Association of America is Professor Aihua Li of Montclair State University.

Aihua served diligently on the MAA-NJ Executive Board for fifteen years. She began as the Liaison Coordinator (2006-2008) before becoming the Secretary (2009-2010). She served as the MAA-NJ Vice-Chair for Student Activities (2010-2014) and then as the MAA-NJ Vice-Chair for Speakers (2014-2017) before being elected as Chair of the section. Aihua served as MAA-NJ Chair from 2017-2019 and, most recently, as Past-Chair (2020).

During that fifteen-year tenure, she was also the Co-Director of the GSUMC (2009-2014) and the Host Organizer of the MAA-NJ Spring 2018 Meeting. Aihua has also contributed to the MAA on the national level having just completed serving on the AWM-MAA Liaison Committee (2019-2021) and as a current member of the MAA Committee on Undergraduate Students.

Aihua received her Ph.D. from the University of Nebraska-Lincoln, specializing in commutative algebra. Her recent research involves topics in graph theory, number theory, and applied algebra. She received a 2013 Faculty Mentor Award from the Division of Mathematics and Computer Science of Council on Undergraduate Research (CUR). She is also recipient of Montclair State University Distinguished Scholar Award. In the past decades, she has mentored many undergraduate students on research projects in mathematics. She had directed REU programs for minority students (NREUP) and CURM teams sponsored by NSF/MAA through BYU.

The section is very appreciative and sincerely grateful to Aihua Li for her many contributions to the New Jersey section of the Mathematical Association of America.

25/50-year Members of the MAA

The section congratulates our past chair Dr. Aihua Li (Montclair State University) for her 25 years of MAA membership. We congratulate Dr. Amy Cohen Corwin (Rutgers University), Dr. Harold Falk (City College of New York), and Dr. Thomas J. Osler (Rowan University) for their 50 years of membership.

MAA/AMS Book Sales

There is a virtual book sale for Spring section meetings for AMS published books. There is no discount code associated with the sale; prices are open to all and good until 5/31/2021. The following is a list of sale prices: Titles on Display. Information will also be posted at https://bookstore.ams.org/books-on-sale.

Future MAA Meetings

MAA-NJ. TBA

GSUMC. TBA

MathFest. The MAA will hold its annual MathFest virtually, August 4-7, 2021.

Social Media Information

Check us out!

Email:	maanj.socialmedia@gmail.com
Facebook:	https://www.facebook.com/maanewjersey
Instagram:	https://instagram.com/maanewjersey
Twitter:	https://twitter.com/maanewjersey

Acknowledgments

A special thanks to Kirstin Uptegrove for her assistance on planning and running this virtual meeting.

MAA-NJ Section Officers

Congress Representative	Thomas Hagedorn, The College of New Jersey
Chair	Paul von Dohlen, William Paterson University
Chair-Elect	Amanda Beecher, Ramapo College
Secretary	Elizabeth Uptegrove, Felician University
Treasurer	Dirck Uptegrove
Vice-Chair for Fall Meetings	Ik Jae Lee, Rowan University
Vice-Chair for Spring Meetings	Linda Ritchie, Centenary University
Vice-Chair for Speakers	Jonathan Weisbrod, Rowan College at Burlington County
Vice-Chair for Student Activities and GSUMC Co-Director	Deepak Bal, Montclair State University; Lee Collins, Atlantic Cape Community College
Vice-Chair for Two-Year Colleges	Tuan Le, Camden County College
Book Sale Coordinators	Dirck Uptegrove; Elizabeth Uptegrove, Felician University
Contributed Paper Organizer and Lunch Discussion Organizer	Kathy Turrisi, Centenary University
Door Prize Coordinator	Linda Ritchie, Centenary University
Liaison Coordinator	Ik Jae Lee, Rowan University
Program Editor	Dawn Nelson, Saint Peter's University
Project NJ-NExT Directors	Susan Marshall, Monmouth University; Chung Wong, County College of Morris
Social Media Director	Grace Cook, Bloomfield College
Web Administrator	Dirck Uptegrove

Join the MAA! https://www.maa.org/join