MATHEMATICAL ASSOCIATION OF AMERICA

THE MAA METROPOLITAN NEW YORK SECTION

2020 ANNUAL MEETING

THE METROPOLITAN NEW YORK SECTION
VIRTUAL MEETING 2020

May 3, 2020

Dear MAA Metro New York Conference Participants,

A warm welcome to our first Virtual Annual Meeting of the Mathematical Association of America Metropolitan New York Section (MAA Metro NY)! We greet all of you who are on your computers, iPads, and even phones, and tuning-in for a day of interesting presentations. Although we cannot meet face-to-face this time, we will certainly have a new appreciation when we meet at Queens College next year on Saturday, May 1, 2021.

Thank you during this trying period, for submitting an abstract and for continuing your research during the Covid-19 pandemic and forced isolation. Knowledge does not have any limits. Unfortunately, humans do. I would like to express my gratitude to my MAA team who thought meeting virtually was possible. With my physical limitations now, I appreciate all the hard work that was invested in making this conference possible.

Thank you to Dr. Max Wakefield, who was so excited to come virtually as our invited speaker. For those who have attended our section meetings before, thank you for coming online. For those who are here for the first time, we invite you to become part of the MAA Metro NY section community.

This year's program features more than 45 presentations extending from pure to applied mathematics to data science and big data and to our mathematics pedagogy sessions. It spans from broadening participation and creative interventions to understanding how students learn mathematics. Thank you for coming online. Please engage yourself with the speakers.

With warm regards,

Janet, on behalf of the MAA Metro NY Committee

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WELCOME

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MAA METRO NEW YORK CONFERENCE ORGANIZERS

Emad Alfar, Armen Baderian, Nadia Benalki, Johanna Franklin, Benjamin Gains, Elena Goloubeva, Ezra Halleck, Xiaomeng (Vivian) Kong, Boyan Kostadinov, Chia-ling Lin, Janet Liou-Mark (Chair), Abraham Mantell, Ariane Masuda, Eric Rowland, David Seppala-Holtzman, Satyanand Singh, Mutiara Sondjaja, and Johann Thiel

CONTRIBUTED PAPER AND POSTER SESSIONS ORGANIZING COMMITTEE

Boyan Kostadinov (Chair), Ezra Halleck, and Johann Thiel

PROGRAM COVER DESIGNER

Mandy Mei, New York City College of Technology

THE MAA ANNUAL MEETING OF THE METROPOLITAN NEW YORK SECTION

MAY 3, 2020

AGENDA

9:45-10:00 AM — Welcome

Dr. Satyanand Singh
Chair-Elect of the Metropolitan New York Section of the MAA, New York City College of Technology, CUNY

10:00-10:45 AM — Invited Speaker: Dr. Max D. Wakefield
United States Naval Academy

10:45-11:00 AM — Break

11:15-12:15 PM — Contributed Paper Sessions I

Research Session: Applied Mathematics I (Presider: Dr. Johann Thiel)
Research Session: Pure Mathematics I (Presider: Dr. Ezra Halleck)
Research Session: Data Science/Big Data and Graph Theory (Presider: Dr. Boyan Kostadinov)
Pedagogy Session: Mathematics Education I (Presider: Dr. Ariane Masuda)
Student/Faculty Session I (Presider: Dr. Eric Rowland)

12:30-1:30 PM — Lunch Break/Contributed Poster Session (Supervisor: Dr. Johanna Franklin)

1:30-2:30 PM — Contributed Paper Sessions II

Research Session: Applied Mathematics II (Presider: Dr. Johann Thiel)
Research Session: Pure Mathematics II (Presider: Dr. Ezra Halleck)
Pedagogy Session: Mathematics Education II and Student/Faculty Session II (Presider: Dr. Eric Rowland)

2:45-3:30 PM — Metro NExT Meeting

- Dr. Benjamin Gaines, *Iona College*
- Dr. Tia (Mutiara) Sondjaja, *New York University*
- Dr. Johann Thiel, *New York City College of Technology*

3:40-4:20 PM — Business Meeting (Presider: Dr. Satyanand Singh)

4:25-4:40 PM — Closing Ceremony (Presider: Dr. Boyan Kostadinov)

INVITED SPEAKERS

TITLE: Theories of Everything: Catalan Numbers, Algebraic Varieties, Matroids, and Kazhdan-Lusztig-Stanley Polynomials

Dr. Max D. Wakefield
US Naval Academy

Abstract: Some of the most striking results in mathematics come from the occurrence of beautiful objects in multiple seemingly disparate fields. Maybe even more fascinating is when entire foundational classes of objects, like algebraic varieties, have direct relationships with other seemingly very different classes of objects. The aim of this talk is to discuss multiple examples exhibiting these remarkable characteristics. Catalan numbers are famous for popping up in many different ways. Matroids and algebraic varieties are closely related via Mnev's universality theorem. KLS polynomials occur in a wide swath of fields. Even more interesting is how all these theories fit together in the broad fields of enumerative combinatorics, algebraic geometry, algebraic topology, representation theory, and algebraic combinatorics.

Biography: Max Wakefield grew up in Seattle, Washington pursuing mathematics, mountains, and the sea. After studying mathematics at Seattle University, he went to the University of Oregon for more mathematics and rock climbing. In 2006 he received his PhD for a thesis on Arrangement Theory and was awarded an NSF International Collaboration grant to study mathematics in Japan. Then in 2008 Wakefield became an Assistant Professor at the United States Naval Academy and has been there ever since enjoying working with undergraduates in mathematics. Professor Wakefield has been a visiting researcher at the Mathematical Science Research Institute in Berkeley California, a visiting Professor at University of Oregon, the University of Hokkaido in Japan, and the University of Pisa in Italy. He has been supported by the NSF, the American Institute of Mathematics, the Simons Foundation, the Office of Naval Research, the Japanese Society for the Promotion of Science, and the Naval Postgraduate school. Professor Wakefield is the coach of the Naval Academy's rock-climbing team and enjoys hanging out with his wife, son and daughter.

CONTRIBUTED PAPER SESSIONS I

11:15 AM – 12:15 PM

RESEARCH SESSION: APPLIED MATHEMATICS I

Presider: Johann Thiel

11:15 a.m. **Islands of the Fractal World: Mandelbrot to Mandelbulb 3D**
Anne Leonhardt, Satyanand Singh, NYC College of Technology, CUNY

In this presentation the audience will be taken on a journey that generated enthusiasm in our students in STEM fields at New York City College of Technology of CUNY. Students had the opportunity to work with organic mathematically based fractal forms and they produced digitally- generated physical models of the forms they created. This presentation showcases work in one of our modules from the project: A Cultural History of Digital Technologies grant, AC-2334555-16, funded by the National Endowment of the Humanities.

11:30 a.m. An Introduction to Quantum Computation

Marianna Bonanome, NYC College of Technology, CUNY

In 1965 Gordon Moore gave a law for the growth of computing power. His law states that computer power will double for constant cost roughly once every two years. The prediction is that this dream will come to an end soon, possibly during this decade, as quantum effects are beginning to interfere in the functioning of electronic devices as they are made smaller and smaller. Moving to a different paradigm can provide a solution. In 1982 Richard Feynman and Paul Benioff independently observed that a quantum system can perform a computation. In this talk we offer a basic introduction to quantum computation and its history. We will also explore how quantum computers offer an essential speed advantage over classical computers and discuss the types of problems quantum computers solve more quickly.

11:45 a.m. Tropical Cyclone Hazards in Relation to Propagation Speed

Jiehao Huang & James Booth, The City College of New York, CUNY

As the overall population and infrastructure along with the US East Coast increase, it becomes increasingly important to study the characteristics of tropical cyclones that can impact the coast. A recent NOAA study shows that the propagation speed of tropical cyclones has slowed over the past 60 years, which can lead to greater precipitation impacts and greater storm surge impacts. The study presented herein is meant to examine and analyze the relationships that exist between the propagation speed of tropical cyclones, their surface wind strength, directional angles, and cyclone averaged winds. This data includes the tracks of tropical cyclones spanning from 1950-2015. This analysis examines the Lagrangian evolution of the cyclones in terms of their propagation speed, the intensity of cyclones and the directional movement of the tropical cyclone path. Then the analysis is repeated for propagation speed versus intensity of cyclones which include maximum surface wind speed and different levels of cyclone averaged winds. The results show a positive correlation between cyclones propagation speed and cyclone averaged wind at 700 hpa in the historical record. The directional propagation speed analysis shows that tropical cyclones move the fastest when they turn eastward and also having the highest correlation to its steering wind strength compared to the westward. Additionally, the displacement angle analysis of cyclone paths describes the abrupt change of angles for each successive two instance cyclones, and the time series of displacement angle analysis shows a significant increasing trend. This research highlights an interesting question about the trends in tropical cyclones over the past 60 years related to the subtle differences in the behavior of the propagation speed and its wind strength.

RESEARCH SESSION: PURE MATHEMATICS I

Presider: Ezra Halleck

11:15 a.m. On some exponential and trigonometric character sums

Brad Isaacson, NYC College of Technology, CUNY

We express three different, yet related, character sums by generalized Bernoulli numbers. Two of these sums are generalizations of sums introduced and studied by Berndt and Arakawa-Ibukiyama-Kaneko in the context of the theory of modular forms. A third sum generalizes a sum already studied by Ramanujan in the context of theta function identities. Our methods are elementary, relying on basic facts from algebra and number theory.

11:30 a.m. Exploring The Integer Sequence 8, 87, 876, 8765, 87654, 876543, 8765432, 87654321, 876543218, 8765432187, 87654321876, etc.

Jay Schiffman, Rowan University

This paper explores the above integer sequence with regards to divisibility patterns and recurring patterns with respect to primes in complete groupings where all eight digits are employed in order as one cycles around an eight-hour clock. We consider 87654321 a single complete grouping, 8765432187654321 a double complete grouping, 876543218765432187654321a triple complete grouping and so forth. I was able to completely factor the initial one hundred terms in the sequence using MATHEMATICA Version 12.0. In addition, we prove that there are no prime outputs in the sequence. The use of congruences and modular arithmetic enables one to detect patterns, form conjectures and substantiate them. In addition, we determine the first occurrence of each prime factor less than one hundred among the initial one hundred terms if such primes exist.

11:45 a.m. **Enumerating All Pairs of Positive Integers that Share the Same LCM and GCD**
David Seppala-Holtzman, St. Joseph's College

We derive a simple formula for enumerating all unordered pairs of positive integers that share the same LCM and GCD. The derivation also gives rise to an easy method to generate them.

12:00 p.m. **On permutation binomials of index $q^{e-1} + q^{e-2} + \cdots + 1$**
Authors: Javier Santiago[1], Ariane Masuda[2], Ivelisse Rubio[1]
1-University of Puerto Rico-Río Piedras, 2-NYC College of Technology, CUNY

The permutation binomial $f(x) = x^r(x^{q-1} + A)$ was studied by K. Li, L. Qu and X. Chen over $\mathbb{F}_{q^2}$. They found that for $1 \le r \le q+1$, $f(x)$ is a permutation binomial if and only if $r = 1$. Over the finite field $\mathbb{F}_{q^3}$ of odd characteristic, X. Liu obtained an analogous result, in which for $1 \le r \le q^2 + q + 1$, $f(x)$ permutes $\mathbb{F}_{q^3}$ if and only if $r = 1$. In this investigation, we complete the characterization for $f(x)$ over both $\mathbb{F}_{q^2}$ and $\mathbb{F}_{q^3}$, as well as obtain a complete characterization over $\mathbb{F}_{q^4}$. Furthermore, for $e \ge 5$, although a full characterization for $f(x)$ has yet to be obtained, we present some partial results which narrow down considerably the search for r's that do indeed yield permutation binomials of the form $f(x) = x^r(x^{q-1} + A)$ over $\mathbb{F}_{q^e}$.

RESEARCH SESSION: DATA SCIENCE/BIG DATA & GRAPH THEORY

Presider: Boyan Kostadinov

11:15 a.m. **NBA Classification: Data Science**
Justin Peter, St. John's University
Advisor: Florin Catrina, St. John's University

Whether you're an avid fan of basketball or may not even follow sports, I'm sure most of you have heard of LeBron James. He is one of the most popular athletes in the world and his position for 15 years in basketball is small forward/power forward. This year, his position is point guard, which classifies him as a floor general. Now, I'm not going too much into depth explaining what positions or these specific classifications entail in this abstract because that information will be present in the poster. As we know, the field of data science, machine learning, and artificial intelligence is spreading throughout the world as a hot trending topic to discuss among businesses and schools. My goal for this project is to classify the current roster of NBA Basketball players not by the position they play, but the statistics that the data provides. In order to achieve this goal, I will produce a combination of mathematical, statistical, and computational programming techniques in the forms of code, algorithms, data visualization, and various images of interest. In addition, I will provide a breakdown of information on each technique and their significance to ultimately reach our goal to classify NBA players.

11:30 a.m. **Modeling the propagation of competing ideas in social networks through combinatorial games**
Josh Hiller, Adelphi University

For a fixed graph G, the burning of G, along with the burning number of G denoted $B(G)$, is a process introduced in 2015 to model the propagation of information through a social network. We will modify the concept of graph burning to model the propagation of competing information. We will see that this gives rise to an interesting combinatorial game.

11:45 a.m. **The Influence of "Bots" and Gas Lighters on Twitter and their Effect on the General Perception of Current Events**
Luc Telemaque & Nadia Benakli, NYC College of Technology, CUNY

The goal of this project is to analyze and visualize Twitter conversations related to the COVID-19 Pandemic. Social network analysis enables us to identify the influencers and followers of these conversations, who are often "bots" and gas lighters. Text analysis is used to develop an understanding of Twitter users' sentiments about the pandemic. Netlytic, a community-supported text and social networks analyzer, was used as the primary tool for this study.

12:00 p.m. Visualizing the Spread of the 2020 COVID-19 Pandemic

Boyan Kostadinov, NYC College of Technology, CUNY

In a short period of time, COVID-19 turned into a global pandemic from a local epidemic. In this project, we use real data to visualize the spread of the virus since the first official case was announced in December 2019. We plan to extend this project to further analyze the pandemic in the US using the SIR model, calibrated to the US data, and compare the model predictions with the actual US data.

PEDAGOGY SESSION: MATHEMATICS EDUCATION I

Presider: Ariane Masuda

11:15 a.m. The Impact of Participation in Peer-Supported Precalculus, Calculus I, and Calculus II Workshops on Gender, Minorities, and First-Generation College Students.

Farjana Shati, Julia Rivera, Victor Lee, Prof. Janet Liou-Mark, NYC College of Technology

Peer-led workshops are effective in providing an increase in students' performance, content knowledge, and retention. The Peer-Led Team Learning collaborative problem-solving sessions involves students working once per week on a set of modules as a group. It has been implemented in Pre-calculus, Calculus I, Calculus II courses at the New York City College of Technology, a Minority Serving Institution (MSI). Data has shown significant mean differences in departmental final exam and course grades between attending and partial attending the workshops; males and females; minority and non-minority students; and first-generation and non-first-generation college students. Results will be shared.

11:30 a.m. Bringing the Peer-Led Team Learning (PLTL) Workshops to an Online Format

Nadia Kennedy & Ariane Masuda, NYC College of Technology

We have faced many academic challenges since our sudden transition to the distance teaching mode during the Covid-19 pandemic. One of them was to quickly find an online format for our PLTL workshops, traditionally offered face-to-face at City Tech. While trying to keep the peer leader's key role in the PLTL model, we made several adjustments to accommodate the changes that the online format brings. We kept synchronous workshops for several classes we had before with their respective peer leaders. In addition, we have been experimenting with another model that we call the Math Peer Study Groups, run by peer leaders who are Mathematics Education graduates and students. In this format, students do not have to be attached to a specific course section to join a group. They can drop in and attend as many sessions as they want. The groups meet for one hour and a half, 2-3 times a week, depending on the course. Each day a different topic is covered, starting with a mini lesson. Then the students are assigned to breakout sessions to work collaboratively on a set of problems, using Zoom Whiteboard. Two peer leaders facilitate the group discussions by entering the breakout rooms in a coordinated way.

11:45 a.m. Using an iPad in Teaching and Research: Some tips, techniques, and lessons learned

Rebecca Coulson, United States Military Academy, West Point

My iPad is now fully integrated in my daily teaching, research, and note taking. This technology enables me to be much more efficient than I would be without it. In this talk, I will share some of my main takeaways.

12:00 p.m. Improving Diversity and Inclusion in a Math College ESL Classroom

Monica Morales-Hernandez & Josh Hiller, Adelphi University

Diversity and Inclusion are two words that have become very popular in the last years. As mathematicians we often listen, write, read and implement policies to diversify our classrooms, but what happens when our classrooms are already diverse? How do we actively practice inclusion? How do we modify and improve our teaching techniques and the way we communicate math to a group of students whose main characteristics are that they are diverse, they have limited math experience and also have limited English skills? How do we modify the math curriculum so that the students can successfully complete the class? How do we actively practice inclusion in an ESL College Math classroom? In this talk, I will explore challenges, modifications to the curriculum and other strategies that may be implemented in introductory math class.

STUDENT/FACULTY SESSION I

Presider: Eric Rowland

11:15 a.m. **Hypergraph Carcinogenesis Models**

Andrew Velasquez-Berroteran, Gabriella Smokovich, Eleni Zamagias, Adelphi University
Advisor: Joshua Hiller, Adelphi University

Over the past six decades, the Armitage and Doll model of carcinogenesis has been a fundamental cornerstone of mathematical oncology, serving as a framework for many investigations. In this talk we examine three variations on this model with the help of hypergraphs. Surprisingly, we will see that a variation of Pascal's matrix arises naturally in our study.

11:30 a.m. **Big Data Algorithms and their Unintended Consequences**

John Pascuzzi, John Rotchford, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

Our research and paper focus on the prevalence of big data in algorithms. We analyze the applications of these algorithms within modern-day business, along with its intended and unintended effects and consequences. The work is split into two primary components: credit scores and auto insurance. Alongside an analysis of objective and subjective data, we conduct a statistical analysis of variable correlations to auto insurance costs. Upon concluding our statistical analysis, the results showed that certain data plays a role in unfairly altering auto insurance costs based on subjective data, such as geographic segmentation based on zip code.

11:45 a.m. **Category Theory**

Christina Labita, Samantha Fischetto, Jillian Mayr, Molloy College

In general, Category Theory can be seen as the "mathematics of mathematics". Cheng (2015) explains that Category Theory seeks to generalize and study how math works. It focuses on the structures and relationships that are in mathematics. We will define and explain the different parts of category theory and specific theorems that make up this specific study of mathematics. Categories consist of objects and mappings between these objects that are called morphisms. There are some properties that these categories satisfy, and category theory studies the relationships between objects and categories. To help get a further understanding of Category Theory, several terms such as natural transformations, morphisms, and functors will all be introduced. These terms help understand the basic concepts of Category Theory along with the theorems about categories. One of the theorems that are covered is the Yoneda Lemma as well as its corollaries. The corollaries include the Yoneda embedding, the universality of representing objects, and the uniqueness of representing objects. In addition to defining category theory and discussing its terms and theorems, this paper will also talk about some applications and simplified connections to our everyday lives.

12:00 p.m. **An Exploration and Generalization of the KRC Sequence**

Brandon Crofts, Hofstra University
Advisor: Eric Rowland, Hofstra University

For the sequence defined as $KRC(n)$ = the number of integer solutions of the equation $a^2 + 2bc = 0$, where a, b, c are bounded by n, previous algorithms were simplistic and costly, given their recursive nature. A closed form of this sequence has been discovered, utilized, and proven, which allows for a significantly faster generation of terms. From this point, a function was written to replicate this process, but for any prime, that is, = the number of integer solutions of the equation $a^2 + (\text{prime})bc = 0$, where a, b, c are bounded by n.

CONTRIBUTED POSTER SESSION

12:30 PM – 1:30 PM

Supervisor: Johanna Franklin

Undergraduate Geoscience Research and Its Effect on Math-Related Majors

Janet Liou-Mark & Reginald Blake, NYC College of Technology, CUNY

Studies have shown that involvement in research as an undergraduate has a positive effect on students pursuing STEM-related majors. A geoscience research program that focuses on satellite and ground-based remote sensing and its state-of-the-art applications to the cryosphere, the atmosphere, the hydrosphere, the lithosphere, and the biosphere have been used to engage, challenge, and transform the scholarship of undergraduates pursuing a math-related major. The experience has increased their STEM identity and their communication skills. Results from assessing the undergraduate research program and the lessons learned from it are shared.

Tropical Cyclone Hazards in Relation to Propagation Speed

Jiehao Huang, The City College of New York, CUNY
Advisor: James Booth, The City College of New York, CUNY

As the overall population and infrastructure along with the US East Coast increase, it becomes increasingly important to study the characteristics of tropical cyclones that can impact the coast. A recent NOAA study shows that the propagation speed of tropical cyclones has slowed over the past 60 years, which can lead to greater precipitation impacts and greater storm surge impacts. The study presented herein is meant to examine and analyze the relationships that exist between the propagation speed of tropical cyclones, their surface wind strength, directional angles, and cyclone averaged winds. This data includes the tracks of tropical cyclones spanning from 1950-2015. This analysis examines the Lagrangian evolution of the cyclones in terms of their propagation speed, the intensity of cyclones and the directional movement of the tropical cyclone path. Then the analysis is repeated for propagation speed versus intensity of cyclones which include maximum surface wind speed and different levels of cyclone averaged winds. The results show a positive correlation between cyclones propagation speed and cyclone averaged wind at 700 hpa in the historical record. The directional propagation speed analysis shows that tropical cyclones move the fastest when they turn eastward and also having the highest correlation to its steering wind strength compared to the westward. Additionally, the displacement angle analysis of cyclone paths describes the abrupt change of angles for each successive two instance cyclones, and the time series of displacement angle analysis shows a significant increasing trend. This research highlights an interesting question about the trends in tropical cyclones over the past 60 years related to the subtle differences in the behavior of the propagation speed and its wind strength.

Category Theory

Christina Labita, Samantha Fischetto, Jillian Mayr, Molloy College

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Geoscience Applications for Reducing Methane Emission from Landfills

Dimitri Ambroise, Joel Quispe, Brian Yellis, Michael Salamonski, NYC College of Technology
Advisor: Masato R. Nakamura, NYC College of Technology, CUNY

Landfill waste will increase over the next few decades as the populations of developing cities around the world grow by a significant amount. Methane emissions, known to be a major greenhouse gas contributor will rise alongside the increase in landfill waste. The purpose of this research project is to explore the different ways that methane can be utilized as an alternative resource to mitigate its effect on increasing greenhouse gas emissions and be utilized as an alternative resource. As well as, investigating alterations in landfill management techniques based on the related knowledge in geoscience, to promote more efficient operations that support the diversion

of organic waste streams beside landfills. We have seen that large cities, like New York City, that had a lack of sanitation infrastructure in the early 1900s, are now creating facilities and reports that outline the efforts to decrease methane emissions. Additionally, technology like the "Homebiogas" system, is being developed in the Middle East to make use of methane as an alternative energy resource. The findings of this project will support methods and practices that reduce the impact methane emissions have on the greenhouse gas effect and global warming. It will also raise a general awareness as to the importance of investing in alternative methods to curbing greenhouse gas emissions.

Surprising Random Patterns Emerge in Keno

Christopher Ingrassia, Kingsborough Community College, CUNY

Keno is a popular game of chance offered by both lotteries and casinos throughout the world. The most prevalent version of the game is 20/80 keno, in which 20 numbers are randomly drawn from a rectangular grid of 80, arranged as 8 rows and 10 columns. As numbers are selected, the corresponding cells on the grid are highlighted. This visual feature separates keno from most other lottery-style games, such as those locally televised on a nightly basis, where numbers are simply listed as they are called. Simple application of the combination formula reveals that over 3.5 quintillion unique random visual patterns are possible. To put that number in perspective, it is approximately 25 times the age of the solar system measured in seconds! Because the sheer number of possible configurations precluded exhaustive searching, an algorithmic approach was developed to find previously unattainable probabilities associated with certain pattern-based scenarios. Several interesting questions may now be answered. For example, how likely is it that any horizontal string of 4 numbers (e.g., 53-54-55-56) will appear? How many vertical pairs (e.g., 38-48 or 63-73) are to be expected in any drawing? What are the chances that none of the selected numbers will be touching? Under what conditions could a casino offer a $10 million jackpot, with little chance of paying it out over the next 50 years? Many of these questions have rather surprising answers.

Graphs such that the nonzero eigenvalues other than the index have the same absolute value

Nelcy Arévalo, Federal University of Rio Grande do Sul, Brazil
Advisor: Virgínia Rodrigues, Federal University of Rio Grande do Sul, Brazil

Among the various spectral parameters studied in the Spectral Graph Theory, one can highlight the energy of a graph, introduced by I. Gutman in 1978. The energy, $E(G)$, of a simple graph G is defined to be the sum of the absolute values of the eigenvalues of G. Nikiforov noted that research on matrix norms is related to advance the study of graph energy. The trace norm matrix M is the sum of its singular values, which for a real symmetric matrix are exactly the modules of its eigenvalues. Hence the trace norm of the adjacency matrix of a graph G is the energy of G. Nikiforov in gives bounds on the trace norm of matrices that extends previous results of Koolen and Moulton for bounds on graph energy. In particular he gives a lower bound on the trace norm of matrices with rank at least 2. In the same work he proposed the following problem, which is the aim of this work: give a constructive characterization of all graphs G such that the nonzero eigenvalues of G other than the index have the same absolute value. Finding the solution of this problem would characterize the graphs that satisfy the equality in the bound mentioned above. The present work brings our progress in the study of all graphs that satisfy the problem proposed by Nikiforov.

Big Data Information Reconstruction of DNA Evolution Models

Aylara Alleyne, Courtney Schordine, Yanqiu Guo, Caihong Zheng, Farmingdale State College, Queensborough Community College, CUNY
Advisors: Wenjian Liu, Queensborough Community College, CUNY
Chunhui Yu, Farmingdale State College

In this project, we establish an exact reconstruction threshold of DNA evolution model on regular d-ary trees and also apply the numerical analysis to develop an algorithm of determining the re-construction threshold.

Analyzing Exotic Functions in Calculus Under the Microscope

Showmik Chowdhury, New York City College of Technology, CUNY
Advisor: Satyanand Singh, NYC College of Technology, CUNY

In studying Calculus, we learn about exotic functions which can be seen everywhere, and we can differentiate them. By differentiating a function, we can visualize and understand the rule of its nature. People frequently wonder if such functions have real life applications. It turns out that movies such as "The Dark Knight" used exotic functions to create special sound effects. In our case, we closely studied the behavior of the Weierstrass function and sequences of functions that approximate to it from both a visual and theoretical perspective.

An In-Depth Look At p-Adic Numbers

Xiaona Zhou, New York City College of Technology, CUNY
Advisor: Satyanand Singh, NYC College of Technology, CUNY

In this study, we consider p-adic numbers. We will also study the p-adic norm representation of a real number, which is defined as $\mathbb{Q}_p = \left\{\sum_{j=m}^{\infty} a_j p^j : a_j \in \mathbb{D}_p, m \in \mathbb{Z}, a_m \neq 0\right\} \cup \{0\}$, where p is a prime number. We explore properties of the p-adic numbers by using examples. In particular, we will show that $\sqrt{6}, i \notin \mathbb{N}, \sqrt{2} \in \mathbb{Q}_7$. P-adic numbers have wide range of applications, such as string theory and quantum mechanics, and transportation in porous disordered media in geology.

An Investigation of Robustness and Power for a Two Independent Sample Test with Preliminary Normality Testing

Gerald Gabriel Gabinete, Elda Castellon, Rebecca Conley, Saint Peter's University

It is well known that the independent sample t-test assume the two samples are drawn from normal distributions. While it is not supported by theory, in practice researchers often apply a preliminary test, such as the Shapiro-Wilk test, to assess normality before applying either a t-test or a nonparametric alternative, such as the Wilcoxon-Mann-Whitney test. In "To Test or Not to Test", Rochon et al. (2012) investigated this two-stage procedure on samples of equal sizes drawn from the equal distributions and found that the two-stage does not seriously affect the power and the probability of a type I error. In this research, we apply the two-stage procedure to samples drawn from different distributions: the normal, the uniform, and the mixed-normal. We also consider unequal sample sizes and heterogeneous variances. We found that depending on the circumstances, the two-stage procedure can considerably inflate or deflate the probability of a type I error. In fact, it often performed worse than simply applying a t-test with no pretesting. We did not find much of a difference in the power of the procedures. All simulations were performed using R-Studio.

Analysis of Land Surface Temperature Over Urban Landcover Types Using Satellite Remote Sensing and Ground-Based applications

Makini Valentine, Antonio Mattis, Hamid Norouzi, Afsana Mimi, Reginald Blake, NSF IUSE

Every year the mean temperature of the earth increases, major cities experience hotter more intense summers and spikes in temperature and expenses to regulate normal temperature increase. Although a rise in temperature is a problem that affects everyone, cityscapes are especially affected being prone to the Urban Heat-island effect. Urban areas have a variety of land surfaces, a large portion of which is concrete and asphalt which retains a lot of heat and causes issues for the environment and population. The objective of this project is to examine and compare the diurnal variation and heat transfer of each surface type by utilizing handheld thermal infrared cameras, an Unmanned Arial Vehicle (UAV) equipped with an infrared camera and satellite images. In addition, a flux tower is in use and enables us to collect measurements of all surface energy balance components in these urban areas. The Flux tower has been planted on material such as concrete, asphalt and rooftops to take measurements through the eddy covariance method. The Latest generation of NOAA's Geostationary Operational Environmental Satellites (GOES), known as the GOES-R Series, Landsat, and the Moderate Resolution Imaging Spectroradiometer (MODIS) LST products were compared to the exact locations of the ground-based data collected from the thermal cameras. the result of daily observations has shown non-organic surfaces like asphalt to have a high diurnal thermal amplitude while more vegetated areas maintain a lower range of thermal variability. This information will greatly assist cities with developing technology to deal with heat stress, the ground data coupled the satellite data will help us understand heat storage in urban regions by confirming the accuracy data produced by these images.

Using Satellite Imaging Radar to Generate Flood Maps for Improved Humanitarian Response: A case study for the 2019 Malawi floods

Janet Llinas[1], Wen Yong[1], Evelin Perez[1], Aaron Davitt[2]
1-New York City College of Technology, 2- CUNY Graduate Center

Floods are the most common, severe, and damaging natural disasters that can last hours, days, or weeks. Given its location along the great African Rift Valley, Malawi is especially vulnerable to floods due to its geography and low economic development (Figure 1). About 80 percent of Malawi's population lives an agrarian economy. From January to March 2019, severe floods affected nearly 1 million people and claimed 56 lives in Malawi. The floods were caused by tropical cyclone Idai from March 4 to March 21, one of the worst tropical cyclones on record, and heavy rains that followed. The floods damaged crops, contaminated water supplies that resulted in cholera outbreaks, displaced people, and destroyed schools. In response to the floods, UNICEF provided aid to identify flooded districts. All assistances were done by providing tents to be used as temporary schools, ensuring that children will be able to continue their classes, providing food, and giving medical treatment. This recovery effort was due to UNICEF mapping specific flood areas with drones to help people understand the need in those areas. However, some flood areas may have been missed due to technical limitations of drones-personal needed to fly, battery power, and lack of available drones. This may have resulted in areas not receiving humanitarian aid. The purpose of this project is to use the European Space Agency (ESA) Sentinel-1A/B synthetic aperture radar (SAR) satellite data to improve flood mapping and identification to better direct humanitarian aid in Malawi. Sentinel-1A/B images from before and after the flood events were used in change detection and classification analysis. Using Sentinel-1A/B classified maps and the UNICEF flood areas from drones,

we compared and contrasted between the two to verify the accuracy of the Sentinel-1A/B generated maps for flood identification. The implications for this project could help identify which areas in Malawi may have been affected by floods to improve the distribution of humanitarian aid for relief efforts.

Studying Global Lakes Surface Temperature Variability at the Basin Level-Scale Using Remote Sensing Observations

Shaun Pollard, Ryan Chen, Abdou Rachid Bah, Ronaldo Carhuaricra, Patty Arunyavikul
Advisors: Hamid Norouzi and Reginald Blake, NYC College of Technology, CUNY

Even though lakes make up a small percentage of the water bodies on the global land surface, natural lakes and impoundments provide critically important ecosystem services that include drinking water, fisheries, recreation, and irrigation. Unfortunately, several lake surface areas around the globe have been changing with many of them dying due to climate variability and local mismanagement at the basin-scale level. Lake Surface Water Temperature (LSWT) is recognized as a critical indicator of climate change in lakes. The changes in water and the surrounding land temperature could be an indicator of climate variability if there is consistency between changes in both temperatures. However, if the water temperature shows an increase accompanied with a reduction in the lake area while the surrounding basin doesn't reflect similar increase in temperature, local water mismanagement could be blamed for such inconsistency and shrinkage of the lake. This project focuses on the application of remote sensing to investigate the changes in lake surface water temperatures and their relationship with their surrounding land cover type in a bid to identify the main driving factors of these changes. In this study, 394 global major lakes have been investigated. An analysis of temperature variation over these lakes has been conducted using daily observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) from year 2002 to 2018 over the lakes and their surrounding land areas. The rates of change of temperature for both the lakes' water surface and their basins as well as the changes in the lakes' surface areas were calculated. Preliminary results show that many of the lakes' water temperatures are warming faster than their surrounding land temperatures approximately 43.22% of the studied lakes are warming, this percent includes 63.00% in the southern hemisphere and 34.70% in the northern hemisphere, and about 51.41% of them are cooling with 29.20% in the southern hemisphere and 61.30% in the northern hemisphere. Furthermore, 63.94% of the lakes are shrinking, specifically, 52.00% in the southern hemisphere and 69.37% in the northern hemisphere, while 29.67% of them are growing overall with 42.00% in the southern hemisphere and 24.40 % in the northern hemisphere. The relationship between the rates of LSWT change and other lake characteristics such as lake depth, salinity level, geographical location, and size were also investigated. A clear latitudinal relationship was discovered in temperature changes with increasing LSWT rates from north to south. This study, therefore, provides insights about LSWT variability on a global scale.

Analysis of Land Surface Temperature in Urban Areas Using an Unmanned Aerial Vehicle (UAV) and Satellite Observations

Kirk Barclay, NYC College of Technology, CUNY
Advisor: Hamid Norouzi, NYC College of Technology, CUNY

Urban areas especially in coastal regions are densely populated and are built with mainly impervious urban materials. The characteristics of these surfaces lead to extreme heat storage and the urban heat island (UHI) in these regions with significant health, economic, and energy consequences. In order to accurately characterizing the dynamics of UHI and its impact on extreme heat events, accurate understanding of the surface energy and water balance in urban regions is crucial. High spatial resolution land surface temperature (LST) at the street level scale, can provide viable information for studying the surface energy balance and also to eventually provide a reliable heat index and other effective indicators that may help to characterize the urban thermal state. In this study, we utilize high spatial and temporal resolution LST products using a combination of Landsat 8 Thermal Infrared Sensor and the recently launched Geostationary Operational Environmental Satellite-R (GOES-R) Series for New York City. This study developed high-resolution both temporally and spatially by downscaling the GOES-R product to the resolution of LandSat. Using a series of infrared cameras - two High-res Cameras and one FLIR Unmanned Aerial Vehicle (UAV) - the quality of the retrieved land surface temperatures by the downscaled GOES-R and Landsat 8 measurements were evaluated against in situ observations that were collected in the Downtown Brooklyn NY area. Preliminary results show that this method is able to downscale GOES-R data to Landsat 8's spatial resolution with less than 1.5 K error. Additionally, the diurnal variations of temperature for each urban surface type such as asphalt, concrete, grass, and rooftops were investigated using collected ground-based data.

New York State Education Demographics

Willow Lopez-Silvers, Iona College
Advisor: Benjamin Gaines, Iona College

Inequality is a growing issue in education. As the United States becomes increasingly diverse, the school system must address these inequities to create a more well-educated and prosperous society. Demographics, location, and the systematic oppression of certain groups appear to have a direct impact on student teacher ratios. These differences are significant and valid. Using mathematical and statistical analysis, there are predictions and analysis of the relationships between student teacher ratios, location, and racial demographics. For example, as a location becomes more urban and grows in size, the student teacher ratio increases. In districts with higher levels of minority populations, student teacher ratios are also higher. This can have an effect on the quality of education for these districts.

Correlation Between Math and Music

Cadee Lee, Bergen County Academies and Juilliard Pre-College
Advisor: Jung Hang Lee

Many aspects of music have firm roots in mathematics. This poster will provide three major examples of how these two fields are closely related. The first part will examine the Circle of Fifths, which was uncovered by Pythagoras, the famous mathematician. The Circle of Fifths is one of the most basic tools used in music theory. It can be particularly useful for making smooth transitions between keys, a technique that is often used by many composers. This project will explain how Pythagoras was able to discover the Circle of Fifths, and the math behind the system. The next part of this project will delve into the mathematical aspect of musical sound and show how sound waves can be modeled by sine graphs. The reason behind why certain intervals sound "pleasant" to our ears and how this is related to frequency ratios will also be explained. The last part will explore why it is impossible to tune an equally tempered piano by using exponential and logarithmic functions. The ultimate goal of this project is to show some of the close correlation between music and mathematics. After all, the beautiful melodies in music would not be possible without the delightful mathematics behind them.

Studying Lake Ice Phenology in The State of Maine Using Remote Sensing and Institute Observations

Zahida Yasmin, Christal Jean, Mahoutin Godonou, Wen Yong Huang, NYC College of Technology
Advisors: Abdou Rachid Bah, Graduate Center of the City University of New York
Hamid Norouzi and Reginald Blake, NYC College of Technology, CUNY

Large-scale climatic phenomena known to affect air temperature can also be expected to leave their signatures in the timing of ice-out of lakes scattered over large areas of the globe. The existence of long series of observations of the timing of ice-out from various lakes and rivers distributed around the Northern Hemisphere has made it possible not only to discover the existence of significant long-term trends towards earlier ice-out (Livingstone, 1997; Magnuson et al., 2000), but also to detect shifting signals in the timing of ice-out (Livingstone, 2000). Although there are numerous regional studies on lake ice phenology, empirical knowledge of the spatial and temporal coherence associated with local lake ice phenology remains fragmented. Here we examine changes in the occurrence in the timing of the annual formation and disappearance of lake ice of the State of Maine in United States. To do so, ground-based and remotely-sensed observations from Moderate Resolution Imaging Spectroradiometer (MODIS) of lake water surface temperature of 110 lakes were collected for the period 2002–2018. In addition, meteorological data (air temperatures, and ice-on/off dates, and geomorphometric characteristics (latitude, longitude, elevation, lake surface area, maximum depth, mean depth, and volume) that could influence lake surface temperature are compiled for each lake. This study will reveal new insights of shifting signal of lake ice-on and ice-off over the past 18 years. In addition, the study will validate the remotely sensed lake water surface temperature with in-situ observations. Key terms: Lake ice phenology, lake surface water temperature, meteorological data, and geomorphometric characteristics.

Analysis of Land Surface Temperature in Urban Areas Using an Unmanned Aerial Vehicle (UAV) and Satellite Observations

Kirk Barclay, NYC College of Technology, CUNY
Advisor: Hamid Norouzi, NYC College of Technology, CUNY

Urban areas especially in coastal regions are densely populated and are built with mainly impervious urban materials. The characteristics of these surfaces lead to extreme heat storage and the urban heat island (UHI) in these regions with significant health, economic, and energy consequences. In order to accurately characterizing the dynamics of UHI and its impact on extreme heat events, accurate understanding of the surface energy and water balance in urban regions is crucial. High spatial resolution land surface temperature (LST) at the street level scale, can provide viable information for studying the surface energy balance and also to eventually provide a reliable heat index and other effective indicators that may help to characterize the urban thermal state. In this study, we utilize high spatial and temporal resolution LST products using a combination of Landsat 8 Thermal Infrared Sensor and the recently launched Geostationary Operational Environmental Satellite-R (GOES-R) Series for New York City. This study developed high-resolution both temporally and spatially by downscaling the GOES-R product to the resolution of LandSat. Using a series of infrared cameras - two High-res Cameras and one FLIR Unmanned Aerial Vehicle (UAV) - the quality of the retrieved land surface temperatures by the downscaled GOES-R and Landsat 8 measurements were evaluated against in situ observations that were collected in the Downtown Brooklyn NY area. Preliminary results show that this method is able to downscale GOES-R data to Landsat 8's spatial resolution with less than 1.5 K error. Additionally, the diurnal variations of temperature for each urban surface type such as asphalt, concrete, grass, and rooftops were investigated using collected ground-based data.

The Effect of Peer Supported Workshops on First-Generation College Students Taking College Algebra

Malika Ikramova, NYC College of Technology, CUNY
Advisor: Janet Liou-Mark, NYC College of Technology, CUNY

First-generation college students often found navigating college mathematics courses challenging, especially when they are not as prepared as their peers who have guidance from their parents. This study examines the effects of a peer-supported workshop on first-generation college students taking an entry-level mathematics course, College Algebra. Data collected from 2015-2018 in sections where there was an additional hour set aside for problem-solving led by an undergraduate student. Analysis comparing first-generation college students' departmental final grades, final grades, and attitudes towards the peer-supported workshops with their non-first-generation college peers conducted. Results showed with this extra support, first-generation college students overall scored higher in their departmental exam and had higher course grades than their counterparts. They found workshops helped them review the fundamental concepts necessary to do well in the course and found the workshops to be motivational.

CONTRIBUTED PAPER SESSIONS II

1:30 PM – 2:30 PM

RESEARCH SESSION: APPLIED MATHEMATICS II

Presider: Johann Thiel

1:30 p.m. **Applying Blankenship's Method in the RSA Cryptosystem to Test Information Security**

Najalia Singh, Valley Stream Central High School
Advisors: Robert Hildebrand & Satyanand Singh, NYC College of Technology, CUNY

The RSA cryptosystem picks keys and uses large prime numbers as an essential tool to allow me to encrypt and decrypt messages. In my research I studied certain linear Diophantine equations and showed how they are used in RSA to encrypt and decrypt information. I also used a technique created by Blankenship, that is rooted in linear algebra to efficiently calculate encryption and decryption keys. I employed the Maple software to simulate data and illustrate RSA in action. Using an application of Blankenship's Method, I illustrated a way to compromise RSA for small primes and identified the weaknesses in RSA for larger primes. I ran several cases for each prime pair I chose randomly with the Maple software and then timed each one to compare how long it would take to find the decryption code in RSA with the standard extended Euclidean Method and then with the Blankenship's Method. The Maple software took less time to figure out what the value of the decryption key was using the Blankenship Method than it did using the standard Euclidean Method of RSA. This work illustrates the importance of using large prime pairs in RSA encryption. It also gives a glimpse to what the future brings with the future quantum computers. With their immense computational power, a technique like Blankenship's method will compromise RSA in a matter of seconds. It is a useful tool for mathematicians as they work on quantum resistance for the advent of quantum computers and the world of qubits.

1:45 p.m. **Application of Calculus**

Christopher Arata & Lucas Javier, Molloy College
Advisor: Elizabeth Viduarre, Molloy College

We will analyze how calculus and the idea of approximation can help us develop and create modern phenomena such as GPS, CAT scans and Artificial intelligence. CAT Scans use a function that requires advanced integration to calculate the intensity of the x rays. Calculus is extremely useful in everyday life and without it, we would never have gotten as technologically advanced as we are today. Also, the idea of approximation has also helped us determine the value of Pi. The idea goes back to the times of Archimedes. He approximated the value of pi without a calculator. While the process was very time-consuming and arduous. We will also explore the magical irrational number *e*. We will take a look at its discovery and applications. Lastly, we will examine how calculus helped build the foundations of machine learning.

2:00 p.m. **The Role Mathematics Plays in Creating Tension and Resolution in Music**
Christopher Ingrassia, Kingsborough Community College, CUNY

Sound waves are best modeled as a superposition of sinusoids, each of which is characterized by its own frequency (interpreted as pitch) and amplitude (interpreted as volume). The frequencies comprising single notes produced by an instrument or voice are integer multiples of a base, or fundamental, frequency. These upper frequencies are known as harmonics. When two different notes are sounded together, the degree to which their respective harmonics coincide determines whether the pitch combination is perceived as more consonant (pleasant) or dissonant (harsh). The ratio of each pitch's fundamental frequency indicates how regularly their associated harmonics line up. Simple ratios, like 2:1 or 3:2, suggest that a high proportion of each pitch's harmonics are common to both, which produces a high level of consonance. On the other hand, more complicated ratios, like 15:8 or 16:15, are indicative of clashing notes characterized by jarring dissonance. Consonance and dissonance both play vital roles in music. Some amount of dissonance is required to create a sense of auditory instability and tension, ultimately resolving to the more comfortable state of tranquil consonance. The balance between tension and stability enlivens a musical piece by adding elements of excitement, surprise, and mood. This talk will illustrate these concepts through a fun live demonstration on a piano keyboard.

RESEARCH SESSION: PURE MATHEMATICS II

Presider: Ezra Halleck

1:30 p.m. **An Introduction to the Game of Cycles**
Benjamin Gaines, Iona College, Ryan Alvarado, Amherst College, Maia Averett, Mills College, Christopher Jackson, Mary Leah Karker, Providence College, Malgorzata Marciniak, LaGuardia Community College, Francis Su, Harvey Mudd College, Shanise Walker, University of Wisconsin-Eau Claire

The Game of Cycles is a new combinatorial game played on any simple connected planar graph, introduced by Su (2020). In this talk I will introduce the rules for the Game of Cycles and discuss results we have found for various classes of gameboard.

1:45 p.m. **Smocked Metric Spaces and their Tangent Cones**
Julinda Mujo, Christina Sormani, Lehman College

We introduce the notion of a smocked metric spaces and explore the balls and geodesics in a collection of different smocked spaces. We find their rescaled Gromov-Hausdorff limits and prove these tangent cones at infinity exist, are unique, and are normed spaces. We close with a variety of open questions suitable for advanced undergraduates, master's students, and doctoral students.

2:00 p.m. **On the Remainders in Taylor's Formula**
Fotios Paliogiannis, St. Francis College

We prove a version of Taylor's Theorem with a remainder in a general form that allows us to deduce directly the Lagrange, the Cauchy and the integral form for remainder. Other forms for the remainder are also discussed.

PEDAGOGY SESSION: MATHEMATICS EDUCATION II AND STUDENT/FACULTY SESSION II

Presider: Eric Rowland

1:30 p.m. **Politics and Mathematics, what is r = ?**
(North Korea: Extreme Example of Politically Driven Mathematics Education)
JungHang Lee, Hostos Community College, CUNY

This research challenges one of our conceivable preconceptions on mathematics education as a politically neutral subject. It presents mathematics education in one of the most sealed countries in the world — North Korea, as an extreme example of politically prompted mathematics education. North Korean secondary school mathematics education is examined through the review of North Korea's social and educational structures as well as its political and ideological position. In-depth interviews were conducted in 2019 with defectors, who are now in South Korea, former secondary school mathematics teachers and students, to understand their real-life experiences in school mathematics in North Korea. Workers' Party's influence on mathematics education and the impact of the March of Suffering are

examined. There are two main focuses of this presentation. One is to introduce an extreme case study of mathematics education in North Korea influenced by political and ideological standpoint. This will broaden the participants' understanding of mathematics education as not only a self-regulating subject based on axioms and theorems, but also as an interwoven matter shaping and shaped by the vessel and the people in it. This will also propose a chance to reassess the participant's own mathematics education experience with possibly an enhanced span.

1:45 p.m. Investigating Identities Involving the Floor of Square Root Expressions

Max Sehaumpai, City College of New York, CUNY
Advisor: Michael Wijaya, Bard High School Early College, Queens

In a recent post on Reddit, Omri Zemer proved that the floor of $\sqrt{n}+\sqrt{n+3}$ is equal to the floor of $\sqrt{4n+5}$ for all positive integers n. This led us to look for positive integers a and b such that the floors of $\sqrt{n}+\sqrt{n+a}$ and $\sqrt{4n+b}$ are equal for all positive integers n. We discovered a necessary condition through computational investigation: if a or $(a-1)$ is odd, then $b = 2a-1, 2a$, or $2a+1$. We proved that if $1 \leq a \leq 8$ (except $a = 7$), the necessary condition is also sufficient. So, there are exactly 21 pairs of positive integers (a, b) such that the identity holds for all positive integers n. For $a = 7$ or $a \geq 9$ and their corresponding values of b, the identity holds for all but finitely many positive integers n. For the remaining pairs of positive integers (a, b), there are infinitely many positive integers n such that the identity fails to hold. However, we discovered that for some pairs such as $(a, b) = (5,8)$ or $(7,11)$, the sequence of positive integers n for which the identity fails has a simple description. In this talk, we will explain the key ideas in our proofs and the computations we did to arrive at our conjectures, as well as the role of the Online Encyclopedia of Integer Sequences (OEIS) in helping us recognize patterns in experimental data. The only prerequisite is high school algebra.

2:00 p.m. Patterns Between the Number of Cevians or Caliians and the Regions That They Form in Polygons

Calia Kugler, Half Hollow Hills High School East
Advisor: Robert Gerver

This paper is a description of an investigation into cevians and caliians (cevians in a figure other than a triangle). The formula for the number of regions formed in a triangle by drawing n cevians from each vertex is obtained in several ways. Next, formulas for the number of regions formed in other simple polygons by drawing n caliians are developed. A pattern is observed and a general formula for the number of regions in any polygon is developed. This formula is then generalized to show the number of regions formed in a simple polygon by drawing caliians not only to the opposite side of a vertex by to other sides as well. A java program is developed to count the number of regions in a triangle and a square formed by any number of cevians or caliians drawn from any vertex, thus not requiring the same number of cevians or caliians from each vertex. The formula for the number of regions in any simple polygon formed by drawing any number of cevians or caliians from any vertex to any side is developed. Additional figures can be considered, including circles, convex and irregular polygons. An investigation to extending caliians to complex polygons can be considered as well. An extension to the java program to include other figures can be developed.

2:15 p.m. Providing Academic Support Remotely via Technology at the Time of Need to Enhance and Encourage Learning in Mathematical Sciences

Marshall Titch, United States Military Academy, West Point

While instructing three sections of MA103 – Mathematical Modeling and Introduction to Calculus in the Fall semester of 2019 at the United States Military Academy (USMA) at West Point, I decided to offer academic support via cell phone (text, calls, etc.) so students could conveniently contact me outside normal business hours (at the time of need) should they get stuck on a concept but be unable to figure it out on their own after spending a reasonable amount of time researching their issue via the course resources, textbook, and Google search. After the final exam in-person and written in the course evaluations, several students from each of my sections specifically mentioned how my availability and willingness to assist via cell phone enhanced their learning. Therefore, I decided to conduct a study in the Spring semester of 2020 with my four sections of MA206 – Probability & Statistics, by collecting and analyzing academic support data to assess three main considerations:

- Can instructors provide this service without upending their current work-life balance?
- Does providing academic support at the time of need via technology effectively enhance learning?
- Do students seem to prefer academic support via technology over in-person?

METRO NEXT (NEW EXPERIENCES IN TEACHING)
3:15 PM – 4:00 PM

Metro NExT (New Experiences in Teaching) is a local version of MAA's Project NExT, a professional development program for new or recent PhDs in mathematics. Our goal is to build a community of new faculty and graduate students in the NY Metro MAA Section to help each other develop effective strategies for all aspects of our professional lives from teaching to research to service.

Please join us at the Metro NExT Session to learn more about our programs. We invite early-career faculty members and advanced graduate students in mathematics and related fields to learn more about our **Metro NExT Fellow Program**. Seasoned faculty members are invited to be involved as mentors for current Metro NExT fellows. All are invited to learn more about our annual **Metro NExT Workshop** (TBD): a mathematics pedagogy and professional development workshop that is open to anyone interested in learning about new teaching techniques and in making connections with other math educators. One of the sessions will be participant-provided Lightning Talks, where we welcome contributions from interested mathematicians at all stages in their careers.

Please visit our website (metronext.github.io) to apply to be part of our 2021-2022 fellow program and for further information.

Organizers: Dr. Benjamin Gaines, *Iona College*
Dr. Tia (Mutiara) Sondjaja, *New York University*
Dr. Johann Thiel, *New York City College of Technology*

MAA METRO NEW YORK SECTION OFFICERS

Section MAA Representative **(2020 – 2023)**	**Johanna Franklin** **Hofstra University**	(516) 463-5739 johanna.n.franklin@hofstra.edu
Chair **(2018 –2021)**	**Janet Liou-Mark** NYC College of Technology (CUNY)	(718) 254-8668 jliou-mark@citytech.cuny.edu
Chair-Elect **(2018 –2021)**	**Satyanand Singh** NYC College of Technology (CUNY)	(718) 260-5926 ssingh@citytech.cuny.edu
Secretary **(2018 –2021)**	**Johanna Franklin** Hofstra University	(516) 463-5739 johanna.n.franklin@hofstra.edu
Treasurer **(2018 –2021)**	**Armen Baderian** Nassau Community College (SUNY)	(516) 572-7394 armen.baderian@ncc.edu
Vice-Chair for Four-Year Colleges **(2018 –2021)**	**Boyan Kostadinov** NYC College of Technology (CUNY)	(718) 260-5195 bkostadinov@citytech.cuny.edu
Vice-Chair for Two-Year Colleges **(2018 –2021)**	**Olen Dias** Hostos Community College (CUNY)	(718) 518-6810 odias@hostos.cuny.edu
Vice-Chair for High Schools **(2018 –2021)**	**Mutiara Sondjaja** New York University	(212) 998-3375 sondjaja@nyu.edu
Book Exhibit Coordinator	**Nadia Benakli** NYC College of Technology (CUNY)	(718) 260-5371 nbenakli@citytech.cuny.edu
Graph Theory Days Liaisons	**Louis V. Quintas,** Pace University **Armen Baderian,** Nassau Community College **Edgar G. DuCasse,** Pace University	lquintas@pace.edu armen.baderian@ncc.edu educasse@pace.edu
Liaison Coordinator	**Elena Goloubeva** Webb Institute	(516) 403-5925 egoloubeva@webb.edu
Math Fair Chair – NYC	**Randy J. Asher** Brooklyn Technical High School	(718) 804–6500 rasher@schools.nyc.gov
Math Fair Chair – Long Island	**Joseph Quartararo** Northport-East Northport Public Schools	(631) 584-2016 cmleague@optonline.net
Metro NExT Coordinators	**Benjamin Gaines** Iona College **Mutiara Sondjaja** New York University **Johann Thiel** NYC College of Technology (CUNY)	(914) 633-2272 bgaines@iona.edu (212) 998-3375 sondjaja@nyu.edu (718) 260-5004 jthiel@citytech.cuny.edu
Newsletter Editor	**Abraham S. Mantell** Nassau Community College (SUNY)	(516) 572-7383 x 26841 mantell@ncc.edu
Public Relations Chair	**Xiaomeng (Vivian) Kong** Nassau Community College (SUNY)	(516) 572-7394 xiaomeng.kong@ncc.edu
Speaker's Bureau Chair	**Abraham S. Mantell** Nassau Community College (SUNY)	(516) 572-7383 x 26841 mantell@ncc.edu
Student Chapter Coordinator	**David Seppala-Holtzman** St. Joseph's College	(718) 940-5315 dholtzman@sjcny.edu
Section Archivist	**Agnes M. Kalemaris** Farmingdale State College (SUNY)	(631) 420-2217 kalemaam@farmingdale.edu
Webmaster	**Eric Rowland** Hofstra University	(516) 463-6806 Eric.rowland@hofstra.edu

METROPOLITAN NEW YORK SECTION OF THE MAA
TREASURER'S REPORT

ASSETS	BALANCE	BALANCE
	05/01/19	04/30/20
Chase Business Classic	$6,766.96	$5,500.50
Chase Business Select High Yield Savings	$15,085.98	$13,088.89
NY Metro Section Total Assets	$21,852.94	$18,589.39

CHASE BUSINESS SELECT HIGH YIELD SAVINGS (0366)

Credits

Date	Description	Amount
05/01/19-04/30/20	Interest (does not include 3/20, 4/30)	$2.91
Total Credits		**$2.91**

Debits

Date	Description	Amount
4/28/19	Transfer to 0365	$2,000.00
Total Debits		**$2,000.00**

CHASE BUSINESS CLASSIC CHECKING (0365)

Deposits/Credits

Check #	Date	Description	Amount
06/03/19	06/03/19	Annual Meeting registration (checks)	$490.00
06/07/19	06/07/19	Annual Meeting registration (cash)	$1,075.00
06/17/19	06/17/19	Pearson Annual Meeting display and presentation	$375.00
06/28/19	06/28/19	transfer from 0366	$2,000.00
07/06/19	07/06/19	Annual Meeting registration (PayPal)	$2,289.27
12/27/19	12/27/19	NJ-NY Joint Meeting Registration	$179.95
02/20/20	02/20/20	Subvention Credit	$1,819.00
03/06/20	03/06/20	St. John's Advertisement in Newsletter	$50.00
Total Credits			**$8,278.22**

Checks Paid/Debits					

#	Date	Description	Amount
934	05/01/19	AED of the NYCCT (Annual Meeting facility cost)	$2484.00
930	05/09/19	Sam Ferguson (Metro NExT grant)	$50.00
931	05/15/19	Culinart Group (catering for GTD 77)	$520.90
938	05/03/19	Abraham Mantell (Unitech Print LLC saddle books)	$41.00
939	05/04/19	Armen Baderian, PhD (Annual Meeting dinner)	$342.31
940	05/04/19	Chin Yu Chang (Annual Meeting photography)	$75.00
941	06/01/19	Dr. Sylvester Gates (Annual Meeting key-note speaker)	$300.00
942	06/01/19	Janet Liou-Mark (Dr. Gates expenses)	$819.17
943	06/01/19	Janet Liou-Mark (Annual Meeting supplies)	$44.29
944	06/19/19	MBJ South Inc. (Annual Meeting catering)	$2,913.75
945	06/19/19	New York University (2018 catering for Metro NExT meeting)	$361.50
946	09/18/19	New York University (2019 Metro NExT meeting catering)	$860.76
947	10/16/19	Chartwell's. (Delegate Assembly catering)	$267.45
948	12/23/19	NU-NY Joint Meeting Guest Speaker Payment	$182.25
949	01/09/20	Florin Catrina (Putnam Mugs)	$193.80
945	06/19/19	New York University (check not cashed)	-$361.50
Total Debits			**$9,544.68**

GRAPH THEORY DAY FUND (CONTAINED WITHIN 0365)

Deposits/Credits			
	Date	**Description**	**Amount**
Total Credits			
Checks Paid/Debits			
Check #	**Date**	**Description**	**Amount**
Total Debits			
		BALANCE	**BALANCE**
		05/01/19	**04/30/20**
Graph Theory Day Fund		**$2,172.41**	**$2,172.41**

Thank you for participating!