# THE MATHEMATICAL ASSOCIATION OF AMERICA

The MAA Metropolitan New York Section
2018 Annual Meeting

## SUNDAY, MAY 13, 2018

Hofstra University

HOFSTRA UNIVERSITY
DEPARTMENT OF MATHEMATICS

MAA
MATHEMATICAL ASSOCIATION OF AMERICA

HOFSTRA UNIVERSITY

DEPARTMENT OF MATHEMATICS

May 13, 2018

Dear MAA Metro New York Conference Participants,

As the organizers of the Annual Meeting of the Metropolitan New York Section of the Mathematical Association of America, we would like to welcome all the participants to Hofstra University here in Hempstead, New York.

The highlighted speakers of this year's conference include:

- Dr. Steven G. Krantz from Washington University in St. Louis,
- Dr. Joe Mitchell from Stony Brook University,
- Dr. Lionel Levine from Cornell University,
- Dr. Nathan Kallus from Cornell University, and
- Our panelists for our discussion on Partner Disciplines on Teaching Mathematics.

The contributed papers and posters include presentations on pedagogical strategies, educational research, and mathematical research topics. There are also several posters and presentations by students from Hofstra University and other institutions. Please support the presenters by attending one or more of the sessions that support your teaching or research interests and by browsing through the posters during the poster session at noon.

We would like to express our gratitude to the Dean of the College of Liberal Arts and Sciences, Dr. Benjamin Rifkin, and to the guest speakers as well as to the Chair of the Metropolitan New York Section of the MAA, Dr. Elena Goloubeva. We also appreciate the contributions of all those presenting at today's conference.

We look forward to a motivating and inspiring conference, and we hope that you will enjoy it.

Best regards,

*The Local Organizing Committee*

WELCOME

# THE METROPOLITAN NEW YORK SECTION OF THE MAA
# and
# THE MATHEMATICS DEPARTMENT OF HOFSTRA UNIVERSITY

*express our gratitude to all who made this event possible*

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## LOCAL CONFERENCE ORGANIZING COMMITTEE

Johanna Franklin (Chair/Coordinator), Dan Ismailescu, Daniel E. Seabold, Abraham Mantell, Eric Rowland, Sylvia Silberger, and Zoran Sunic

## MAA METRO NEW YORK CONFERENCE ORGANIZERS

Elena Goloubeva (Chair), Emad Alfar, Armen Baderian, Nadia Benalki, Florin Catrina, Thomas Cheung, Johanna Franklin, Genady Grabarnik, Boyan Kostadinov, Chia-Ling Lin, Janet Liou-Mark, Abraham Mantell, Valentina Semenova, David Seppala-Holtzman, Satyanand Singh, Mutiara Sondjaja, and Johann Thiel

## CONTRIBUTED PAPER AND POSTER SESSIONS ORGANIZING COMMITTEE

Boyan Kostadinov (Chair), Emad Alfar, and Chia-ling Lin

*A special thank you to New York City College of Technology for contributing prizes to the Math Bowl.*

HOFSTRA UNIVERSITY®
DEPARTMENT OF MATHEMATICS

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# THE MAA ANNUAL MEETING OF THE METROPOLITAN NEW YORK SECTION

**MAY 13, 2018**

HOFSTRA UNIVERSITY

# AGENDA

| | | |
|---|---|---|
| 8:30-12:00 PM | Registration | *Student Center Theater Lobby* |
| 8:30-11:30 AM<br>3:30-5:00 PM | Refreshments | *Student Center Theater Lobby* |
| 8:30-3:00 PM | Book Exhibits | *Multipurpose Room* |
| 9:00-9:20 AM | Welcome<br>Dr. Benjamin Rifkin<br>*Dean of the College of Liberal Arts and Sciences, Hofstra University*<br>Dr. Daniel E. Seabold<br>*Chairman, Department of Mathematics, Hofstra University*<br>Dr. Elena Goloubeva<br>*Chair of the Metropolitan New York Section of the MAA, Webb Institute* | *Student Center Theater* |
| 9:20-10:20 AM | Invited Speaker<br>Geometric Optimization Problems for Efficient Viewing: Finding Good Ways to See Things Well<br>Dr. Joe Mitchell, *Stony Brook University* | *Student Center Theater* |
| 10:30-11:30 AM | Invited Speaker<br>A Matter of Gravity<br>Dr. Steven G. Krantz, *Washington University in St. Louis* | *Student Center Theater* |
| 11:30-12:30 PM | Lunch | *Multipurpose Room* |
| 12:00-12:30 PM | Contributed Poster Session | *Multipurpose Room* |
| 12:40-1:10 PM | Business Meeting and Awards Ceremony | *Student Center Theater* |
| 12:30-1:10 PM | Math Bowl<br>Moderators: Dr. Dan Ismailescu, *Hofstra University*<br>Dr. Eric Rowland, *Hofstra University* | *Plaza Room Middle* |

1:15-2:15 PM — Invited Speaker — *Student Center Theater*

The Future of Prediction

Dr. Lionel Levine, *Cornell University*

2:20-3:20 PM — Invited Speaker — *Student Center Theater*

Learning to Personalize from Observational Data

Dr. Nathan Kallus, *Cornell University*

3:30-4:30 PM — Panel Discussion — *Student Center Theater*

Partner Disciplines on Teaching Mathematics

Organizers: Dr. Mutiara Sondjaja, Dr. Johanna Franklin, and Dr. Johann Thiel

Moderators: Dr. Mutiara Sondjaja, Dr. Johann Thiel

Panelists:

Dr. Elizabeth Bauer, *Department of Psychology, New York University*

Dr. Kevin Bisceglia, *Department of Chemistry, Hofstra University*

Dr. Peter Daniel, *Department of Biology, Hofstra University*

Dr. Ashwin Satyanarayana, *Department of Computer Systems Technology, New York City College of Technology*

Dr. Alan Tucker, *Department of Applied Mathematics and Statistics, Stony Brook University*

3:30-5:30 PM — Contributed Paper Sessions

*SC denotes "Student Center"*

| | |
|---|---|
| Research Session I: Applied Mathematics | *SC Plaza Room West* |
| Research Session II: Applied Mathematics | *SC Plaza Room East* |
| Research Session III: Pure Mathematics | *SC Plaza Room Middle* |
| Pedagogy Session I | *Davison Room 101* |
| Pedagogy Session II | *Davison Room 102* |
| Pedagogy Session III | *Davison Room 104* |
| Modern Technology in Mathematics Education Session | *SC Room 141* |
| Student Session I | *SC Room 142* |
| Student Session II | *SC Room 143* |

## Internet login (use the eduroam network):

*username:* employees\h702898911@hofstra.edu

*password:* newyork321*

# INVITED SPEAKERS

## A MATTER OF GRAVITY


### Dr. Steven G. Krantz

*Washington University in St. Louis*



**Abstract:** We take a new look at the concept of the center of gravity. In particular, we look at the stability of the center of gravity and also what geometric conditions guarantee that the centroid lies in the region. Matter become particularly interesting when we consider these questions in very high dimensions and asymptotically as the dimension tends to infinity. Some of this joint work is with Harold Parks, John McCarthy, and undergraduate Eric Hintikka.


**Biography:** Dr. Steven G. Krantz was born in San Francisco, California in 1951. He received a B.A. degree from the University of California at Santa Cruz in 1971 and a Ph.D. from Princeton University in 1974. His thesis advisor was E.M. Stein. Dr. Krantz has taught at UCLA, Princeton University, Penn State, and Washington University in St. Louis. He was Chair of the latter department for five years. Krantz has had nine Masters students and 20 Ph.D. students. He has written more than 110 books and more than 235 scholarly papers. He edits five journals and is Managing Editor of three. He is the founding editor of the Journal of Geometric Analysis and of Complex Analysis and its Synergies. Krantz has won the Chauvenet Prize, the Beckenbach Book Award, and the Kemper Prize. He was recently named to the Sequoia High School Hall of Fame. He is an AMS Fellow. Among Krantz's research interests are: several complex variables, harmonic analysis, partial differential equations, differential geometry, interpolation of operators, Lie theory, smoothness of functions, convexity theory, the corona problem, the inner functions problem, Fourier analysis, singular integrals, Lusin area integrals, Lipschitz spaces, finite difference operators, Hardy spaces, functions of bounded mean oscillation, geometric measure theory, sets of positive reach, the implicit function theorem, approximation theory, real analytic functions, analysis on the Heisenberg group, complex function theory, and real analysis. He has applied wavelet analysis to plastic surgery; creating software for facial recognition. Krantz has also written software for the pharmaceutical industry.

## GEOMETRIC OPTIMIZATION PROBLEMS FOR EFFICIENT VIEWING: FINDING GOOD WAYS TO SEE THINGS WELL


### Dr. Joe Mitchell

*Stony Brook University*



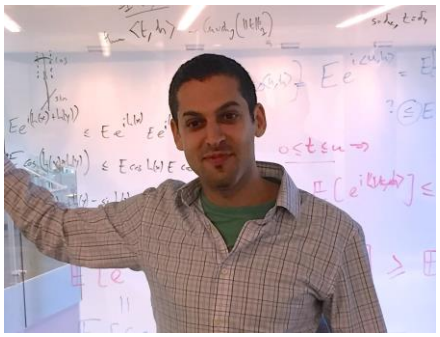
**Abstract:** A famous problem posed by Victor Klee in the early 1970's is the Art Gallery Problem: How many points ("guards") are sufficient to place within a simple polygon $P$ having $n$ vertices so that every point of $P$ is "seen'" by at least one guard? This problem falls into a rich class of computational geometry problems that ask one to optimally cover a domain. We discuss several interesting mathematical and algorithmic questions that arise in this class, both in the case of stationary guards and mobile robotic guards. The problems are simple to state, easy to visualize, but often very challenging to solve.


**Biography:** Dr. Joseph S. B. Mitchell received a BS (Physics and Applied Mathematics), and an MS (Mathematics) from Carnegie-Mellon University, and Ph.D. (Operations Research) from Stanford University (under advisorship of Christos Papadimitriou). Mitchell was with Hughes Research Labs and then on the faculty of Cornell University. He is now SUNY Distinguished Professor at Stony Brook University, where he serves as chair (since 2014) of the Applied Mathematics and Statistics Department and as research faculty in the Department of Computer Science. Mitchell has received various research awards (ACM Fellow, 2010 Godel Prize, NSF Presidential Young Investigator, Fulbright Scholar, President's Award for Excellence in Scholarship and Creative Activities) and numerous teaching awards. His primary research area is computational geometry, applied to problems in computer graphics, visualization, air traffic management, manufacturing, and geographic information systems. Mitchell has served for several years on the Computational Geometry Steering Committee, often as Chair. He is on the editorial board of the journals Algorithmica, Discrete and Computational Geometry, Computational Geometry: Theory and Applications, Journal of Computational Geometry, and the Journal of Graph Algorithms and Applications, and is an Editor-in-Chief of the International Journal of Computational Geometry and Applications. He has served on numerous program committees and was co-chair of the PC for the 21st ACM Symposium on Computational Geometry (2005).

## THE FUTURE OF PREDICTION

### DR. LIONEL LEVINE

*Cornell University*



**Abstract:** Can you predict the next term in this sequence?

0,1,3,4,9,10,12,13,27,28,30,31,...

I'll share my experience in a prediction tournament with thousands of players, focusing on the uses (and abuses!) of mathematics in predicting the future; why Bayes' rule is not the answer to everything; how to incentivize good predictions; and when to expect surprises. We'll see how randomness can be more predictable than you think, and determinism can be less predictable than you think! I'll hazard a few predictions with input from the audience: Will we ever know the 10^100th digit of pi? Will we discover life on Mars (and should we hope the answer is yes or no?)?

**Biography:** Lionel Levine is an associate professor at Cornell University. His research is on abelian networks. His hobby is inventing toy universes and studying their physics. You can usually find him thinking about why things are the way they are, or why they aren't the way they aren't.

## LEARNING TO PERSONALIZE FROM OBSERVATIONAL DATA

### DR. NATHAN KALLUS

Cornell University

**Abstract:** Personalization has long been central in machine learning, with successful applications in online news and product recommendation systems. A question of growing urgency is how to translate this success to emergent challenges such as personalized medicine, where personalization is key but experimentation can be prohibitively small-scale, costly, dangerous, and/or unethical in comparison to passive data collection. In this talk I will discuss recent advances in learning to personalize from purely observational data, such as hospitals' electronic medical records (EMR), where the isolated effect of a treatment is hidden by a myriad confounding factors. This question brings together machine learning, to handle individual-level targeting and very rich data, with causal inference, to handle the counterfactual nature of the question. I will present a particular application to personalizing pharmacological treatments for type-2 diabetes (T2D) management based on patient characteristics, disease progression, and treatment history by leveraging the EMR database of a large hospital. I will show how standard reductions of the problem to supervised learning, where predictive algorithms are used as a black box, can fail to achieve no-regret learning and also fail in practice. I will present instead a principled approach to learning to personalize that is based on mathematical optimization and demonstrate its success empirically and explain it theoretically.

**Biography:** Nathan Kallus is Assistant Professor in the School of Operations Research and Information Engineering and Cornell Tech at Cornell University. Nathan's research revolves around data-driven decision making, the interplay of optimization and statistics in decision making and in inference, and the analytical capacities and challenges of observational, large-scale, and web-driven data. He holds a PhD in Operations Research from MIT as well as a BA in Mathematics and a BS in Computer Science both from UC Berkeley. Before coming to Cornell, Nathan was a Visiting Scholar at USC's Department of Data Sciences and Operations and a Postdoctoral Associate at MIT's Operations Research and Statistics group.

# Metro NExT (New Experiences in Teaching)

The Metropolitan New York Section of the MAA is pleased to introduce a special program aimed at supporting new and rising Ph.D's in mathematics or mathematics education. Metro NExT (New Experiences in Teaching) will be a local version of the highly successful national MAA program Project NExT. Like Project NExT, Metro NExT's goal is to support new and pre-tenured faculty who are interested in improving the teaching and learning of undergraduate mathematics.

Metro NExT aims to provide mathematicians in the metropolitan New York area who have recently entered the profession with practical information about, and concrete suggestions for, implementing more effective pedagogical and professional strategies, ranging from new teaching methods to writing grant proposals and balancing teaching and research responsibilities. Metro NExT events will also provide opportunities for its fellows to meet other young professionals, socialize, and network. Furthermore, Metro NExT fellows will be invited to participate in some future Project NExT events including those at the Joint Meetings and at Mathfest.

Metro NExT is open to all Metropolitan New York MAA Section faculty members holding a Ph.D. in mathematics or mathematics education and having full-time, pre-tenure status at a post-secondary institution. Metro NExT is also open to all graduate mathematics or mathematics education students in their final two years of doctoral study.

# PANEL DISCUSSION WITH PARTNER DISCIPLINES ON TEACHING MATHEMATICS

## 3:30 – 4:30 PM

Organizers: Dr. Johanna Franklin, *Hofstra University*
Dr. Tia (Mutiara) Sondjaja, *New York University*
Dr. Johann Thiel, *New York City College of Technology*

Panelists: Dr. Elizabeth Bauer, *Department of Psychology, New York University*
Dr. Kevin Bisceglia, *Department of Chemistry, Hofstra University*
Dr. Peter Daniel, *Department of Biology, Hofstra University*
Dr. Ashwin Satyanarayana, *Department of Computer Systems Technology, New York City College of Technology*
Dr. Alan Tucker, *Department of Applied Mathematics and Statistics, Stony Brook University*

We teach a large number of non-math majors in our math classes; many of these students take our math classes to fulfill the requirements of their majors, or to fulfill a distribution requirement. Yet, we rarely have the chance, or time, to have a meaningful discussion with colleagues in other disciplines about how successful our mathematics courses really are in achieving the intended purpose of their mathematics requirements. What mathematical skills are important in other disciplines? Are our traditional approaches in teaching math—for instance, one of them is teaching with an emphasis on algebraic manipulations—effective in helping students gain skills relevant to their majors? The goal of this session is to provide an opportunity for lively conversations on these questions with some of our colleagues from other disciplines.

# CONTRIBUTED POSTER SESSIONS

## 12:00 – 12:30 PM

*Supervisor: Zoran Sunic* *Location: Multipurpose Room*

### Topological Optimizations in Design & Fabrication

*Marco Dwyer, Asli Oney, Heraldi Sadmojo, Xiaoneng Tang*
*Advisers: Anne Leonhardt and Satyanand Singh, New York City College of Technology, CUNY*

From an architectural design perspective, after a design concept is arrived at, a designer needs to analyze potential weaknesses in supporting load capacities and material usage. This project explores the foundations of the topology behind computer aided generation of gyroids, and other complex forms, utilizing the tools of Wolfram Mathematica and Robert McNeel's Grasshopper and Kangaroo. Models were generated from parametrized mathematical inputs and analysed for form-optimization and then 3D printed to visualize their final shape. Some of the simulations were based on the study of the Klein bottle and the Möbius strip. This process will allow designers and engineers to take advantage of optimization techniques of pure forms to becoming something more tangible and efficient when designing a physical object such as a pavilion or a structure. This process will allow us designers (and engineers) to take advantage of optimization techniques of pure forms to becoming something more tangible and efficient when designing a physical object such as a pavilion or a structure.

### Limiting Densities of the Fibonacci Sequence Modulo p^n

*Nicholas Bragman, Genevieve Maalouf*
*Adviser: Eric Rowland, Hofstra University*

The Fibonacci sequence mod p^n, where p is prime, is periodic. It is already known that the limiting density of the Fibonacci sequence modulo powers of 11 is 145/264. We look to determine Fibonacci densities with respect to general powers of primes p. We take primes p congruent to 1 or 4 mod 5, and whose residues satisfy the remaining conditions of Hensel's Lemma, and interpolate Binet's formula in the p-adic numbers. We discover several partitioned, converging subsequences of prime densities, bounded above by .46. We see that this sequence of primes obtained is a subsequence of a sequence obtained by Lehmer in 1966, in connection with the Fibonacci sequence, reflecting the representation of p as the sum of two squares and p mod 40 is congruent to 1, 9, 21, or 29.

### Forging Empathy to Enhance Classroom Experience

*Behailu Mammo, Marissa Grill and other Hofstra Noyce Scholars, Hofstra University*

Empathy is the ability to understand and recognize other's needs and respond appropriately. Research suggests that empathy can be used to cultivate better communication, improved intercultural relations, and more impartial school discipline systems. This makes empathy a powerful tool, especially for pre-service Noyce teachers (Hofstra program funded by National Science Foundation) who will go on to work with learners of diverse backgrounds. Noyce programs may consider implementing empathy-training programs, as empathy is a skill that can be developed with training and practice. To be most effective these programs should focus not only on empathy development and the benefits of empathy, but also the burnouts and biases that empathy can cause.

### Urbanization in Developing Countries

*Allon Pevzner, Adviser: Tina Gallagher, Paul D. Schreiber High School*

Urbanization is a movement that entails the migration of people from rural to urban areas. First-world countries experienced mass urbanization in the past, but the 21st century has third-world countries experiencing their own urbanization. In this study, the urbanization of three countries classified by the United Nations as Least Developed Countries are examined: Mali, Mongolia, and Zambia. These three countries have primate cities: Bamako, Ulaanbaatar, and Lusaka, respectively. Three factors are taken into account: the difference in GDP from the rural area to the primate city, the difference in population densities, and the percent population of the country that lives in the primate city. A matrix calculation is done to determine the effect of the three factors on a country's domestic urbanization. It is found that for every one USD increase in GDP per capita from the rural area to the city, the rate of urbanization increases by 4.93 x 10^(-5) percent. For every increase of one person per square kilometer from the rural area to the city, the rate of urbanization increases by 4.03 x 10^(-4) percent. For every one percent of the country's population that lives in the city, the rate of urbanization increases by 4.15 x 10^(-2) percent. The factors, in order of decreasing influence per unit, are as follows: Percent of the country's population living in the primate city, the change in population density, and the change in GDP per capita.

### The Theory of the Two-by-Two

*John Gupta-She and Megan Gupta-She, MS 158 Marie Curie and Stuyvesant High School*
*Adviser: Shamita Dutta Gupta, Pace University*

Let the 2×2×2's sequence of moves be group G. This group is a non-Abelian group because its binary operator is not commutative. It is made up of a set of moves and a binary operator (*). The binary operator x*y is the composition of move x followed by move y. It is a group as:

1. The operation * is closed, that is, for any elements x and y ∈ G, x*y is in group G.
2. The operation * is associative, so that for any elements x, y, and z ∈ G, x*(y*z) is equal to (x*y)*z.
3. There is an identity element φ that represents doing nothing.
4. There is a corresponding element for every element that represents doing the reverse (the inverse of turning the right side clockwise is turning the right side counterclockwise).

The generating moves on a 2×2×2 cube are front, right, and up (F, R, U). The other three moves (back, left, and down) can be represented by the first set of moves' inverses, respectively. In this poster session, we will discuss and demonstrate the solution of the 2×2×2 Rubik's cube using the non-Abelian group above. We also plan to calculate the amount of positions that the 2×2×2 can be in and understand God's number. It is interesting to note that one can extend the solution to unconventional Rubik's cubes like the megaminx, which is not even a cube but a dodecahedron. In fact, the idea of Rubik's can be expanded to a whole array of puzzles like the shape shifting mirror cube. Finally, for fun, we are going to demonstrate solving higher Rubik's cube of the type S×S×S, S=2, 3, 4,…10.

### Role of Power Centers in Dynamical Systems

*Nur Dean, Adviser: Shweta Jain, The CUNY Graduate Center*

Game Theory captures the mathematical behavior of some strategic situations whereas individual players choose strategies and their payoff is dependent upon the combination of their own strategy relative to the strategies of other players. Evolutionary biologists study games played by individuals in a population. The game is played in infinitely many rounds or until a steady state is reached. After each round, each player might independently decide to change his/her strategy. This change in strategy is determined using some evolutionary game dynamics or diffusion. In a steady state also known as the evolutionary stable state (ESS), there may exist different proportions of each strategy in the population. Before 1992, evolutionary game theorists used well mixed, unstructured population and found that in games such as the Prisoner's Dilemma, the dominant strategy was to defect so much that cooperators were completely removed from the entire population. However, in the late 1990s, researchers started using networked structures in which players interacted only with their immediate neighbors and found the emergence of cooperation in the stable population in regular and random networks. More recently, these studies were performed on complex networks since they more closely represented the structure of real-life social and technological networks. Researchers found cooperators were even more common in complex networks than in random networks. However, due to the structure of complex networks, certain nodes in the network can be more ``important'' compared to others. This "importance'' must be incorporated in the evolutionary dynamics on complex networks. The first game dynamics which is studied with evolutionary game theory is replicator dynamics. Then the studies extended to other game dynamics such as best response dynamics, imitation dynamics, The Brown–Von Neumann–Nash dynamics, etc. We present an overview of different evolutionary game dynamics. Then in order to analyze the emergence of cooperation in the presence of power centers, we incorporate the measure of Centrality in the game dynamics. We built a simulation framework and experimented with a two-player game played on various simulated complex networks of different sizes. We will present our findings in our poster.

### Recurrence Relations and Computational Complexity

*Mian Shabbir and Anh Trieu, Adviser: Satyanand Singh, New York City College of Technology, CUNY*

In this project we will show how recurrence relations can be used to analyze the computational Complexity of divide-and- conquer algorithms. We will use these recurrence relations to estimate the number of operations used by many different divide-and- conquer algorithms. Our studies will also involve the creation of various examples and the use of transformations to extend our studies to a larger group of problems.

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### Using Graphs to Assemble DNA Fragments

*Rabea Begum, Mukadder Cinar, Shrijana Ghimire*
*Adviser: Ariane Masuda, New York City College of Technology, CUNY*

The DNA sequence assembly is a process in which DNA fragments are aligned and merged into a longer DNA sequence. The goal is to reconstruct the original sequence with a small error. We will discuss how graph theory can be used in this process. We will introduce the de Bruijn graph and show how the Eulerian circuits in these graphs can lead to the whole sequence with some error. The number of Eulerian circuits determines the probability of constructing the original strand of DNA based on a collection of fragments. The probability we will present depends on the number of certain spanning trees in a de Bruijn graph. This work is supported by an MSEIP Grant from the Department of Education.

### Ramsey Numbers

*Diana Zhu and Baikuntha Acharya*
*Adviser: Satyanand Singh, New York City College of Technology, CUNY*

The research focuses on the Ramsey number which is denoted by $R(m,n)$, and can be viewed as the minimum number of people needed to be in a party such that at least $m$ of them are friends or at least $n$ of them are strangers. $R(m,n)$ can also be used to represent the minimum number of vertices that are needed to obtain at least one red subgraph that has $m$ vertices or at least one green subgraph that has $n$ vertices in graph theory. In this research we will prove various results associated with Ramsey theory that are useful in combinatorics

### Using Multiple Metrics to Analyze Weather Variability in New York City

*Jiehao Huang, Adviser: James Booth, New York City College of Technology, CUNY*

As the overall temperature of Earth continues to warm, changes in the Earth's climate are being observed through extreme weather events, such as heavy precipitation events and heat waves. This study examines the daily precipitation and temperature record of the greater New York City region during the 1979-2014 period. Daily station observations from three greater New York City airports: John F. Kennedy (JFK), LaGuardia (LGA) and Newark (EWR), are used in this study. Multiple statistical metrics are used in this study to analyze trends and variability in temperature and precipitation in the greater New York City region. The temperature climatology reveals a distinct seasonal cycle, while the precipitation climatology exhibits greater day-to-day variability. Two types of thresholds are used to examine the variability of extreme events: extreme threshold and daily anomaly threshold. The extreme threshold indicates how the strength of the overall maximum is changing whereas the daily anomaly threshold indicates if the strength of the daily maximum is changing over time. We observed an increase in the frequency of anomalous daily precipitation and temperature events over the last 36 years. The most extreme precipitation events occur during the months of late summer through early fall. For temperature, the greatest frequency and variation in temperature anomalies occur during winter and spring. In addition, temperature variance and temperature differences is also analyzed to determine if there is greater day-to-day temperature variability today than in the past.

### Keep Complaining Because Satellites Can't See Underground

*Xuebin Zou, Adviser: Michael Grossberg, City College of New York, CUNY*

According to the World Bank, two-thirds of the global population will live in urban areas by 2050. The impacts of major weather events have sometimes led to huge economic losses in urban areas and impacts are projected to increase as cities grow. Using remote sensing to study weather in urban areas is challenge because urban areas are small relative to the resolutions of many satellite products. In addition, most human activity is indoors and underground, which neither satellites nor other remote sensing instruments can measure. As a substitute for these instruments, there are datasets that can potentially provide information about the local impacts of the weather. Many cities use the U.S. Federal Communications Commision code for non-emergencies (311) as a hotline for residents to report municipal issues. For example, New York City's 311 dataset contains over 100 million reports, many of which are potentially related to the impacts of weather events. To isolate the impacts, we aggregate over space and time to reduce the noise in the data and normalize the data to account for uneven distributions of people and complaints. We then compare the potentially weather related 311 reports with global monthly summaries of weather observations from the Global Historical Climatology Network (GHCN) to analyze the impact of weather events as reported by the residents of NYC.

### Underlying Mathematical Concepts in RSA Crypto-system

*Basiru Mohammed, Advisers: Sanju Vaidya and Charles Li, Mercy College*

The main objective of this project is to study the underlying mathematical concepts in RSA cryptosystem. In 1977, R. Rivest, A. Shamir, and L. Adleman invented this crypto-system which is currently most widely used for protecting online data. It uses many concepts and theorems in Number Theory such as factoring, modular arithmetic, Euler's Theorem, and Chinese Remainder Theorem. It is fascinating to see how RSA cryptographic algorithm uses various concepts in Number Theory and is very successful.

### Sprouts of Insanity: Using Two Simple Games to Explore the World of Graph Theory in the Classroom.

*Dennis Hopkins Jr., Advisers: Sanju Vaidya and Charles Li, Mercy College*

Using two simple games, Sprouts and Instant Insanity, concepts in graph theory and mathematics can be explored in the classroom. Graph theory provides the perfect subject material for helping students develop heuristic thinking and problem-solving skills. The basic ideas behind graph theory enable students to visually understand connections between abstract ideas and the formulation of logical solutions to resolve the problems presented. Many students only see the computational aspect of mathematics, and don't develop a sense of how to extend these concepts to other fields of mathematics, or other disciplines in general. This also poses a challenge for some students who are primarily visual learners, where trying to understand mathematical concepts through the lens of formulas can be prohibitive. Games are a great tool to teach not only the basics of logic, but also the application of abstract concepts and problem solving. Sprouts and Instant Insanity are two games that are accessible to everyone, and they connect many important ideas within mathematics, which include graph theory, combinatorics, linear algebra, and topology. We will focus on how the fundamental ideas in graph theory not only can be used to solve these two simple games, but also illustrate how the strategies employed can help make mathematics more approachable for K-12 students.

### Application of a Flipped Classroom Model: Using XYZ eTextbook, Co-Teaching and Blackboard

*Matthew Meangru, Pace University*

The application of a flipped classroom model can have a positive effect in an Algebra classroom (MATH 103) at the New York City campus of Pace University. Each student has a unique personality in learning mathematics. These students understand the basic concept of algebra, but struggle in certain areas. As a result, a flipped classroom model can help students overcome their struggles through the use of XYZ eTextbook, co-teaching, and Blackboard. XYZ eTextbook: Students enrolled in Algebra (Math 103) are required to purchase an XYZ eTextbook called "Algebra: A combined Course for Pace University." Each chapter of the eTextbook is equipped with videos reviewing the example problems of a section. With Professors assigning students videos to watch, students get an idea of the materials that will be discuss in the next class. Co-Teaching: Allowing the students to become the teacher of the classroom lets an instructor play the role of student. Using XYZ eTextbook, professors can assign students to watch the videos before coming to class. This allocates class time for students to work on the application problem of the lesson. After students solve the problems, they will be given the opportunity to explain it to the entire class. This teaching technique helps motivates students to learn mathematics and build their mathematical diction. Blackboard: Students are required to upload their homework on Blackboard. By taking a photo of their assignment and uploading the image through the blackboard app on their mobile device. mathematical anxiety is lowered, especially because students don't have to worry about forgetting their assignment at home. Most importantly, this allows students to save money on purchasing homework platforms such as Aleks or WebAssign. Professors can now see all the steps that the students took in their homework and this cannot be seen on an online homework platform. In the end, applications of a flipped classroom model play a major role in helping students to overcome their struggles in learning algebra.

### Wind Speed Data Analysis at Laguardia Airport

*Sanjib Lamichhane, Adviser: Malgorzata Marciniak, LaGuardia Community College, CUNY*

This paper summarizes how the behavior of the wind speed has been changing around LaGuardia International Airport for about twenty years based on our data analysis. The airport is the closest airport to LaGuardia Community college where we aim to build a wind turbine. Knowing the nature of the wind flowing through the region would assist us in optimizing a design of the turbine and generate maximum energy. It is crucial to understand the wind pattern while designing a wind turbine. This is due to the need of extracting the most power out of the wind and to also prevent structural damages due to unexpected wind speeds. Our research found out that there has always been a pattern in which wind is flowing through the region. An experiment with wind turbine design will then be performed to confirm that the data analysis of the wind speed in fact worked efficiently.

### Stochastic Cyber-attacks Detection on College Network Using Linear Algebra Theory and Stochastic Cyber-attacks Detection Approach

*Rojan K. C., Adviser: Malgorzata Marciniak, LaGuardia Community College, CUNY*

Increasing use of computers and internet has multiplied the illegal use of internet and networks. In a Network Controlled System (NCS) hackers compromise the actuator and sensor of network by overflowing data and jamming the server. This research is based on the algebraic detection schemes for NCSs under stochastic cyber-attacks and disturbances. Further, it deals with the multiple stochastic cyber-attacks detection problem aiming at multiple communication channels of NCS. We construct a model of stochastic attack that hacker might launch on actuators which satisfies Markovian stochastic process to detect the hack on network from the equation of Network. First, we suppose network be hacked which will have residual value of 1 and using the physical data from actuator and sensor, we substitute values in equation and solve them. For our conclusion, we will test the compatibility of the process in LaGuardia Community College network.

### Optimization of a Wind Turbine using Genetic Algorithm

*Andrei Dragutan, Shou Oikawa*
*Advisers: Vladimir Przhebelskiy, Malgorzata Marciniak, Marina Nechayeva*
*LaGuardia Community College, CUNY*

Genetic Algorithm (GA) mimics the natural selection that occurs in nature to solve optimization problems. Our goal is to design a wind turbine blade with optimal geometry that would give rise to the greatest Coefficient of Power (Cp) for a given range of wind speeds. To do so, a program that calculates a Cp for a specific blade was taken and modified to incorporate GA. A parent vector consisting of a random set of seven chords and seven pitch angles was generated within a set parameter and the Cp was calculated. A mutant vector was generated based off of that parent vector, cross-bred with the parent, a child vector created, then the Cp for the newly created child is calculated. To improve the convergence of the blade design, the chord and the pitch of the blade is sorted in a decreasing order separately to avoid irregular geometry before calculating the Cp. The Cp of the parent and the child are compared and the higher of the two will be used as the new parent and the process is repeated until the Cp converges or a user-set amount of generation has passed. The initial phase of the program is promising, resulting in an average coefficient of power values of 0.56347. Upon obtaining desirable results, a wind turbine rotor is designed in AutoCAD and 3D printed, which will need to be tested in a wind tunnel. Despite a high Cp is desirable, values close to 0.6 is not realistic, which prompts further improvement and debugging of the program. An experiment of the wind turbine design will also be necessary to see if the program did in fact generated an efficient wind turbine.

# CONTRIBUTED PAPER SESSIONS

## 3:30 – 5:30 PM

## RESEARCH SESSION I: APPLIED MATHEMATICS

*Presiders: Satyanand Singh/Valentina Semenova* *Location: Student Center Plaza Room West*

**3:30 p.m.** **A Jump-Diffusion Process for Asset Price with Non-independent Jumps**
*Yihren Wu and Majnu John, Hofstra University*

A market recovery model, defined as a jump-diffusion model for the asset price where the jumps and the diffusion are not independent, is proposed. In this model a jump will be triggered when there is an unusually large downward movement over a certain time interval, and the jump size is correlated to this downward drop. We show that the market data supports such a model and parameter estimates based on market data is discussed. An explicit formula for the risk-neutral drift is presented so that the option prices based on this model can be computed through Monte-Carlo simulation of the asset price. The characteristic function for the return of the asset price is derived, through which the option prices can be computed by numerical integration. The volatility of asset classes in this model, defined using the option prices through the variance swap (VIX) equation, is analyzed. A sensitivity study of the volatility with respect to jump parameters is performed. Results are compared to other well-known jump models.

**3:50 p.m.** **Modeling Extreme Risk Events via Bayesian Processing**
*Douglas E. Johnston, Farmingdale State College*

The modeling and assessment of extreme events is a critical mission in many applications. The statistical analysis of extreme events has applications ranging from network traffic to wealth distributions to hydrological studies. An area that has seen significant interest is in quantitative risk-management with applications in the banking and the insurance industries. In this paper, we introduce a new approach to analyze extreme events, which we term stochastic block-maxima. Utilizing the Fisher-Tippett/Gnedenko Theorem, we obtain a parametric form for the density of the maximum of a subset, or block, of the data; the block-maximum. To allow for dependency between blocks of data, we assume the parameters of the distribution are stochastic according to a vector autoregressive process, which allows for clustering of extreme events. Traditionally, large blocks of data are needed to approximately satisfy the i.i.d. assumption required for estimation of the density parameters. Our approach allows for the block-maxima to be dependent thus requiring smaller block sizes, leading to more blocks for a given set of data. To estimate the parameters of the block-maxima density, which vary over time, we utilize a particle filter. This reduces the computational effort and allows a recursive solution which is important for large-scale data sets and real-time risk-management systems. Given the additional static parameters, associated with the temporal variation of the density, we use Rao-Blackwellization to marginalize these "nuisance" parameters. As a result, we obtain a joint solution for the predictive density of future returns and the density parameters. This is particularly important when using risk-metrics, which are typically nonlinear functions of the cumulative predictive density. Risk-metrics are random-variables and their expectation can be significantly different than the risk-metric derived solely from the marginalized (expected) predictive density. We introduce new risk-metrics (e.g., p-VaR), which is a more accurate description of risk and will show our results using real stock market returns from 1928 through the end of 2017.

**4:10 p.m.** **Probabilistic Simulations Using R**
*Satyanand Singh, New York City College of Technology, CUNY*

We will illustrate how we can use the R software to simulate the probability density functions of distribution and expectations by way of the R software. In our examples we will use the continuous uniform distribution on the unit interval (0,1). One can easily adapt these techniques to other distributions. This is a useful and dynamic teaching tool that allows students to make predictions before they employ rigorous techniques to support their claims.

**4:30 p.m.** **The Mathematics of Big Data: How Mathematics Uses Data and How it is Interpreted by Different Disciplines**
*Joan E. DeBello, St. John's University*

This paper will discuss how mathematics has impacted the age of Big Data, Data Analytics and Data Science. It will address the impact mathematics has on Big Data and how courses are being created across program curriculum due to its influence and popularity. Computer Science, Business, Sports and Healthcare are using mathematics and big data to create new courses and programs to meet the growing trend of jobs and research in this area. It will discuss ways to incorporate big data into mathematics courses for all majors and sample topics and problems to motivate and teach mathematics to all majors. It will also address how a mathematics course in big data can be used as a core course or taught between two professors, one with a mathematics background and one with another discipline designed to help teach and interpret big data in discipline specific mathematics courses.

**4:50 p.m.** **A Framework for Unconditionally Secure Public-Key Encryption (with Possible Decryption Errors)**
*Mariya Bessonov, New York City College of Technology, CUNY*

We offer a public-key encryption protocol where decryption of a single bit by a legitimate party is correct with probability p that is greater than 1/2 but less than 1. At the same time, a computationally unbounded (passive) adversary correctly recovers the transmitted bit with probability exactly 1/2.

**5:10 p.m.** **Maxwell's Formulation of Electromagnetism and the Development of Vector Analysis**
*Frank Wang, LaGuardia Community College, CUNY*

From 1855 to 1865, James Clerk Maxwell published a series of three papers that established the foundation of the theory of electromagnetism. His first paper contains Faraday's law, which describes Michael Faraday's experimental results on electromagnetic induction through equations. In Maxwell's paper, and later his Treatise on Electricity and Magnetism, Faraday's law is expressed in terms of the rate of change of the vector potential. After Maxwell's death, Heinrich Hertz and Oliver Heaviside discovered that one can eliminate the vector potential and express Faraday's law in terms of electric and magnetic fields that are more concrete for scientists and engineers. The equivalence of the two forms is established through Stokes' theorem. Maxwell's original equations, written in components of vectors, are quite difficult to comprehend. By examining the original equations and comparing them with the modern form in vector notation, one can see the motivation behind the development of vector analysis.

## RESEARCH SESSION II: APPLIED MATHEMATICS

*Presider: Sylvia Silberger* *Location: Student Center Plaza Room East*

**3:30 p.m.** **Vulnerability Measures and Topological Indices of Graphs**
*Sanju Vaidy, Mercy College*

Vulnerability measures and topological indices are crucial in solving various problems such as assessment of communication networks and development of mathematical models for chemical compounds. In this presentation, I will establish formulas for certain vulnerability measures such as Residual Closeness and certain topological indices such as hyper-Wiener index for various graphs. I will do this by computing Husova polynomials and their derivatives. It is amazing to see how Hosoya polynomials give powerful tools for fields of Communications and Chemistry.

**3:50 p.m.** **A Treecode for 3D Stokeslets and Stresslets**
*Lei Wang, Svetlana Tlupova (presenter), Robert Krasny, Farmingdale State College*

Many problems in fluid dynamics are modeled as particle interactions in Stokes flow, including for example simulations of falling particle-laden jets in viscous fluids, microfluidic crystals, cilia- and flagella-driven flows, free-surface flows of liquid drops, and vesicle flows. The formulation is often based on the Stokeslet and stresslet, which are the fundamental solutions of the Stokes equations and form the basis for boundary integral and singularity methods in slow viscous flow. Evaluating the velocity induced by a collection of Stokeslets and stresslets by direct summation requires O(N^2) operations, where N is the system size. In this talk, we will describe a treecode algorithm that reduces the cost to O(Nlog N). The particles are divided into a hierarchical tree of clusters, and well-separated particle-cluster interactions are computed by a far-field Cartesian Taylor approximation. A new recurrence relation is developed for the Taylor coefficients of the Stokeslet and stresslet kernels which facilitates using higher-order approximations. We will present serial and parallel numerical results that demonstrate the performance of the algorithm in terms of accuracy and efficiency.

**4:10 p.m.** **Creating a Formula for Score on the PGA Tour**
*Burton Lieberman, NYU Tandon School of Engineering*

An analytical formula that relates the 18-hole score in a round of golf to readily available golf statistics is found for PGA Tour players. Using Putting Average, P, Greens-In-Regulation %, G, Scrambling Success %, S, and Eagle Opportunity % on N5 par 5's, E, one obtains the following formula for a player's score: Score = Course Par + 18G(P-2) – N5E – 0.9(1-G)S + 10.5(1-G)(1-S)P
rounded to the nearest integer. For over 175,000 rounds of the PGA Tour players between 2004-2017, this formula is within +/- 2 strokes of the actual score 99.7% of the time, within +/- 1 stroke, 96.5% of the time, and is exact 68.6% of the time.

**4:30 p.m.** **A Probabilistic Population Model with Cyclic Birth Rates**
*Claire Mirocha (presenter), Mariya Bessonov, New York City College of Technology, CUNY*

Simulating dynamics of a population with a mathematical model gives insight into ecological systems. The stochastic processes behind actual population changes can be complex. Applying mean field theory, we use probabilistic rates to simulate events that alter the population in a system, such as births with cyclic rates, deaths, competition, and local extinctions. We further consider births with random cyclic rates. The behavior of these population models is used to identify conditions that produce "cyclic equilibria" which persist despite the existence of random processes in a model. This method makes the efficient simulation of a large and complex population possible and can be extended to cover multiple population groups living within the same ecological system.

**4:50 p.m.** **Genetic Algorithms in Application to the Vehicle Routing Problem**
*Valentina Semenova (presenter),Thibaud Bezanger, Antoine Guincestre, Columbia University*

The number of delivery services has risen exponentially in the last decade. From Amazon prime to UberEats, there is increasing pressure to deliver goods to customers quickly and efficiently. This has given rise to a class of problems in optimization called Vehicle Routing Problems (VRPs). In this project, we consider different, specialized instances of the VRP. We consider different, existing fast ways to solve them. We then attempt to solve them using a Genetic Algorithm (GA) and compare algorithm performance in terms of speed and optimality of solution.

**5:10 p.m.** **The Bases of Association Rules of High Confidence**
*Justin Cabot-Miller (presenter), Oren Segal, Kira Adaricheva, J.B. Nation, Anuar Sharafudinov*

Association rules are an important pattern to be found in various types of data and have applications both in data mining and artificial intelligence. In this paper we develop a new approach for the distributed computing of association rules of high confidence given a binary table. This process is done in multiple parts. First, we employ a time-efficient approach, based in Formal concept analysis, to finding association rules of confidence 1. This is done via the earlier developed approach titled D-Basis, which provides a unique representation for a binary table based upon the structure of its Galois lattice (concept lattice) which is then analyzed via the hypergraph dualization algorithm. This approach output is the full set of transversals for the given Sperner hypergraph. After the association rules of confidence 1 are found, the D-basis approach is then run on multiple sub-tables of the input and the results are then aggregated, keeping newly found rules. The inclusion of these new rules allows us to obtain rules which hold almost everywhere given that elements which contradict their inclusion may have been removed from the sub-table, this fact is what determined the original title of the paper, "On Near Perfect Association Rules," and later, the final title "The Bases of Association Rules of High Confidence." The latter title referencing the finding of a basis of rules. The paper focuses on the technical implementation of the program and the development of a new parameter for rules, "relevance." Relevance is a measure of how often a rule such as "a implies b" is contradicted by the rule "a implies not-b," and is comparable to the analogous metric called "conviction." Other parameters are also discussed, such as the inclusion of various metrics such as lift, confidence, and support. Lastly, the potential that removing rows might have on the rules' statistics is discussed.

## RESEARCH SESSION III: PURE MATHEMATICS

*Presider: Florin Catrina* *Location: Student Center Plaza Room Middle*

**3:30 p.m.** **Some Interesting Magic Squares of Order Three**
*Jay Schiffman, Rowan University*

Magic squares have fascinated both professional and amateur mathematicians for centuries. In this paper, we will feature some interesting magic squares of order three including a magic square consisting of nine consecutive primes. Participants will then be invited to explore a magic square of order three consisting of all primes and the number one and then seek constants to add to form a new magic square comprised of from zero through nine prime entries inclusive. This problem is not as easy as one might believe. Hence put on your thinking caps and have fun while enjoying the journey.

**3:50 p.m.** **Golomb Rulers**
*Robert Schutz, Industry Consultant*

Let X1,X2, ..., XN be a non-negative sequence, such that all differences of the XK are different, i.e. XI-XJ=XK-XL iff I=K and J=L, then this is defined as a Golomb ruler. They have applications in signal processing and communication theory. They also have many questions in mathematics such as maximizing the number of differences while minimizing the length of the sequences. Some results with this question will be given.

**4:10 p.m.** **A Constructivist View of The Four Exponential Conjecture**
*Barbara A Lawrence, Borough of Manhattan Community College, CUNY*

The Four Exponential Conjecture is one of the top unsolved conjectures. It was first considered in the 1940's and presented in the 1960's by Serge Lang and Kanakanahalli Ramachadra as a result of proving the Six Exponential Conjecture. Their proof was a classical approach and they just couldn't extend it to the Four Exponential Conjecture. The purpose of my paper is to consider a constructivist proof for the Six Conjecture Theorem and extend it to the Four Exponential Conjecture.

**4:30 p.m.** **The Intrinsic Volume Difference of the Euclidean Ball and a Polytope**
*Steven Hoehner (presenter), Farmingdale State College, SUNY*
*Florian Besau, Institut für Mathematik, Goethe-Universität Frankfurt*
*Gil Kur, Weizmann Institute of Science*

We provide optimal bounds for approximation of the Euclidean unit ball by polytopes with respect to the intrinsic volume difference. We consider the cases of inscribed polytopes with a fixed number of vertices chosen from the boundary of the ball, as well as circumscribed polytopes with a fixed number of facets chosen tangent to the boundary of the ball.

**4:50 p.m.** **A Twisted Generalization of the Classical Dedekind Sum**
*Brad Isaacson, New York City College of Technology, CUNY*

In this talk, we introduce a twisted generalization of the classical Dedekind sum. We express twisted Dedekind sums as linear combinations of generalized Bernoulli numbers and give some examples to illustrate.

## PEDAGOGY SESSION I

*Presider: Janet Liou-Mark* *Location: Davison Room 101*

**3:30 p.m.** **The Effects of a Metacognitive Learning Strategies Intervention on Student Performance**
*Behailu Mammo, Hofstra University*

Nationally, only about fifty percent of students who declare majors in STEM graduate with a STEM degree. Given the attrition rates for STEM fields and a growing need for more individuals to fill STEM jobs, national efforts are underway to reform STEM education. While there are multiple efforts to infuse STEM classrooms with promising pedagogies, one of the most straightforward is teaching students how to learn by developing their metacognitive skills. We will share how we integrated metacognition into a first-year calculus class. Preliminary findings will also be discussed.

**3:50 p.m.** **Exploring the Gender Effects of a Mathematics Preparatory Workshop on Student Learning**
*Janet Liou-Mark and Guichang Chen, New York City College of Technology, CUNY*

Undergraduates interested in majoring in a Science, Technology, Engineering, and Mathematics (STEM) discipline are sometimes challenged by the mathematics requirements. To assist in supporting these students, New York City College of Technology has been offering three-day mathematics preparatory workshops during the winter and summer intersessions. Students are enrolled in a free workshop that allows them to pre-learn selected topics prior to taking the required mathematics course. These preparatory workshops are offered in the following classes: Intermediate Algebra/Trigonometry (MAT 1275), Precalculus (MAT 1375), Calculus I (MAT 1475), and Calculus II (MAT 1575). The primary focus of this study was to examine if there are gender differences in final mathematics grades and their responses to a satisfaction survey. Results showed that males who enrolled in the Calculus I preparatory workshop showed statistically significant higher mean grade differences than females, but not in the other mathematics courses. For the Intermediate Algebra/Trigonometry, Precalculus, and Calculus II workshops, females found the course materials and workbook statistically significantly more helpful than the males. Moreover, for females taking the Precalculus workshop, they would recommend the workshop to other friends more so than their male counterparts. For the Calculus II workshop, the mean response for females is statistically significantly higher than the males for the statement "learning mathematics make me nervous.

**4:10 p.m.** **Numeracy: A Journey in an Urban College**
*Nadia Benakli, New York City College of Technology, CUNY*

The quantitative reasoning program at an urban college will be described. Strategies that have been used to develop and improve numeracy skills will be presented.

**4:30 p.m.** **Prospective Mathematics Teacher Learning in a Video Club**
*Nadia Kennedy, New York City College of Technology, CUNY*

This presentation discusses prospective teacher learning in a video club in which a group of prospective teachers along with the instructor watch and discuss video recordings of their teaching during student teaching placement.

**4:50 p.m.** **Supplemental Instruction: A Success for Three Community Colleges in the City University of New York**
*Johannes Familton, Borough of Manhattan Community College, CUNY*

Supplemental Instruction was created at the University of Missouri-Kansas in 1973 by Dr. Deanna Martin. It incorporated ideas from developmental psychology. The original form of Supplementary Instruction required that students were motivated enough to be open to being independent learners. Unfortunately, this is not always true for students in remedial mathematics courses. Thus, there became a need to modify the original model to suit the needs of these students. The Borough of Manhattan Community College (CUNY), along with other City University of New York (CUNY) community colleges has been developing their own versions of Supplemental Instruction (SI) and modifying their SI programs to accommodate these types of students for their particular institutions. These more flexible forms of SI were developed in order to remove the remedial stigma that is often attached to traditional academic assistance programs. This modified model does not identify high-risk students but identify high risk classes. In this talk Dr. Familton will talk briefly about three CUNY community colleges, BMCC, Hostos and LaGuardia, their history with Supplemental Instruction and their SI programs. He will focus mainly on his own institution, BMCC, and on mathematics. He will show the statistics about how successful its most recently developed SI program run by the BMCC Learning Resource Center is doing as it continues to develop, modify and grow into a vital part of the BMCC community.

## PEDAGOGY SESSION II

*Presider: David Seppala-Holtzman* *Location: Davison Room 102*

**3:30 p.m.** **Integrating Proof Writing and Mathematical Communication Skills Throughout the Mathematics Curriculum (Preliminary Report)**
*Josh Hiller and Salvatore Petrilli, Adelphi University*

The mathematics department at Adelphi University has undertaken a major initiative: to improve the ability of our majors to communicate mathematically. In this presentation we will touch on why we feel this to be necessary, and what our initial recommendations have been. We will also explore ideas to integrate this objective throughout the mathematics curriculum. We would appreciate feedback and additional ideas from the audience.

**3:50 p.m.** **Developing a Co-requisite Mathematics Course for STEM Path: Intermediate Algebra and Precalculus**
*Liana Erstenyuk, Jae Ki Lee, Susan Licwinko, Hong Yua*
*Borough of Manhattan Community College, CUNY*

BMCC Mathematics Department recently demonstrated the successful case of an accelerated course "Introduction to Statistics with Algebra Workshop (MAT 150.5)." We have developed an accelerated course "Precalculus with Algebra and Trigonometry Review (MAT 206.5)" for STEM major students. We expect this study to 1) increase pass rates, 2) increase retention of knowledge of Algebra and Trigonometry and its application for functional analysis in Precalculus, 3) increase students motivation to stay on STEM path and attract more students to STEM career by reducing the sequence of mathematics courses, and 4) develop students as independent learners. The course "Integrated MAT 206.5 course" shortens the time for completing a STEM degree. We expect that the redesigned course will increase student retention and passing rates. This semester, there are three sections of MAT 206.5 offered, and in Fall 2018, there will be nine sections.

**4:10 p.m.** **Mathematical Writing for Critical Thinking**
*Benjamin Gaines, Iona College*

In introductory level math classes, writing assignments can be used to encourage students to think critically about the subject at hand. Writing assignments that present a `real world' question in context help students develop their communication and logical reasoning skills while providing motivation for the concepts being discussed. Peer review then gives students an opportunity to evaluate arguments, and learn to recognize what makes an effective response. This paper will include some of the prompts that are given, how they are assessed by the instructor and their peers, and what the student response has been.

**4:30 p.m.** **Creating an Integrative STEM Mathematics Classroom**
*Michael Gilliam, The College of New Rochelle*

Demand is on the rise for robust bridge programs and first-year experience courses within the major. To optimize the use of existing 100-level STEM courses in this capacity, institutions are re-imagining how to augment course content to provide an inviting, experiential, and more personally relevant course that equips students with strategies and a community to improve academic success. We explore a course redesign, initially implemented in a Precalculus summer bridge program, that *holistically* integrates STEM into a mathematics classroom, incorporating such topics as modes of learning, application labs, community mentors, and the exploration of their #FutureMe.

**4:50 p.m.** **Teaching in a Total Institution: Toward a Pedagogy of Care in Prison Classrooms**
*Lauren Wolf, Hostos Community College, CUNY*

If a student perceives the genuine concern and caring for the student by the professor then not only does the student enjoy the class but they thrive. There has not been much research on the pedagogy of caring with respect to higher education of pedagogy in a prison classroom. The education research has primarily been in K-12. Prison education has discussed reentry and recidivism not pedagogy. This paper focuses on college mathematics in particular college classes in medium and maximum-security prison. This research is a culmination of 15 years of success in the classroom and seven years in a prison classroom creating a nurturing space which is a warm safe space open for engaging and high expectations. In this article the former students and I discuss what they felt about the pedagogy of care and how it helped them learn mathematics.

## PEDAGOGY SESSION III

*Presider: Emad Alfar* *Location: Davison Room 104*

**3:30 p.m.** **What Should We Be Teaching in Mathematics as Artificial Intelligence Becomes Increasingly Powerful?**
*Alexander Atwood, Suffolk County Community College*

Artificial Intelligence has become increasingly powerful in the past five years. New techniques such as Deep Learning Networks have been successfully implemented to make meaningful progress in difficult problems in medical diagnoses, in game playing (such as the games of Go and Poker), and in the emerging area of autonomous vehicles. Artificial Intelligence also has the real potential of transforming the workplace by powerfully augmenting human performance. In 2013, Carl Benedikt Frey and Michael Osborne, of the University of Oxford, examined the probability of computerization for 702 occupations and found that 47% of workers in America had jobs at high risk of potential automation in the next 10 to 20 years. What should we be teaching in our math courses if Artificial Intelligence will radically change the nature of employment? What skills will our students need to navigate a world in which many jobs may be transformed or even disappear because of Artificial Intelligence? How will increasingly powerful Artificial Intelligence systems change the way in which mathematics is taught in colleges?

**3:50 p.m.** **Using Data Sets to Show Relationships Among Basic Statistical Parameters**
*Lawrence Sher and David Sher*
*Borough of Manhattan Community College, CUNY (retired) and Nassau Community College*

This paper will show the value of simple data sets in discovering and illustrating relationships between basic statistical parameters. We also use simple high school level algebra throughout this paper to demonstrate each of the relationships we describe, making this technique accessible to any student in a college level or AP statistics course. The selection of data sets and the moving of data points in this process indicates to students that statistics is a laboratory science. We will use three data sets, bedpost, tower, and outlier, to explore relationships between the number of terms (n), range (R), mean ($\mu$), median, mode, standard deviation ($\sigma$), and Standard Score (z). Relationships provable by this technique include: the maximum value of the standard deviation is half the range; the minimum value of the standard deviation is the range divided by the square root of twice the number of terms in the distribution. the maximum standard score is the square root of one less than the number of terms in the distribution, the absolute value of the difference between the median and the mean is smaller than the standard deviation, the standard score of the median is less than or equal to one, the |Median-Mode| can be as large as the range. We will present an instructive selection of these proofs.

**4:10 p.m.** **The Tricky Nature of Infinity: A History of Paradoxes from Zeno to Russell**
*Jean Nicolas Pestieau, Suffolk County Community College - Eastern Campus*

This presentation is a commentary on some of the historical problems and paradoxes related to the infinite, from the ancient Greek problems pitting the potential with the actual infinite to the standard treatment of infinitesimals and limits in calculus to the logical difficulties stemming from the modern theory of sets.

**4:30 p.m.** **Tilted Planes and Curvature in Three-Dimensional Space: Explorations of Partial Derivatives**
*Andrew Grossfield, Vaughn College*

Many engineering students encounter and algebraically manipulate partial derivatives in their fluids, thermodynamics or electromagnetic wave theory courses. However, it is possible that unless these students were properly introduced to these symbols, they may lack the insight that could be obtained from a geometric or visual approach to the equations that contain these symbols. We accept the approach that just as the direction of a curve at a point in two-dimensional space is described by the slope of the straight-line tangent to the curve at that point, the orientation of a surface at a point in 3-dimensional space is determined by the orientation of the plane tangent to the surface at that point. A straight line has only one direction described by the same slope everywhere along its length; a tilted plane has the same orientation everywhere but has many slopes at each point. In fact, the slope in almost every direction leading away from a point is different. How do we conceive of these differing slopes and how can they be evaluated? This paper provides the visual connection displaying the remarkably simple and beautiful relationships between the gradient, the directional derivatives and the partial derivatives. We find that the altitude above the horizontal coordinate plane varies sinusoidally with direction. The properties of multivariable derivatives can be easily grasped in terms of the properties of the orientation or tilt of planes in a 3-dimensional Cartesian coordinate system. In addition, we are led to conclude that the derivative of a multivariable function is the gradient vector. The spotlight is turned on the curvature or deviation from the tangent plane in terms of the classic second-degree surfaces that prevails almost everywhere on well-behaved, that is, continuous and smooth (differentiable), warped surfaces. Here too the curvature is found to vary sinusoidally, only at twice the frequency and raised or lowered vertically. We see the significance of that wonderful intrinsic point property of surfaces, the Gaussian curvature and what it reveals about the differences between the curvature at the mountain passes and the curvature of the mountaintops and valleys. This visual treatment of fundamental mathematical theory should serve as an introduction to precollege students of what lies ahead in their continuing study of mathematics.

## MODERN TECHNOLOGY IN MATHEMATICS EDUCATION SESSION

***Presider:*** *Boyan Kostadinov* ***Location: Student Center Room 141***

**3:30 p.m.** **Introduction to CoCalc**
*Johann Thiel, New York City College of Technology, CUNY*

This talk will serve as an introduction to the online computing environment CoCalc. In particular, we will showcase the computer algebra system SageMath, the SageMath LaTeX package, and show how these tools can be used in a mathematical modeling course.

**3:50 p.m.** **Creating Interactive Mathematical Tutorials in RStudio with Adaptive Feedback Using R Markdown**
*Boyan Kostadinov and Ariane Masuda, New York City College of Technology, CUNY*

This new technology based on R Markdown documents in RStudio allows us to create tutorials that consist of content along with interactive components for checking and reinforcing understanding. Tutorials can include any or all of the following: narrative, figures, illustrations, LaTeX equations, code exercises, quiz questions, videos, and interactive Shiny components. The R package *CheckR* can be used to provide adaptive, constructive feedback for students to help them correct their own errors. The package also helps instructors monitor their students' work. The *CheckR* package supports a framework to specify what a correct answer is, and to give formative feedback when answers fail to meet that specification. We demonstrate this technology with a sample tutorial.

**4:10 p.m.** **Mathematical Modeling Examples using Simulation in R**
*Leslie Chandrakantha, John Jay College of Criminal Justice, CUNY*

In this paper, we explain how to use simulation to study mathematical modeling. The simulations are performed using the R programming environment. We use three examples to demonstrate the modeling activities: Chaos Game, Secretary Problem, and Infection Outbreak Modeling. For each case, the description of the model, simulation steps, and the solution are discussed. R codes for each case are also provided. This simulation approach using R is useful in the classroom to model and visualize the solutions when it is difficult to construct the real physical experiment.

**4:30 p.m.** **Rediscovering Discrete Mathematics Through Python**
*Rachel Montanez, Molloy College*

For all computer science majors, discrete mathematics is often seen as a challenging course with many abstract ideas. It typically begins with an introduction to logic followed by techniques in proofs and ends with graph theory and its applications. Python is an algorithm-oriented language with an emphasis in code readability and interactivity that encourages experimentation. We explore how Python can be used to better understand the many concepts students face in discrete mathematics.

### 4:50 p.m. Various Use of Test Generator Software

*Tanvir Prince, Hostos Community College, CUNY*

I have been using "Test-Generator" software for more than seven years in elementary mathematics course. There are various use of this software. This particular software is used to create algorithmically generated online homework (which are automatically graded by the blackboard), online and paper quizzes, class handouts, workbooks (to be used throughout the semester), create practice for CEAFE exam, automatically generate multiple versions of the same exam and assessment. A workbook (with some additional resources from "Open Education Resources") can make the course a "zero cost textbook course" where students are not required to buy books. In this presentation, I will show step by step from the installation to all of the use of the software that is previously mentioned. No previous knowledge is necessary.

### 5:10 p.m. Using Technology for Interactive STEM Applications

*Lucie Mingla, New York City College of Technology, CUNY*

In this talk I will focus on using technology and OER for an active learning and STEM applications in mathematics courses:

1. Using WeBWork as an online platform for assignments and practicing. At City Tech we use the WeBWorK for most of the math courses, and especially for Mat 1275, which is an Intermediate Algebra and Trigonometry. Most of the topics and objectives listed in the Department Outline are included in the online assignments created carefully from a group of Professor led by Prof. Andrew Parker. All of us hold the responsibility to:
    a) Create the classlist.
    b) Assign the assignments appropriately.
    c) Instruct the students on how to use the system (How to input, preview and check their answers before submitting them).
    d) The WeBWork is linked to OpenLab through "Ask for Help" link, so they can seek help from professors.
2. Creating a class site on OpenLab (City Tech online) where students can find valuable materials posted by the professor, post their questions, discussions, and projects or research papers. In the course site students can find:
    a) Important Information about the course such as department outline, course policy (syllabus), final exam review etc.
    b) Different types of files such as: Handouts, reviews for the test or quiz, supplementary handbooks, PowerPoints and other reading materials.
    c) Links to videos, and other OER (websites that supplement their research and learning).
    d) Announcements, discussions and questions for immediate connections and feedback.
3. Using Desmos.com online graphing calculator to create and monitor interactive activities. The website desmos.com online graphing calculator is being used for:
    a) Graphing to observe and discover the transformations of the graph, solutions to equations and systems, behavior of the functions, checking the sketching of a graph of a function etc.
    b) Selecting interactive activities and using discovery method to draw conclusions.
    c) Creating and monitoring my own specific activities and assigning to my students.
    d) Evaluating and giving feedback to students.
4. Using other OER, videos links etc.:
    a) Finding valuable trusted websites, written materials, PowerPoints, videos and handouts.
    b) Creating my own STEM applications (OG Fellowship) and videos for my courses.
    c) Using very trusted materials created by colleagues at City Tech.
    d) Using OER from CUNY and other Colleges and Universities created from other colleagues.
    e) Having students' posting their materials and creating pair experience resources as examples.

## STUDENT SESSION I

*Presider: Zoran Sunic* *Location: Student Center Room 142*

### 3:30 p.m. A Probabilistic Analysis of Sign Pattern Matrices

*Nicholas Bragman, Adviser: Johanna Franklin, Hofstra University*

Sign pattern matrices are matrices where the only possible entries are +,-, and 0. For an n x n square matrix, assuming no element is exactly zero, we see that there are 2^{n^2} possible sign patterns. We know that the absolute value of a determinant is preserved under row transposition, row negation, and transposition, and we use these properties to construct equivalence classes for sign pattern matrices of a given size. We say that two sign pattern matrices are equivalent if they can be obtained from one another solely though the three aforementioned operations. We focus on the probability of nonnegative determinant for each equivalence class, sign patterns that yield quick classification, and some characteristics of a few special case sign patterns.

### 3:50 p.m. Generating Perfect Powers with Certain Divisibility Properties

*Justin James Meyer, Adviser: Satyanand Singh, New York City College of Technology, CUNY*

We observe that the number 648 when divided by 2 is a perfect square and when it is divided by 3 it is a perfect cube. It is an interesting problem to study integers n/p_{i}, that are perfect p_{i} th roots for finite sets of primes. In this paper we will illustrate how to generate sequences of n's with this property over a finite set of primes.

### 4:10 p.m. Direct and Binary Direct Bases for One-set Updates of a Closure System

*Taylor Ninesling, Adviser: Kira Adaricheva, Hofstra University*

The computation of an implicational basis for a given closure system is a well-studied problem in several fields. From fields such as Formal Concept Analysis, Database Theory, AI, and Operations Research, we learn of well-known types of implicational bases such as the the canonical direct unit basis. The canonical direct basis is the shortest basis with the property of directness, a property that allows very simple and efficient computation of closures. Similarly, to direct bases, we introduce a new type of basis, the binary-direct implicational basis, and show that there is a shortest such basis, the D-basis introduced in Adaricheva, Nation, Rand [Discr. Appl. Math., 2013]. Given this definition and the similarities between it and the concept of directness, we approach the algorithmic solution to the Singleton Horn Extension problem and the one set removal problem when there is an existing direct or binary-direct basis. In this problem, a new closed set is added to or removed from the closure system forcing the rewrite of a given basis. Our goal is to obtain the same type of implicational basis for the new closure system as was given for original closure system and to make the basis update an optimal process. Since we work with direct and binary-direct bases, we choose to work with the shortest such bases, the canonical direct basis and D-basis, respectively.

### 4:30 p.m. Infinitely Many Stable Marriages

*Genevieve Maalouf, Adviser: Daniel Seabold, Hofstra University*

In 1962 the Gale-Shapley Algorithm was produced in order to solve the Stable- Marriage problem in the finite case. It is already well known that the algorithm will terminate in a finite number of steps and always produce stable marriages. Will this algorithm work in the infinite case? Is it ever impossible to develop such an algorithm? If there are infinitely many men and women, it is not too hard to see that it is not necessary that everyone be matched. With this in mind, we would like to discuss the possibilities of a semi-stable pairing. First, we find the conditions needed to always produce a semi-stable pairing. Then, we discover that it is possible that no semi-stable pairing can exist, independent of any algorithm. Lastly, we analyze the run time of the algorithm when each of the men's preference lists has order type omega + 1.

### 4:50 p.m. Using Big Data Analysis to Investigate Where It Pays to Attend College

*Mukadder Cinar, Adviser: Boyan Kostadinov, New York City College of Technology, CUNY*

We will use public data with salaries by college, region and academic major to do big data analysis using R, and investigate where in the US it pays to attend College, given the salaries after graduation, compared to the college tuition. Students know that their starting salary will be different depending on what type of school they attend, on their majors and other factors. We will look at how graduates do on average, ten years after graduating from College, depending on various factors.

### 5:10 p.m. Improving Player Value Approximation in Cooperative Transferable Utility Games

*Joseph Melkonian, Advisers: Mrs. T. Gallagher and Zoran Sunik*
*Paul D. Schreiber High School and Hofstra University*

A cooperative transferable utility game is a system in which the two entities, or players, can combine to form a coalition that is equal to or more valuable than the sum of the parts. Within these games, it is often valuable to determine the importance or contribution of the players. While there are algorithms that exist, there is no perfect way to calculate each player's contribution to the game. This research is designed to incorporate components of both the Shapley and tau values to result in a function that is both accurate and efficient. The new value considers both the first and second-tier extrema, within the breakdown of player marginal impacts on the values of coalitions. These values were weighted relative to the difference between the tier totals and the value of the coalition of all players to determine the values of each player. A simulation was designed to test the new value, relative to the others, based on values calculated from several independently generated games. The new value showed an average accuracy improvement of 62.29% when compared to the tau value. Additionally, the worst case of the new value was 56.45% more accurate than the worst case of the tau value. Moreover, the new value provided more accurate solutions in 92.14% of the approximations. As this new function still considers less components of the game, it is applicable in larger systems, while remaining plausible. Therefore, it addresses the components it intends to and accomplishes its purpose.

## STUDENT SESSION II

*Presider: Eric Rowland* *Location: Student Center Room 143*

**3:30 p.m.** **Some Properties of Reversible Cellular Automaton Rules**
*Brian Zilli, Adviser: Eric Rowland, Hofstra University*

A cellular automaton is a simple model of physics that applies a local rule at every time step. A cellular automaton rule f is reversible if there exists another cellular automaton rule g such that f(g(x)) = x for all bi-infinite words x. In a 1991 paper, D. Hillman formalized a characterization of reversible rules. We implemented this characterization in Mathematica to study the structure of the group of reversible cellular automaton rules under composition.

**3:50 p.m.** **FIND: A Tool to Filter Noisy Data Using Ensemble Model Averaging.**
*David Friedman and Nadia Rodriguez, Adviser: Ashwin Satyanarayana*
*New York City College of Technology, CUNY*

In any dataset, there is random variation that is outlying from the target phenomenon. This random variation creates 'noisy' data, which causes lower classification accuracy when generating predictive models. To address this, we present FIND (FIlter Noisy Data), a new tool that silences noisy data through an ensemble filtering technique. We combine the predictions of multiple base models, each of which is learned using a traditional algorithm, then use a majority vote technique to identify and filter noise from a given dataset. FIND is written in Python and works on a growing set of platforms and data formats.

**4:10 p.m.** **The Most Frequent Words in "Moby Dick"**
*Hashir Qureshi, Adviser: Boyan Kostadinov, New York City College of Technology, CUNY*

We will scrape the novel "Moby Dick" from the Project Gutenberg website, where the text of the novel is freely available. Our goal will be to analyze the distribution of words using the Python Natural Language ToolKit to find the most frequent words in "Moby Dick". These natural-language processing tools have many applications in modern data science.

**4:30 p.m.** **Dr. Semmelweis and the Discovery of Handwashing**
*Shmuel Kamensky, Adviser: Boyan Kostadinov, New York City College of Technology, CUNY*

In 1847 the Hungarian physician Ignaz Semmelweis discovers the health benefits of handwashing. Dr. Semmelweis saved thousands of lives by requiring hand washing at his hospital after analyzing medical data he had collected. In this project, we will analyze the same medical data and draw conclusions based on the data analysis, following the footsteps of Dr. Semmelweis.

**4:50 p.m.** **A Network Analysis of Game of Thrones**
*Harmandeep Singh, Adviser: Boyan Kostadinov, New York City College of Technology, CUNY*

In this project, we will build and analyze the network of characters in Game of Thrones, and how it changes over time. Jon Snow, Daenerys Targaryen, or Tyrion Lannister? Who is the most important character in Game of Thrones? We will look at the character co-occurrence network and its evolution in Game of Thrones. We use a dataset from the Network of Thrones blog.

**5:10 p.m.** **Solving the Birthday Problem with Monte Carlo Simulations**
*Kwokching Hui, Advisers: Holly Carley and Boyan Kostadinov*
*New York City College of Technology, CUNY*

The classic Birthday Problem investigates the least number of people required if the probability exceeds 50% that two or more of them have the same birthday. We assume 365 equally likely and independent birth dates. Clearly, if we have 366 people, then at least two will have the same birthday, for sure. We implement in R a simulation solution, which shows that even with 57 people, the probability of having at least two common birthdays is already around 99%, and having just 23 people implies that the probability exceeds 50% that two or more of them have the same birthday.

# MAA DEPARTMENTAL MEMBERSHIP

Dr. David Seppala-Holtzman

The MAA has created a new Departmental Membership with the following benefits: One faculty member (the Departmental Membership Administrator) would receive the following full membership privileges:

- Membership in the local MAA Section
- Online subscriptions to:
  - *The American Mathematical Monthly* (10 issues per year)
  - *The College Mathematics Journal* (5 issues per year)
  - *Mathematics Magazine* (5 issues per year)
  - *Math Horizons* (4 issues per year)
  - *MAA FOCUS* (6 issues per year)
- All faculty members in the department will receive $100 off every hosted WeBWorK course.
- Administrator and Student Nominees will also receive *MAA Math Alert*, the MAA's monthly e-newsletter, filled with the latest news and happenings from across the mathematical community.
- Student and Administrator Members receive discounts on MAA books (typically 20% off list price), and discounted registration for MAA MathFest and the Joint Mathematics Meetings (JMM).
- Student and Administrator Members are eligible to join any of MAA's Special Interest Groups (SIGMAAs).

The Departmental Membership Administrator may nominate ***any number*** of mathematics students (undergraduate and graduate) for MAA membership at no additional cost. The students you nominate become MAA members with these benefits:

- Online access to all MAA journals: The American Mathematical Monthly, Mathematics Magazine, and the College Mathematics Journal
- Online access to Math Horizons
- Online access to MAA FOCUS
- Online access to archives for all MAA journals.
- Access to the online Member Library, featuring a selection of MAA's outstanding books
- Discounts on meeting registration fees at both MAA MathFest and the Joint Mathematics Meetings
- Discounts on purchases of MAA books

The fee to become a Departmental Member is based upon the size of the academic institution in question as well as whether or not it is a Ph.D. granting institution. For more information and how to apply, visit www.maa.org. With this new procedure in place, it is now quite inexpensive and easy to bring large numbers of your students into the mathematical community. Once they become members, they are quite likely to see the benefits of having joined. There are, of course, the tangible benefits, listed above, that include access to journals, archived materials and discounts. But, just as importantly, they will come to feel a part of something larger, a community of like-minded people. Once they come to appreciate that, your students are apt to remain members for the rest of their lives.

# METROPOLITAN NEW YORK SECTION OF THE MAA
# TREASURER'S REPORT

| ASSETS | BALANCE | BALANCE |
|---|---|---|
| | 04/29/17 | 04/27/18 |
| Chase Business Classic | $8,640.21 | $8,682.80 |
| Chase Business Select High Yield Savings | $15,078.37 | $15,082.10 |
| Miscellaneous | $425.00 | $0.00 |
| NY Metro Section Total Assets | **$24,143.58** | **$23,764.90** |

## CHASE BUSINESS SELECT HIGH YIELD SAVINGS (0366)

| Credits | | |
|---|---|---|
| Date | Description | Amount |
| 04/29/17-04/27/18 | Interest | $3.73 |
| Total Credits | | **$3.73** |

## CHASE BUSINESS CLASSIC (0365)

| Deposits/Credits | | |
|---|---|---|
| Date | Description | Amount |
| **05/17/16** | registration-MAA Annual Meeting | $920.00 |
| **05/30/17** | registration donation (GTD 73) | $200.00 |
| **05/30/17** | registration donation (GTD 73) | $200.00 |
| **06/05/17** | registration PayPal-MAA Annual Meeting | $2093.58 |
| **11/17/17** | registration donation (GTD 74) | $110.00 |
| **12/15/17** | gift card purchase (Armen Baderian) | $425.00 |
| **01/03/18** | spring 2017 book sales (section percentage) | $14.70 |
| Total Credits | | **$3,763.28** |

| Checks Paid/Debits | | | |
|---|---|---|---|
| Check# | Date | Description | Amount |
| **901** | 06/01/17 | Mandy Mei (program design MAA Annual Meeting) | $50.00 |
| **902** | 05/15/17 | Abraham Mantell (Crown trophy award plaques) | $350.00 |
| **903** | 05/15/17 | Abraham Mantell (Unitech Print, LLC, Newsletter) | $245.00 |
| **904** | 05/15/17 | Abraham Mantell (plaques postage) | $16.30 |
| **905** | 05/30/17 | Charles Familton (returned over-payment) | $40.00 |
| **906** | 06/27/17 | Teewende Kisbedo (returned registration fee) | $20.00 |
| **907** | 06/15/17 | Carl Simon (MAA Meeting guest speaker) | $1,394.08 |
| **908** | 06/12/17 | Rosa Orellana (MAA Meeting guest speaker) | $935.82 |
| **909** | 07/03/17 | Armen Baderian (MAA Meeting badges) | $33.74 |
| **910** | 10/23/17 | Aladin Food Management Services, LLC (Delegate Assembly) | $349.75 |
| **911** | 10/26/17 | Florin Catrina (Putnum mugs) | $186.00 |
| **913** | 03/19/18 | Thomas Cheung (website repair) | $100.00 |
| Total Debits | | | **$3,720.69** |

| GRAPH THEORY DAY FUND (CONTAINED WITHIN 0365) | | | | |
|---|---|---|---|---|
| Deposits/Credits | | | | |
| Check # | **Date** | **Description** | | **Amount** |
| | 05/30/17 | Graph Theory Day 73 donation | | $200.00 |
| | 11/17/16 | Graph Theory Day 72 donation | | $110.00 |
| **Total Credits** | | | | **$310.00** |
| | | | | |
| Checks Paid/Debits | | | | |
| Check # | **Date** | **Description** | | **Amount** |
| | -- | -- | | |
| **Total Debits** | | | | **$0.00** |
| | | | | |
| | | | **BALANCE** | **BALANCE** |
| | | | **04/29/17** | **04/27/18** |
| **Graph Theory Day Fund** | | | **$1,487.41** | **$1,797.41** |

# NOTES:

# MAA METRO NEW YORK SECTION OFFICERS

| | | |
|---|---|---|
| **Section Governor**<br>**(2017 – 2020)** | **Alan Tucker**<br>Stony Brook University | (631) 632-8365<br>Alan.tucker@stonybrook.edu |
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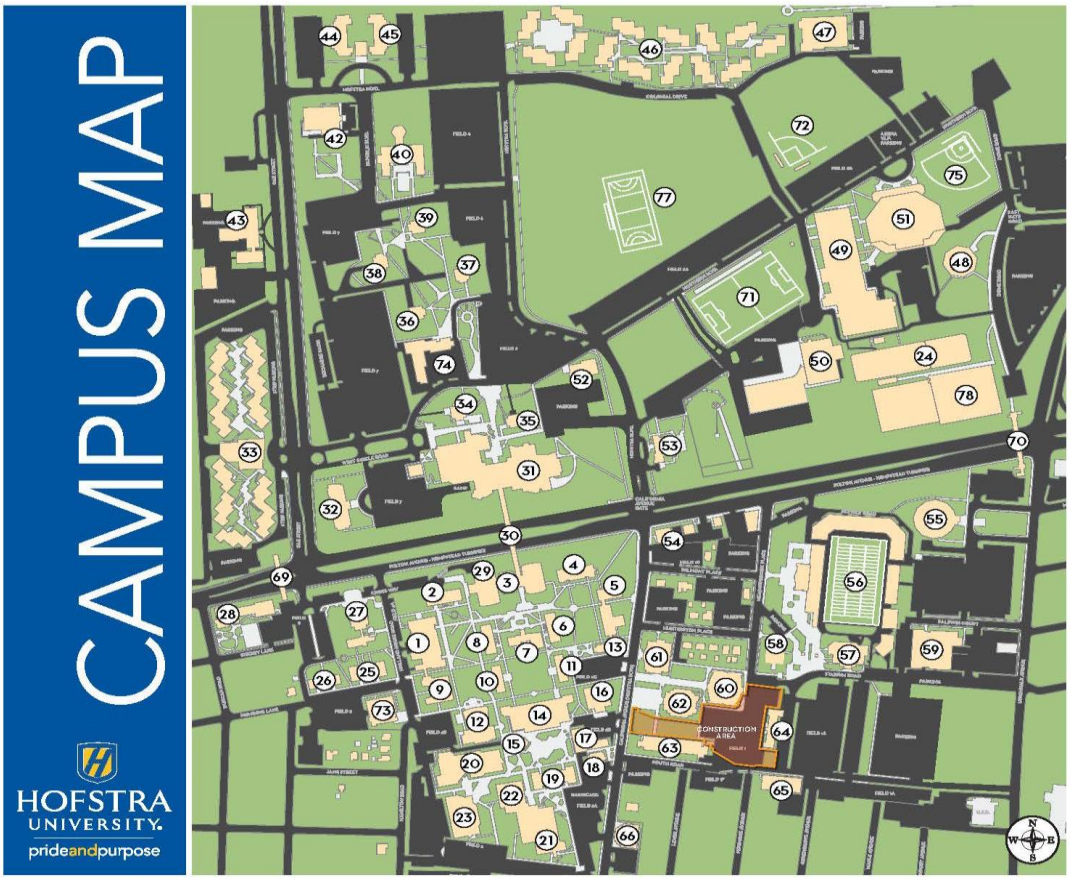
# PROGRAM COVER DESIGNER

Mandy Mei, New York City College of Technology

HOFSTRA UNIVERSITY®

# *Campus Map*




## Map Legend

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*NOTE: Registration, plenaries, panel discussion, contributed paper sessions, and lunch, will be held in the Student Center (#31); three afternoon sessions will take place in Davison (#8).*

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# *Student Center Map*

**HOFSTRA UNIVERSITY STUDENT CENTER**

E-mail:
conferenceservices@hofstra.edu