MATHEMATICAL ASSOCIATION OF AMERICA

THE MAA METROPOLITAN NEW YORK SECTION

2019 ANNUAL MEETING

NEW YORK CITY COLLEGE OF TECHNOLOGY

May 4, 2019

NEW YORK CITY COLLEGE OF TECHNOLOGY
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MATHEMATICAL ASSOCIATION OF AMERICA

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Dear MAA Metro New York Conference Participants,

A warm welcome to our Annual Meeting of the Mathematical Association of America Metropolitan New York Section (MAA Metro NY)! We are delighted to be at New York City College of Technology again, and we express our gratitude to President Russell K. Hotzler for inviting us back. For those returning colleagues and students who have attended our section meetings before, thank you for your faithful participation and support. For those who are here for the first time, we invite you to be fully engaged in our section; you may want to take the opportunity to expand your networks and to learn new research and teaching practices.

We are very happy to provide you with diverse group of exceptional speakers. Please welcome our Polya Lecturer, Dr. Kristin Lauter, Dr. Sylvester James "Jim" Gates, Jr., and Dr. Christina Sormani. For early career faculty, we have a vibrant Metro NExT Fellows program which will be sponsoring a Roundtable during lunch. Drop by to learn more about their upcoming programs. For undergraduate and high school students, we have a Mathematics Career Panel where you can discuss possible career paths with mathematics graduates. Additionally, Dr. Sylvester James "Jim" Gates, Jr. will also engage you in a conversation and inspire you to reach your full potential despite possible challenges.

This year's program features more than 50 presentations extending from pure to applied mathematics to data science and big data. Our mathematics pedagogy sessions span from presentations about broadening participation and creative interventions to assessments of best practices and pilot programs. We also have over 50 posters on pure and applied mathematics research. Thank you for your willingness to share your good work.

We are honored to have you at this year's meeting. Please enjoy your day.

With warm regards,

The Local Organizing Committee

WELCOME

THE METROPOLITAN NEW YORK SECTION

CO-SPONSORS

New York City College of Technology Mathematics Department
CUNY Black Male Initiative
City Tech Black Male Initiative
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CONTRIBUTED PAPER AND POSTER SESSIONS ORGANIZING COMMITTEE

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

LOCAL CONFERENCE ORGANIZING COMMITTEE

Janet Liou-Mark (Chair), Mariya Bessonov, Marianna Bonanome, Corina Calinescu, Holly Carley, Sandie Han, Nadia Kennedy, Nan Li, Ariane Masuda, Kate Poirier, Arnavaz Taraporevala, Laura Yuen-Lau, Sydney Umana, and Lin Zhou
City Tech Black Male Initiative Program:
Justine Ginchereau, Edgar Gomez, Evelin Perez, Andre Rodriguez, Shawn Telesford, and Makini Valentine

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THE MAA ANNUAL MEETING OF THE METROPOLITAN NEW YORK SECTION

MAY 4, 2019

NEW YORK CITY COLLEGE OF TECHNOLOGY
CITY TECH
WHERE CAN TECHNOLOGY TAKE YOU?

AGENDA

8:30-12:00 PM	Registration	*New Academic Complex Lobby*
8:30-10:00 AM	Refreshments	*New Academic Complex Lobby*
8:30-3:00 PM	Book Exhibits Drs. Nadia Benalki, Arnavaz Taraporevala, Lin Zhou, & Thomas Cheung	*New Academic Complex Lobby*
9:00-9:20 AM	Welcome Dr. Russell Hotzler *President, New York City College of Technology* Dr. Sandie Han *Chair of the Department of Mathematics, New York City College of Technology* Dr. Janet Liou-Mark *Chair of the Metropolitan New York Section of the MAA, New York City College of Technology, CUNY*	*New Academic Complex Auditorium, AB 108*
9:20-10:15 AM	Polya Lecturer How to Keep Your Secrets in a Post-Quantum World Dr. Kristin Lauter, *Microsoft, University of Chicago*	*New Academic Complex Auditorium, AB 108*
10:20-11:15 AM	Invited Speaker A Mathematical Journey Thru SUSY, Error-Correcting Codes, Evolution, and a Sustainable Reality Dr. Sylvester James "Jim" Gates, Jr., *Ford Foundation Professor of Physics and an Affiliate Mathematics Professor, Brown University*	*New Academic Complex Auditorium, AB 108*
11:15-11:30 AM	Break	*New Academic Complex Lobby*
11:30-12:30 PM	Contributed Paper Sessions I	*New Academic Building*

Research Session: Applied Mathematics	*A409*
Research Session: Pure Mathematics	*A103*
Research Session: Data Science/Big Data and Graph Theory	*A106*
Pedagogy Morning Session I: Math Education	*A104*
Pedagogy Morning Session II: Math Education	*A705*
Student/Faculty Session I	*A105*
Student Session I	*A703*

12:30-1:30 PM	Lunch	*Namm 1st Floor Cafeteria*
	Metro NExT Roundtable Dr. Benjamin Gaines, *Iona College* Dr. Mutiara Sondjaja, *New York University* Dr. Johann Thiel, *New York City College of Technology (CUNY)*	*Namm 1st Floor Cafeteria*
12:30-1:30 PM	Contributed Poster Session	*Namm 1st Floor Cafeteria*
1:45-2:30 PM	Mathematics Career Panel How My Mathematics Degree Helped Me Find My First Job Moderator: Dr. Ira Gerhardt, *Manhattan College*	*New Academic Building A409*
1:40-2:00 PM	Sponsor Presentation Review of MyLab Educator Efficacy Study and Feature Presentation Marcus Scherer, *Pearson, Digital Sales Specialist*	*New Academic Building A105*
2:00-2:45 PM	Business Meeting and Awards Ceremony	*New Academic Building A105*
2:30-3:00 PM	A Conversation with Dr. Gates Dr. Sylvester James "Jim" Gates, Jr., *Ford Foundation Professor of Physics and an Affiliate Mathematics Professor, Brown University* Moderator: Dr. Maianna Bonanome, *New York City College of Technology, CUNY*	*New Academic Building A409*
3:00-3:15 PM	Break	*New Academic Complex Lobby*
3:15-4:30 PM	Contributed Paper Sessions II	*New Academic Building*
	Pedagogy Afternoon Session I: Math Education	*A104*
	Pedagogy Afternoon Session II: Math Education	*A103*
	Pedagogy Afternoon Session III: Math Education	*A105*
	Student/Faculty Session II	*A106*
	Student Session II	*A703*
	Miscellaneous Session	*A705*
4:30-5:20 PM	Invited Speaker When do sequences of metric spaces converge? Dr. Christina Sormani, *Lehman College and CUNY Graduate Center*	*New Academic Building A105*
5:25-5:45 PM	Closing Ceremony	*New Academic Building A105*

INVITED SPEAKERS

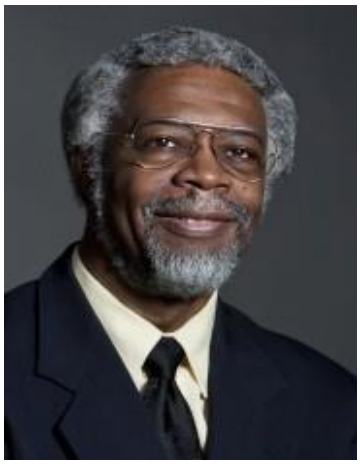
HOW TO KEEP YOUR SECRETS IN A POST-QUANTUM WORLD

Dr. Kristin Lauter (A Polya Lecturer)
Microsoft, University of Chicago

Abstract: As we move towards a world which includes quantum computers which exist at scale, we are forced to consider the question of what hard problems in mathematics our next generation of cryptographic systems will be based on. Supersingular Isogeny Graphs were proposed for use in cryptography in 2006 by Charles, Goren, and Lauter. Supersingular Isogeny Graphs are examples of Ramanujan graphs, which are optimal expander graphs. These graphs have the property that relatively short walks on the graph approximate the uniform distribution, and for this reason, walks on expander graphs are often used as a good source of randomness in computer science. But the reason these graphs are important for cryptography is that finding paths in these graphs, i.e. routing, is hard: there are no known subexponential algorithms to solve this problem, either classically or on a quantum computer. For this reason, cryptosystems based on the hardness of problems on Supersingular Isogeny Graphs are currently under consideration for standardization in the NIST Post-Quantum Cryptography (PQC) Competition. This talk will introduce these graphs, the cryptographic applications, and the various algorithmic approaches which have been tried to attack these systems.

Biography: *Kristin Lauter is a Principal Researcher and Research Manager for the Cryptography group at Microsoft Research. Her research focuses on post-quantum cryptography, algorithmic number theory, elliptic curve, pairing-based, and lattice-based cryptography, homomorphic encryption, and cloud security and privacy, including privacy for healthcare. Her work has been featured in the press in articles in Science, Nature, American Scientist, and PNAS. She has published over 75 research articles and 5 books, her work appearing in venues ranging from the American Journal of Mathematics to the Journal of Biomedical Informatics and the Proceedings of CRYPTO and EUROCRYPT. Lauter has served the mathematical community as President of the Association for Women in Mathematics, and on the Council of the American Mathematical Society. She is a Fellow of the American Mathematical Society and the Association for Women in Mathematics. She was a co-founder of the Women in Numbers Network, a research collaboration community for women in number theory, and she serves on the Scientific Advisory Board for BIRS, the Banff International Research Station. Lauter is also an Affiliate Professor in the Department of Mathematics at the University of Washington. In 2008, Lauter, together with her coauthors, was awarded the Selfridge Prize in Computational Number Theory. She loves to engage audience with accessible lectures highlighting the importance of mathematics in society.*

A MATHEMATICAL JOURNEY THRU SUSY, ERROR-CORRECTING CODES, EVOLUTION, AND A SUSTAINABLE REALITY



Dr. Sylvester James "Jim" Gates, Jr.
Brown University

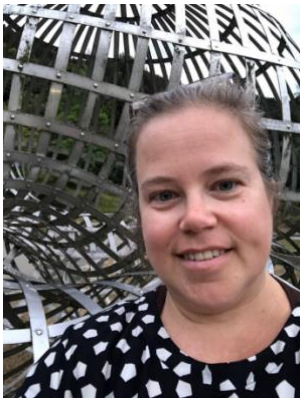
Abstract: This presentation will describe an arc in mathematical/theoretical physics traversing concepts from equations, graphs, error-correction, and pointing toward evidence of an evolution-like process for mathematical laws that sustain reality.

Biography: *Sylvester Jim Gates is an American theoretical physicist. He received two B.S. degrees and a Ph.D. degree from the Massachusetts Institute of Technology, the latter in 1977. His doctoral thesis was the first one at MIT to deal with supersymmetry. In 2017, Gates retired from the University of Maryland and is currently the Ford Foundation Professor of Physics, and an Affiliate Mathematics Professor at Brown University. While at the University of Maryland, Gates was a University System Regents Professor, the John S. Toll Professor of Physics at the University of Maryland, College Park, the Director of the String and Particle Theory Center, Affiliate Professor of Mathematics. Gates served on the U.S. President's Council of Advisors on Science and Technology and contemporaneously on Maryland State Board of Education from 2009-2016, and the National Commission on Forensic Science from 2013-1016. He is known for his work on supersymmetry, supergravity, and superstring theory. He is a past president of the National Society of Black Physicists, and is an NSBP Fellow, as well as a Fellow of the American Physical Society, the American Association for the Advancement of Science, and the Institute of Physics in the U.K. He also is an elected member of the American Academy of Arts and Sciences and the American Philosophical Society. In 2013, he was elected to the National Academy of Sciences, becoming the first African-American theoretical physicist so recognized in its 150-year history. On November 16, 2013, Prof. Gates was awarded the Mendel Medal by Villanova University "in recognition of his influential work in supersymmetry, supergravity and string theory, as well as his advocacy for science and science education in the United States and abroad." President Obama awarded Prof. Gates the 2011 National Medal of Science, the highest award given to scientists in the U.S., at a White House ceremony in 2013. During 2014, he was named the Harvard Foundation's ''Scientist of the Year.'' In 2015, he became a member of the Board of Directors of the Achieve, Inc and the Board of Councillors for the Boy Scout of America's STEM National Council. He currently continues his research in supersymmetry in systems of particles, fields, and strings.*

WHEN DO SEQUENCES OF METRIC SPACES CONVERGE?

Dr. Christina Sormani

Lehman College and CUNY Graduate Center



Abstract: When one has a sequence of circles of smaller and smaller radii they could be said to converge to a point or to disappear. If one has a sequence of spheres with a single increasingly thin well, they could be said to converge to a sphere with a line segment attached, or one could say the wells disappear and only the sphere remains. What if a sequence of spheres has increasingly many increasingly thin wells? Here we will present two different notions of convergence: one defined by Gromov and one by Sormani-Wenger. I will also mention work by my most recent doctoral students, Perales and Lakzian, and by my old undergraduate LSAMP team at Lehman College.

Biography: *Christina Sormani grew up in New York City attending PS 166, IS 44, and Hunter College High School. Awarded a scholarship, she commuted to NYU for college and stayed there with an NSF fellowship for the doctorate. After completing postdoctoral positions at Harvard and Johns Hopkins University, she came back home to work at CUNY. She presents her research on geometric analysis around the world and is an American Mathematical Society Fellow. Today she will present undergraduate research completed with Lehman College students: Shanell George, Ulysses Hernandez, Fifonsi Lantonkpode, Vanessa Ortiz, Amanda Rodriguez, and Benjamin Arthur.*

METRO NEXT (NEW EXPERIENCES IN TEACHING) ROUNDTABLE

12:30 PM – 1:30 PM

Namm Building 1st Floor Cafeteria

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

Please join us at the Metro NExT Roundtable to learn more about our programs. We invite early-career faculty members and advanced graduate students in mathematics and related fields to learn more about our **Metro NExT Fellow Program**. Seasoned faculty members are invited to be involved as mentors for current Metro NExT fellows. All are invited to learn more about our annual **Metro NExT Workshop** (Friday, September 13, 2019 at Courant Institute, NYU): a mathematics pedagogy and professional development workshop that is open to anyone interested in learning about new teaching techniques and in making connections with other math educators. One of the sessions will be participant-provided Lightning Talks, where we welcome contributions from interested mathematicians at all stages in their careers.

Please visit our website (metronext.github.io) to apply to be part of our 2019-2020 fellow program and for further information.

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

Congratulations to Sam Ferguson!

MacCracken Fellow
New York University
for winning the Inaugural Metro NExT grant award

Sam Ferguson was born in South Carolina, and he dropped out of high school to attend Bard's College at Simon's Rock. There, he fell in love with mathematics and stories, writing plays to share his favorites. After two master's degrees from Iowa, he came to New York University. Now, he teaches mathematics through history, plays, and games.

SAVE THE DATE

Metro NExT Workshop

Friday, September 13, 2019

Courant Institute, New York University

MATHEMATICS CAREER PANEL

HOW MY MATHEMATICS DEGREE HELPED ME FIND MY FIRST JOB

MODERATOR: Dr. Ira Gerhardt

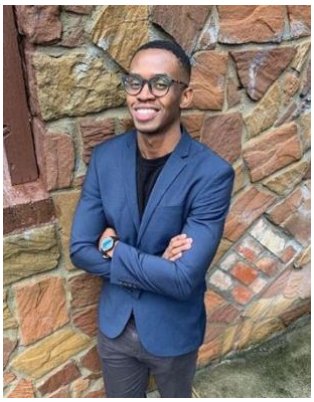
Associate Professor of Mathematics, Manhattan College

Bio: Dr. Gerhardt is completing his tenth year in the Mathematics Department at Manhattan College. He is an instructor in Manhattan's newly established Master's program in Applied Mathematics-Data Analytics, having developed courses in Probabilistic Methods and Mathematical Modeling (a.k.a., Math in the Real World). Before coming to academia, Dr. Gerhardt was a quantitative analyst on the global portfolio trading desk at Merrill Lynch and Co.

PANELISTS:

Joel Chapman

CAD/ BIM Designer & Technician
NYC Department of Environmental Protection



Joel Chapman works as a CAD/ BIM Designer & Technician for the In-House Design Civil Engineering team at New York City's Department of Environmental Protection. He had received his Bachelor's Degree in Applied Mathematics - Information Science and the James H. Come Award for Academic Excellence at New York City College of Technology in June 2018. Joel was also a Mathematics Peer Leader for the Peer-Led Team Learning program, Co-Vice President of the Black Male Initiative program, and a volunteer for most events and activities related to the African-American Department. If you would like to reach him regarding opportunities relating to mathematics or engineering, you can reach him via LinkedIn.

Taylor Salkowsky

BlackRock

Bio: Taylor Salkowsky received a B.S. degree in Mathematics, *magna cum laude,* and M.S. degree in Applied Mathematics & Data Analytics from Manhattan College. During her undergraduate career, Taylor was a member of the Women's Soccer Team and served as captain each of her final two years. Currently, Taylor is an Analyst on BlackRock's Internal Audit team and assists in the execution of global and regional audit reviews throughout the firm.

Sam Karasik

Director, Data Science
Schireson Associates

Bio: Sam is a Director of Data Science at Schireson Associates, a strategy consulting firm headquartered in New York, NY. His work centers around building high-impact predictive models, data pipelines, and decision-making software for clients in the media and technology space. Sam holds a MS in Operations Research from Columbia University and a MA in Economics from the University of Edinburgh. While at Columbia, he worked with the accounting department at the Business School to develop a machine learning algorithm that detects anomalies in SEC filings. Other relevant academic work includes graph theory, stochastic modeling, and analysis of algorithms. He has also worked in financial journalism and at a commodities trading firm.

CONTRIBUTED PAPER SESSIONS I

11:30 AM – 12:30 PM

RESEARCH SESSION: APPLIED MATHEMATICS

Presiders: Ezra Halleck & Andre Rodriguez *Location: New Academic Building A409*

11:30 a.m. **Generalized Zagreb Indices of Graphs**
Sanju Vaidya, Mercy College

In the last forty years, many scientists have developed mathematical models for analyzing structures and properties of various chemical compounds. Graph Theory plays a very important role in developing many types of models such as Quantitative Structure-Property Relationships (QSPR) models, Quantitative Structure-Activity Relationships (QSAR) models, and Quantitative Structure-Toxicity Relationships (QSTR) models. In molecular graphs of chemical compounds vertices correspond to atoms and edges correspond to the bonds between them. A topological index (connectivity index) is a type of a molecular descriptor that is based on the molecular graph of a chemical compound. In 1947 Harry Wiener introduced a topological index related to molecular branching. Now there are more than 100 topological indices for graphs. The main research question is how to compute formulas and bounds of various topological indices. In this presentation, I will establish formulas and bounds for generalized Zagreb indices which are based on the degrees and eccentricities of vertices. Additionally, I will discuss relations between the First Zagreb index and extended Wiener indices of graphs.

11:45 a.m. **Optimal Consumption, Investment and Life-insurance Purchase Under a Stochastic Fluctuating Economy**
Susana Pinheiro, Queensborough Community College, CUNY
Authors: A. S. Mousa, D. Pinheiro, S. Pinheiro, & A. A. Pinto, Queensborough Community College, CUNY

We study the optimal consumption, investment and life-insurance purchase and selection strategies for a wage-earner with an uncertain lifetime with access to a financial market comprised of one risk-free security and one risky-asset whose prices evolve according to linear diffusions modulated by a continuous-time stochastic process determined by an additional diffusive nonlinear stochastic differential equation. The process modulating the linear diffusions may be regarded as an indicator describing the state of the economy in a given instant of time. Additionally, we allow the Brownian motions driving each of these equations to be correlated. The life-insurance market under consideration herein consists of a fixed number of providers offering pairwise distinct contracts. We use dynamic programming techniques to characterize the solutions to the problem described above for a general family of utility functions, studying the case of discounted constant relative risk aversion utilities with more detail.

12:00 p.m. **Mathematical Modeling of Heating and Cooling of Solar Panels**
Malgorzata Marciniak, LaGuardia Community College, CUNY
Authors: Malgorzata Marciniak, Andrea Martinez, Delfino Enriquez-Torres, Abel Asfaw, Arame Sow & Enmanuel Valdez, LaGuardia Community College, CUNY

The efficiency of solar panels is strongly influenced by their temperature. Continuing our previous research that analyzed the efficiency of solar panels based on the geometrical movement of the sun, we prepared a sequence of improvements of the model. The most significant aspect contains modeling the temperature of the panels. This presentation will contain a preliminary report on the results of the joint faculty and students project that analyzes the temperature of solar panels. Data collected by students using the thermal camera, temperature sensor and the LabQuest, is analyzed and fit into statistical and mathematical models based on Newton's Law of heating and cooling. This is the first step to make an attempt to simulate the panel's temperature based on the solar irradiance data.

12:15 p.m. **The Role of Vorticity in Rotational Oscillating Flow Applications**
Moise Koffi, Hostos Community College, CUNY

Nature provides several illustrations of rotational oscillating plate-like objects. This study analyzes the fluid-structure interactions in the close proximity of a rotating rectangular flat plate in oscillatory motion from 0 to 90 degree, over several flapping cycles. Computational Fluid Dynamics (CFD) simulations with Fluent 6.3 and flow visualization techniques with smoke particles enable to investigate the resulting flow and thermal characteristics. It was observed the formation of a strong tip vortical structure in the wake induced by the motion of the rotating plate. The shedding of these vortices at end-strokes are responsible for the related enhanced flow and thermal characteristics used in numerous industrial and biological applications.

RESEARCH SESSION: PURE MATHEMATICS

Presiders: Satyanand Singh & Edgar Gomez *Location: New Academic Building A103*

11:30 a.m. **Skewed Integrals**
Satyanand Singh, NYC College of Technology, CUNY

In this presentation, will illustrate how a seemingly inapplicable substitution method can be used to evaluate a family of skewed integrals that are usually evaluated via partial fractions. We will use a variant of the first technique to show how we can reduce and solve a computationally involved integral in an elementary way.

11:45 a.m. **Abundant Fibonacci and Lucas Numbers**
Jay Schiffman, Rowan University

An abundant number is any positive integer such that the sum of all its aliquot (proper) divisors including one exceeds the number. In exploring the Fibonacci sequence, one notes that the first abundant Fibonacci number is the twelfth; namely 144. Alas, 144 is even. This raises the question as to the existence of any odd abundant Fibonacci numbers. We show that indeed such Fibonacci numbers exist with the fortieth (102334155) being the initial one. We produce a scheme that generates infinitely many odd abundant Fibonacci numbers. In contrast, while abundant Lucas numbers exist (the first two terms of the Lucas sequence are 1 and 3 respectively and each term thereafter follows the Fibonacci recursion relation), I have yet to secure any odd abundant Lucas numbers among the initial four hundred. The initial abundant Lucas number is 18, the sixth term in the sequence. Using the abundancy of a number which is defined as the ratio of the sum of all the divisors of the number to the number itself, I illustrate why it appears that no odd abundant Lucas numbers exist.

12:00 p.m. **Lipschitz-Volume Rigidity of Singular Spaces**
Nan Li, NYC College of Technology, CUNY

We will discuss whether a distance non-increasing and volume preserving onto map is always length preserving. It is true for smooth manifolds, but not always true for singular spaces. It turns out that this is related to a control of the curvature (bending) of the space.

12:15 p.m. **The Hodge Chern Character as a Map of Simplicial Presheaves**
Micah Miller
Authors: Cheyne Miller, Micah Miller, Thomas Tradler, Mahmoud Zeinalian
Borough of Manhattan Community College, CUNY & NYC College of Technology, CUNY

Toledo and Tong construct an analog of a projective resolution for a coherent sheaf on a complex manifold called the twisted complex, a Cech-type complex whose cohomology can be used to compute global Ext functors. They then use it to extend the Chern character to coherent sheaves, which is a map from the twisted complex to the Cech-Hodge complex. We describe their work using concepts from category theory, and in so doing, obtain a simplicial map whose value on vertices is their Chern character map. The values on the edges describe Chern-Simons invariants.

RESEARCH SESSION: DATA SCIENCE/BIG DATA & GRAPH THEORY

Presiders: Mariya Bessonov & Farjana Shati *Location: New Academic Building A106*

11:30 a.m. **A Single-Neuron Data Classification Algorithm**
Lawrence C. Udeigwe, Manhattan College

An unsupervised learning algorithm that makes use a single neuron to perform classification tasks on a given data set is presented. The algorithm makes use of the so-called BCM theory of synaptic plasticity first proposed by and named after Elie Bienenstock, Leon Cooper, and Paul Munro to measure the selectivity of neurons in primary visual cortex and its dependency on neuronal inputs. We discuss the algorithm, its computational complexity, and how it performs in comparison to benchmark algorithms that perform similar tasks; while paying attention to the qualitative behavior of an underlying differential equation.

11:45 a.m. **Diffusion Maps on Large Datasets**
Brian Zilli
Authors: Moses Apreku, Richard VanBenthuysen, & Brian Zilli
Advisor: Florin Catrina, St. John's University

We implement the diffusion maps framework in the R statistical software and demonstrate its usage on selected datasets.

12:00 p.m. **A New Elementary Statistics Course for the Age of Big Data**
Joshua Paul Hiller, Adelphi University

Like many colleges, Adelphi University has several elementary statistics courses. These include a survey of statistics course and statistics for the natural sciences (an SPSS based introduction). Recently, the Department of Mathematics and Computer Science introduced a new course: Statistics and Data Analytics. The primary audience of this course is computer science majors. The question we asked in creating this course was: in the age of Big Data, how do we create a relevant introduction to statistics for our CS students? What topics can be covered in minimal detail (or even discarded) from the traditional elementary stats course? Which nontraditional topics should be introduced? We will report what we have found after struggling to find the right balance in this course. Opinions and strategies from the audience would be most welcome.

12:15 p.m. **Interlace Polynomials of Friendship Graphs**
Aihua Li, Montclair State University
Authors: Aihua Li & Christina Eubanks-Turner, Montclair State University

In this presentation, properties of the interlace polynomials of friendship graphs and related butterfly graphs are provided. Friendship graphs are graphs that satisfy the Friendship Theorem given by Erdos, Renyi and Sos. An application of such polynomials in analyzing the adjacency matrices of the ground graphs is given.

PEDAGOGY MORNING SESSION I: MATHEMATICS EDUCATION

Presiders: Ariane Masuda & Julia Rivera *Location: New Academic Building A104*

11:30 a.m. **Opening Gateways Through WeBWorK: Expanding the Power of Online Homework to Build Engagement and Support Student Learning**
Andrew Parker, Marianna Bonanome, Ariane Masuda, Laura Ghezzi, & Jonas Reitz
NYC College of Technology, CUNY

WeBWorK provides a powerful platform for online homework, freely available and open source. At City Tech, more than a decade of experience with WeBWorK has provided many opportunities to experiment with existing features, explore new functionality, and develop new tools that extend the reach and scope of the WeBWorK system. In addition to developing high-quality problems and problem sets aligned with the curriculum, our work makes frequent use of customized feedback and error-recognition, providing guidance without giving away too much about the expected result. Cutting edge features such as scaffolded problems provide ongoing support to students as they progress through multi-step solutions, and Just-In-Time problem sets adapt to student behavior, providing practice at the point of greatest need. Integration of GeoGebra, another open source mathematics platform, into WeBWorK problems provides a rich visual dimension to mathematical problem-solving. Finally, the development of our WeBWorK leaderboards project brings the motivating principles of game-based learning to the WeBWorK platform, with exciting preliminary results. Join us in this session as we share a multitude of examples as well as lessons learned and best practices for WeBWorK development.

11:45 a.m. **Mathematicians' Perceptions of Their Teaching**
Christian Woods, Rutgers University
Authors: Christian Woods & Keith Weber, Rutgers University

Recent research in mathematics education has uncovered a host of teaching behaviors that are commonly enacted by instructors of proof-based mathematics courses. While these descriptive accounts of math teaching are useful, little investigation has been conducted into the reasons for why these practices are so prevalent. In this study, we interviewed eight mathematicians about regularities that have been observed in the literature on the teaching of advanced mathematics. In this report we discuss whether mathematicians view these findings as accurate (they often did), whether they thought these regularities were productive or problematic teaching practices, and why mathematicians engaged in these teaching practices. In this talk, we will discuss the themes that arose from mathematicians' responses concerning two sets of findings: the use of "chalk talk" and the difference in the presentation of formal versus informal mathematical content. We discuss how these themes may elucidate the practices of instructors. In particular, we use Schoenfeld's (2010) Resources, Orientations, and Goals framework for explaining how their views explain the widespread use of these practices, despite some statements that might suggest the practices do not align with the mathematicians' beliefs and goals. We also propose implications of the methods of the present study for changing how proof-based math courses are taught.

12:00 p.m. **The Consequences of Developmental Mathematics Placement on Community College Completion Outcomes**
Heidi L Kiley, Suffolk County Community College, SUNY

There is some debate as to whether remediation is an effective means for preparing students for success in college. The significance of this mini study was to establish an argument that multiple pathways through remedial mathematics should be created, thereby enabling community college students to realize completion goals in an equitable manner compared to their N-RMP peers. Equitable mathematics pathways can be a fundamental part of attracting, encouraging, and otherwise facilitating RMP students to enroll and complete in an academic community. This researcher was compelled to investigate further the apparent penalties imposed upon community college student completion outcomes as a consequence of remedial-level mathematics placement. The purpose of this quantitative study was to examine remedial level mathematics placement on first college level mathematics course performance and degree completion for students from a large tri-campus suburban community college in the Northeast.

12:15 p.m. **Various Use of QR Codes in Teaching**
Tanvir Prince, Hostos Community College, CUNY

In this age of technology, we need to take advantage of all the available tools to attract our new generation of tech-savvy students. QR code is another way to encode information and present it in a new way to your students. You can encode text, website, videos and many other types of information in QR code. I have been using this QR code in various workbooks that I have created for some of my mathematics classes. But this can be used in any disciplines. In this short presentation, I will talk about what is QR code and how can you create your own QR code just by a few clicks in your computer. I will also describe various use of the QR codes in my teaching. No previous knowledge is required and everything will be presented from the scratch.

PEDAGOGY MORNING SESSION II: MATHEMATICS EDUCATION

Presiders: Holly Carley & Shawn Telesford *Location: New Academic Building A705*

11:30 a.m. **Infuse Quantitative Reasoning in Differential Equations**
Tanvir Prince, Hostos Community College, CUNY

I have implemented the QR goals in my differential equation class. The main QR goal that I wanted to achieve is for the students to be able to read graphs, tables, and charts and to be able to extract the relevant information to create a model of the problem. Students later will be able to analyze the model to answer more questions. The table that I have used is the population of harbor seals in the Wadden Sea over the years 1997 to 2012. Students use the given data to answer some relevant questions. For example, is the data set follow a pattern for logistic growth model? If yes find the logistic model for the given data set. Students will also be able to calculate error between the given model and the actual data (error analysis). Students were tested (assessed) at the end on three questions to see how well they acquired the knowledge.

11:45 a.m. **Teaching Mathematics at the Brooklyn Institute for Social Research**
Suman Ganguli, NYC College of Technology, CUNY & Brooklyn Institute for Social Research

The Brooklyn Institute for Social Research (BISR) is a recently established teaching and research institute that offers evening courses (as well as other academic/scholarly activities and events) to the general public in a wide variety of disciplines--primarily the humanities and social sciences. We will describe our experience developing and offering a variety of BISR courses on topics in mathematics and computer science over the past 6 years. Course topics have included Godel's incompleteness theorems; set theory and infinity; Turing computability; artificial intelligence; calculus; statistics; chaos and dynamical systems; and game theory. Each of these courses was interdisciplinary in nature, approaching the topic not only via the mathematics, but also via the subject's history, its conceptual development, its applications, and its philosophical implications. We will describe the techniques, challenges and rewards of developing such interdisciplinary seminar-style courses for a general audience, which typically varies widely in age and educational background/preparation. We also discuss the contrasts between teaching mathematics in an "alternative academic" (alt-ac) setting such as BISR with that of teaching in "traditional academic" setting such as CUNY.

12:00 p.m. **Integrating the University Library and the Mathematics Classroom**
Johanna Franklin, Hofstra University

For their final project, the students in my "Mathematics of Elections" First-Year Seminar developed a guide to one of the Hofstra Library's Special Collections that contains materials from a voting rights court case. I will describe my preliminary collaboration with the University Archivist and then the way the students designed and developed this collection guide using their newly acquired expertise.

12:15 p.m. **Calculated by Politics - North Korea: Extreme Example of Politically Driven Mathematics Education**

JungHang Lee, Hostos Community College, CUNY

This presentation addresses mathematics education in one of the most closed countries in the world — North Korea, as an extreme example of political influences on mathematics education. North Korean secondary school mathematics education is examined through the review of North Korea's social and educational structures as well as its political and ideological position. In-depth interviews were conducted with defectors, who are now in South Korea, former secondary school mathematics teachers and students, to understand their real life experiences in school mathematics in North Korea. Workers' Party's influence on mathematics education and the impact the March of Suffering are examined. There are two main focuses of this presentation. One is to introduce an extreme case study of mathematics education in North Korea influenced by political and ideological standpoint. This will broaden the participants' understanding of mathematics education as not only a self-regulating subject, but also as an interwoven matter shaping and shaped by the vessel and the people in it. This will also propose a chance to reassess the participant's own mathematics education experience with possibly enhanced span.

STUDENT/FACULTY SESSION I

Presiders: Lin Zhou & Makini Valentine *Location: New Academic Building A105*

11:30 a.m. **An Exploration of the Shape and Properties of Parabolas with an Expanded Focus**

Lance Lampert

Advisor: Robert Gerver, Institute for Creative Problem Solving

This paper explores the behavior of the locus of points equidistant to a circle. Derived from parabolas whose focus is a single point, these "circle-focused parabolas" were shown to demonstrate similar behavior to point-focused parabolas in some cases, and unique behavior in others. In particular, a general locus for an arbitrary circle-directrix pair was determined through the definition of a circle-focused parabola. All such possible combinations of circle and directrix were considered, and conditions on these general loci were then established. Non-intersecting circle-directrix pairs were deemed to behave different that intersecting pairs. Specifically, a non-intersecting pair produced a single curve, while an intersecting pair produced two intersecting curves. Properties of these circle-focused parabolas were then investigated, such as conditions for equivalence and similarity between any two given circle-focused parabolas. While all pairs of point-focus and directrix produce unique curves, this was proven not to be the case for circle-focus and directrix pairs. The fact that all circle-focused parabolas are similar was first derived, and then used to determine that all pairs of non-intersecting circle-directrix pairs produce similar curves. However, intersecting pairs were concluded to be similar in only certain cases due to their properties of producing two distinct curves. Suggestions for further research include exploration of other conic sections, such as ellipses, with expanded foci, expanding the focus into other figures, such as polygons, or making adjustments to the directrix of a parabola.

11:45 a.m. **Testing the Pipeline Hypothesis of Female Under Representation in Scientific Computing**

Lynoska Garcia & Jennefer Maldonado, Adelphi University

Advisor: Monica Morales Hernandez, Adelphi University

Despite recent progress, women are still heavily underrepresented among professional mathematicians. One explanation for this is a lack of the "pipeline of female mathematicians", our work looks to explore this hypothesis in multiple ways: the first is by examining the number of female authors and editors of scientific computing journals over the last two decades and the other is by interviewing female mathematicians about their experiences and journeys. In this talk, we will explore the structure of our study and discuss our methodology. Feedback from the audience would be greatly appreciated.

12:00 p.m. **Examining the Impact of Embedding an Upper Class Student in a First Year Calculus Class**

Philip Mann & Behailu Mammo, Hofstra University

Advisor: Behailu Mammo, Hofstra University

In Spring 2019, as part of a project funded by a Hofstra University Research and Development grant, I am embedded in a Calc I class. I am a junior mathematics major. My responsibility includes encouraging students to seek out help, helping them how to learn mathematics, holding help hours in the library, and providing formative feedbacks to the instructor. Even though I also came in to safeguard the students from the expert's blind spot, I quickly realized that my exposure to advanced classes inhibited me to completely relate to the students, especially to those who are struggling. To help me carry out my responsibility effectively, I write daily reflections on classroom observations and discuss it with the instructor. In this brief report, both the instructor and I will share what we learn from this experience. We will also discuss the research questions that we will plan to explore.

12:15 p.m. **Calculator Use in Foundational Adolescent Math**
Victoria Gianatiempo, Michael Scheuerer, & Kristiana Salerno, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

At the secondary level, calculators are not only expected but essential. They provide students with more opportunities to explore and experiment in mathematics as opposed to pen and paper. The TI-84 has been a common tool found in classrooms around Long Island since the 2000's, however the TI-Nspire is gaining popularity in some districts. The TI-84 is capable of calculating real and complex numbers, graphing several functions, as well as performing several matrix operations. This is also the calculator that educators are most proficient and comfortable teaching with. The TI-Nspire surpasses the TI-84 in its mathematical capabilities. The TI-Nspire can do everything the TI-84 can do, and more; it can factor and expand variable expressions, find antiderivatives, compute limits, find exact solutions in irrational forms, etc. It is evident the TI-Nspire is the more powerful calculator between the two. However, is it possible that it is too advanced for an age group of younger students, such as an 8th grade Algebra 1 class? This study examines three eighth grade Algebra 1 classes in the Long Island/Queens area through interviews, observations, and surveys. The authors offer a firsthand experience and insight to student interaction and success with the TI-Nspire.

STUDENT SESSION I

Presiders: Kate Poirier & Justine Ginchereau *Location: New Academic Building A703*

11:30 a.m. **Googling Information Retrieval and SVD**
Kayla Gill, Molloy College
Advisor: Manyiu Tse, Molloy College

Information retrieval (IR) is the process of retrieving relevant information from large amounts of information stored in databases. The process involves the collection and processing of information called documents, creating the query, and searching and recovering the information based on the query. With the exponential growth in the quantity and complexity of information, approaches to IR have surpassed the method of lexical matching. Singular Value Decomposition (SVD) is a factorization of real or complex matrices and is used to reduce its rank. When the documents are stored as a matrix (document matrix) and a query as a vector, SVD can be used to speed up the search. A basic understanding of SVD and its application to IR is presented.

11:45 a.m. **Limiting Densities of the Fibonacci Sequence Modulo p^n**
Nicholas Bragman, Hofstra University
Advisor: Eric Rowland, Hofstra University

The Fibonacci sequence modulo p^n, where p is prime, is periodic. Therefore, it is natural to ask what proportion of Fibonacci residues is attained modulo p^n. As n goes to infinity, this proportion converges. It is already known that the limiting density of the Fibonacci sequence modulo powers of 11 is 145/264. We look to determine the limiting density of the Fibonacci sequence with respect to general primes p. We see that this question is split into two cases, dependent on whether p is congruent to 1 or 4 mod 5 or congruent to 2 or 3 mod 5. For primes congruent to 1 or 4 mod 5, we give a method for computing the density. We also discuss the difficulties of the case where p is congruent to 2 or 3 mod 5, which arise from the fact that the extension Z_p[x]/<x^2-5> is nontrivial.

12:00 p.m. **A Quantum Leap: The Mathematics of Quantum Mechanics**
Ana Maria Delgado, NYC College of Technology, CUNY
Advisor: Satyanand Singh, NYC College of Technology, CUNY

While many scientific fields use real functions to investigate components in their research, quantum mechanics must travel into the complex realm, as the wave-functions which describe a variety of phenomena "exist" in the complex plane. In this way, we can evaluate special integrals that have widespread applications in quantum mechanics. Utilizing the complex plane allows us to create a useful representation of the information present. These special integrals contain values for which the integral is undefined. We consider these values and create a path that excludes them, while also approaching them at an infinitesimally close proximity. Leaping across various contours, twisting and turning along various paths, we can redefine the integral into more accessible parts. These contours lead us to a solution that is otherwise unachievable as the legs of the integral succumb. Through the evaluation of these special integrals as contours, and the researching and referencing of established mathematical solutions to well-known portions of the integrals, we were able to obtain finite, real values. By modifying these contours, one could certainly apply the methodology to other functions. Furthermore, we hope to have produced something that not only allows people to appreciate problems in quantum mechanics, but is also accessible to students.

12:15 p.m. **Determining the Shortest Paths Between Two Points on Opposite Faces of a Cube**
Rachel Roca, Manhattan College
Advisors: Richard Goldstone & Robert Suzzi Valli, Manhattan College

In an edition of the Weekly Dispatch in 1903, Henry Dudeney published the "spider and fly" puzzle. The puzzle presents a rectangular prism with a fly on one face and a spider on the opposite face, with the position of the fly and spider being strategically symmetrical to each other. The shortest path along the surface of the prism was to be found, which happens to be a five-face path (a path that crosses over five faces). In this project, two key components of Dudeney's puzzle have changed: instead of a rectangular prism we are considering a cube, and the position of the spider (source point) and fly (target point) can be located anywhere on the opposite faces. While we have proved that there is never a shortest five-face path between the points, determining whether the shortest path crosses over three faces or four faces is more complicated. Desmos and MATLAB have been utilized to gain a better understanding of the paths between the source and target points visually. This project focuses on mapping regions of the target face corresponding to three and four-face shortest paths for each possible source point location.

CONTRIBUTED POSTER SESSIONS

12:30 PM – 1:30 PM

Namm Building 1st Floor Cafeteria

Supervisors: Dr. Nadia S. Kennedy and Evelin Perez

A Study of Natural Fractals with Dimension Approaching the Golden Ratio
Uma Arengo, High School Student
Advisor: Robert Gerver, Institute of Creative Problem Solving at SUNY Old Westbury

In this paper, the connection between constructed and natural fractals (e.g. snowflakes, root systems, coastlines) was made using fractal analysis and the concept of dimension, which was employed as a measure of complexity. First, fractals were defined, dimension was introduced, and the Golden Ratio was defined. A fractal was constructed with the dimension of the Golden Ratio (the value of the dimension was proven mathematically), exhibiting a characteristic of mathematical self-repeating patterns. Fractal analysis using the box-counting method was demonstrated manually. The relationship between constructed fractals and natural fractals was explored in original research using the computer programs ImageJ and FracLac, both allowing for the computation of dimensions of photographed patterns. Natural fractals in lima bean roots (Phaseolus lunatus) with dimension approaching the Golden Ratio were found and studied, exhibiting characteristics that were compared to the mathematical self-repeating patterns introduced previously. Recommendations for further research included studying more natural fractals for occurrences of the Golden Ratio in addition to exploring other methods for measuring complexity, such as lacunarity. A recommendation for a more in-depth analysis included understanding why some patterns result in a specific dimension.

Active Matter: Biological Simulations
Muhammad Hannan, Jorwyn Medina, & Adama Sene, Borough of Manhattan Community College
Advisor: Chris McCarthy, Borough of Manhattan Community College, CUNY

Our research consisted of biological simulations done in NetLogo (software) and analyzed in the R programming environment. Simulations include chemotaxis with diffusion and decay of chemoattractants and predator-prey systems.

Analysis of Freeze and Thaw Dates Over Mountain Glaciers in High Mountain Asia Using Satellite Remote Sensing
Khaing Hsu Wai, Jessica Chiu, Tarendra Lakhankar, Nir Krakauer, Nick Steiner, & Kyle McDonald
NOAA CREST, LaGuardia Community College, CUNY
Advisor: Tarendra Lakhankar, City College of New York, CUNY

Glacier melt over the Himalayan region influences input for hydrologic systems that feed many critical rivers and fisheries for downstream water supply and the hydropower generation. Shifts in seasonal Freeze/Thaw/Melt (F/T/M) cycles with a changing climate could affect the billions of people who depend on the rivers of Nepal, India, China and Myanmar. Derived from the NASA Advanced Scatterometer (ASCAT) on EUMETSAT Metop-A and Metop-B satellites operating at 5.255 GHz (C-band), a daily F/T/M data is available based on vertically polarized (V-pol) backscatter measurements over seasonally frozen land and glacierized areas for the High Mountain Asia region. Soil moisture and temperature data were obtained from Third Pole Environment (TPE) database, a network of Chinese

stations over the Tibetan Plateau. These ground soil moisture and temperature data are compared with the ASCAT satellite product over the period 2008 to 2016. Statistical analysis of the NASA ASCAT data compared with in-situ data is performed to validate the satellite-retrieval data, find trends, and quantify and characterize errors. NASA ASCAT data also is compared with the data from European Space Agency Sentinel-1 Satellites that uses the microwave C-band. Moreover, the accuracy of the scatterometer will be evaluated too for future research purposes. The goal of the project is to help predict seasonal soil freeze/thaw cycles, which can help study how climate change affects locations differently, and the far-reaching hydrologic impacts of changing snow cover, and improve modeling of future climate predictions. (Supported by NSF REU Grant #AGS 1560050)

Analysis of the Predator-Prey Relationship Between Blue Whales and Krill

Michael Campiglia, Oscar Oh, & Anthony Doqaj, Manhattan College
Advisor: Lawrence C. Udeigwe, Manhattan College

An interacting species model involving blue whales and krill is studied as planar systems using the techniques detailed in [2]. Starting with the underlying Lotka-Volterra equation – with realistic parameters – derived in [1], we obtained phase portraits and bifurcation diagrams that describe the predator-prey relationship of blue whales and krill. We then studied a modified model that takes carrying capacity into account, and obtained phase plane diagrams that shed more light on the original model. We further modified the model by introducing the presence of another predator, the Antarctic Seal.

Analysis of Urban Heat Islands with Air Flow Simulation

Carlos Villalva, Timothy Medina, Xian Lin, NYC College of Technology, CUNY
Advisor: Masato Nakamura, NYC College of Technology, CUNY

Combinations of vehicles, buildings and industry within metropolitan areas produce higher thermal emittance defined as an urban heat island. Compared to surrounding rural areas, urban heat islands like New York City substantially have high-volume of building material (concrete and asphalt), low-volume of green spaces, and unique building patterns. Due to an urban heat island's unique geographical region traffic congestion, air flow direction(s) and thermal emittance are affected. Thus, influencing resultant location(s) of gas emissions released into the troposphere. As presciently released air pollutants combine with water, acid rain occurs and as temperature rises, indirect heat drying is a consequence. This projects' goal created an air flow simulation model using SolidWorks, GIS and insitu data around the downtown Brooklyn area. The analysis provided areas with higher heat emittance have lower air flow velocity compared to areas with lower heat emittance which had higher air flow velocity. Therefore, helping notify urban designers' locations of high thermal emittance, direction of air flow creating stress on buildings, and outdoor air quality. (Supported by NSF IUSE GEO Grant #AGS 1540721)

Analysis of Urban Surface Temperatures using Remote Sensing and Ground Based Applications

Jonathan Chea, Leonardo Ramos, NYC College of Technology, CUNY
Advisors: Hamidreza Norouzi, Reginald Blake, & Abdou Bah, NYC College of Technology, CUNY

Urbanization plays an important role in the modification of surface and atmospheric temperatures. Urban areas are densely populated and covered with conventional urban materials and less vegetation. As a result, the land surfaces of these areas capture more of the sun's energy, contributing to the urban heat island effect. This study examines and compares the results of land surface temperature in New York obtained from ground-based data and remote sensing. The diurnal variation of each surface is evaluated in this project to understand its effects on heat transfer in urban environments. Measurements of different land covers in New York City are taken with hand held thermal infrared cameras and one Unmanned Aerial Vehicle (UAV) infrared camera. A thorough analysis of ground observations of different land surfaces is provided by using a flux tower that measures surface energy balance components through the eddy covariance method. The satellite observations from NOAA's latest generation of Geostationary Operational Environmental Satellites (GOES) and the Moderate Resolution Imaging Spectroradiometer (MODIS) LST products were compared to the ground-based data collected from the thermal cameras. Seasonal diurnal measurements were obtained on each surface and the differences in the response of each surface type to energy balance were studied. Distinct behavior of temperature variations over major urban surfaces was found. Asphalt surfaces showed the highest temperatures with high diurnal amplitude. The analysis of the measured data also revealed how much vegetated area can help in lowering the average temperature in developed urban regions. The results of this study can provide a valuable source of information in developing a heat stress product for cities when high resolution LST data from different surfaces are used to predict their corresponding air temperature. In addition, the results can aid in understanding the energy storage in urban regions by providing a valuable boundary condition information at the surface for urban canopy models.

Analysis of Surface Temperature Trends of World's Major Lakes and Relationships with their Basins' Characteristics

Jelani Barro, Patrice Prosper, Ronaldo Carhuarica, & Jimmol Singh, NYC College of Technology
Advisors: Hamidreza Norouzi, Reginald Blake, & Abdou Bah, NYC College of Technology, CUNY

Lakes make up only 42,320 cubic miles (mi3), exponentially less than the 3.7% of earth's 332,500,000 mi3 of freshwater. Considering the size of the earth, 260 billion cubic miles (1 trillion cubic kilometers), its population of 7.7 billion can fit into one cubic mile. While it seems

that there might be enough fresh water to go around, lakes serve as the most crucial freshwater ecosystem in giving water supply, power production and agricultural use. As demands for freshwater continue to increase, to an estimated 55% within the next 50 years since 2000, the availability of fresh water from lakes are decreasing. The causes of the reduced availability of freshwater are mostly related climate change, the greenhouse effect and global warming. This study is based on determining the change in lakes surface water temperature and their relationship with their surrounding land cover type. In this study, the world biggest lakes have been investigated. An analysis of LST variation over the global lakes have been conducted using observations from the Moderate Resolution Imaging Spectroradiometer (MODIS), an infrared-based satellite platform. The data products were first processed to obtain the average daily temperature over the lakes and their surrounding land areas from 2002 to 2019. A statistical approach was applied to calculate the temperature trends of the lake water, the surrounding land. The trend of the difference in temperature over land and water was computed. At the end of this project, a database of all the lakes in the world will be compiled and available for future use on our group research website. The characteristics of the lakes will be shown, and the anthropogenic effects can be measured and observed more accurately. (Supported by NSF IUSE GEO Grant #AGS 1540721)

Analysis of Urban Surface Temperature Using Satellite Remote Sensing and In-situ Applications

Justine Ginchereau, Makini Valentine, & Nigel Franklyn, NYC College of Technology, CUNY
Advisors: Christopher Beale, Hamid Norouzi, & Reginald Blake, NYC College of Technology, CUNY

Urban areas are densely populated and covered with conventional urban materials and less vegetation. As a result, more of the sun's energy is captured which contributes to the heat island effect. This study examines and compares the results of land surface temperature in New York obtained from ground- based data and remote sensing. The diurnal variation of each surface is evaluated in this project to understand its effects on heat transfer in urban environments. Measurements are taken with hand held thermal infrared cameras and one Unmanned Aerial Vehicle (UAV) infrared camera. A thorough analysis of ground observations of different land surfaces is provided by using a flux tower that measures surface energy balance components. The satellite observations from NOAA's latest generation of Geostationary Operational Environmental Satellites (GOES) and the Moderate Resolution Imaging Spectroradiometer (MODIS) LST products were compared to the ground-based data collected from the thermal cameras. Diurnal measurements were obtained on each surface and the differences in the response of each surface type to energy balance were studied. Distinct behavior of temperature variations over major urban surfaces was found. The results of this study can provide a valuable source of information in developing a heat stress product for cities when high resolution LST data from different surfaces are used to predict their corresponding air temperature. In addition to understand the energy storage in urban regions by providing a valuable boundary condition information at the surface for urban canopy models. (Supported by NSF REU Grant #AGS 1560050)

Analyzing Stock Prices using Markov Chains and Neural Network

Kevin Garcia, Manhattan College
Advisor: Lawrence C. Udeigwe, Manhattan College

A Markov Chain is a memoryless stochastic process in which probabilistic decisions do not depend on the outcome of decisions taken before the current state: the probability of the next transitions is determined only by the current state. In this project we use discrete Markov Chains to build a model that concerns predicting the closing prices of a stock market. At any given time the moving average of possibly dynamic dataset a {x1,x2,...,xn} is calculated over a sliding window of length k<n. By binning the differences between the actual prices and the moving average, we can then construct our transition matrix. Our analysis so far shows that the resulting steady-state vector corresponds to the probability of where future prices may lie. We also present an alternative approach that uses fully connected neural networks and convolutional neural networks to numerically predict and completely recognize the trend of our data to forecast future stock prices.

Assessing Urban Drinking Water using (ICP-MS)

Abel Urgiles, NYC College of Technology, CUNY
Tezel Yearwood, Medgar Evers College, CUNY
Advisor: Dereck Skeete, Medgar Evers College, CUNY

Drinking water quality can be affected due to scaling and corrosion from iron pipes, contributing to health disorders. The general objective of this study is to measure heavy metal concentrations (Cd, Cr, Cu, Pb, Ni, Fe and Zn) from several locations in Brooklyn, and the Bronx locations in urban residential buildings tap water collected in 2019. The Medgar Evers College core facility laboratory will perform the water sample digestions by EPA Method 3052 and analyses for the trace metals by EPA Method 200.8, which describes a method for analyzing metals by Ion Coupled Plasma—Mass Spectrometer (ICPMS) (EPA 2003). Step-Wise Regression, Principal Component Analysis and Cluster Analysis will be used to group variables, and to assess their relationship to age of building and to the different locations. (Supported by NSF IUSE GEO Grant #AGS 1540721)

Calculator Use in Foundational Adolescent Math

Victoria Gianatiempo, Michael Scheuerer, & Kristiana Salerno, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

At the secondary level, calculators are not only expected but essential. They provide students with more opportunities to explore and experiment in mathematics as opposed to pen and paper. The TI-84 has been a common tool found in classrooms around Long Island since the 2000's, however the TI-Nspire is gaining popularity in some districts. The TI-84 is capable of calculating real and complex numbers, graphing several functions, as well as performing several matrix operations. This is also the calculator that educators are most proficient and comfortable teaching with. The TI-Nspire surpasses the TI-84 in its mathematical capabilities. The TI-Nspire can do everything the TI-84 can do, and more; it can factor and expand variable expressions, find antiderivatives, compute limits, find exact solutions in irrational forms, etc. It is evident the TI-Nspire is the more powerful calculator between the two. However, is it possible that it is too advanced for an age group of younger students, such as an 8th grade Algebra 1 class? This study examines three eighth grade Algebra 1 classes in the Long Island/Queens area through interviews, observations, and surveys. The authors offer a firsthand experience and insight to student interaction and success with the TI-Nspire.

Catchment-Scale Storm Orientations and Rainfall Patterns in the Missouri River Basin

Mohamed Layachi, Cesar Hincapie, Nasser Najibi, & Naresh Devineni, City College of New York, CUNY
Advisor: Naresh Devineni, City College of New York, CUNY

This study addresses the directionality of storms as they transpose over the Missouri River Basin, and the risks they pose to dams and flooding. The Missouri River will serve as the foundation track that will set a precedent to compare to the storm tracks. The posit under review is that parallel oriented storm tracks with respect to the Missouri River's main stem path bear the highest flood risk, while the orthogonal tracks bear the least risk. Daily precipitation data obtained from the Global Historical Climatology Network-GHCN covering the years 1900 to 2014 will be used to detect major precipitation events. Visual representations of storm tracks will be composed and compared, in a statistical manner with respect to the river's physical behavior. Through quantification and plotting of major daily precipitation patterns coupled with application of statistical analysis to said assessments, we will attempt to bridge the gap between the understanding of storm tracks, and aiding in flood preparations and dam failures. (Supported by NSF REU Grant #AGS 1560050)

Chemistry Student Attitudes and Utilization of Office Hours

Andre Rodriguez, Edgar Gomez, & Babacar Dieng, NYC College of Technology, CUNY
Advisors: Pamela Brown, Diana Samaroo, & Katherine Gregory, NYC College of Technology, CUNY

While research has demonstrated that faculty-student interactions increase retention and graduation rates, faculty often report that their office hours are underutilized. To better understand students' attitudes, usage, and plans towards faculty hours pre and post surveys were administered to students in 5 sections of general chemistry courses in the fall semester of 2018. The goal is to better understand how students perceive the benefits and hindrances of office hours along with planned. Prior to survey administration, it was speculated that not attending office hours could be because they were not scheduled at a convenient time, the students were overall not motivated to ask for help, or instructors were not encouraging their students to participate. The results were then collected and the data analyzed. Presumptions were partially correct. While overall 65% of the students indicated that office hours were scheduled at a convenient time, in one section only 40% indicated that they were; 41% indicated that a reason for not attending office hours was that they "do not like asking for help", despite the fact that 94% agreed that their instructor provided useful feedback. These results can help faculty improve their strategies and improve student attendance at office hours.

Data Analysis and Visualization of Heart Disease Patient Data

Dahiana Jimenez & Afis Animashaun
Advisor: Boyan Kostadinov, NYC College of Technology, CUNY

Doctors often study old cases hoping to learn better ways of treating their patients. A new patient who has a health history similar to a previous patient could benefit from undergoing the same treatment. This project investigates whether doctors might be able to group together patients with heart disease to specific treatments using some unsupervised learning techniques.

Diffusion Maps on Large Datasets

Moses Apreku, Richard VanBenthuysen, & Brian Zilli, St. John's University
Advisor: Florin Catrina, St. John's University

We implement the diffusion maps framework in the R statistical software and demonstrate its usage on selected datasets

Dynamical Systems in Hopf Bifurcations

Joshua Edwards & Guillermo Maxi, Manhattan College
Advisor: Lawrence Udeigwe, Manhattan College

This paper investigates Hopf bifurcations in the chlorine dioxide-malonic acid (ClO2- I2- MA) reaction. This reaction belongs to a family of nonlinear chemical dynamics which display periodic, chaotic behavior and spatial pattern formation. Techniques used to simplify complex reaction kinetics from n-variables to a system of two partial differential equations and subsequently to a system of ordinary differential equations for qualitative analysis were reviewed to further the understanding of Hopf bifurcations. Furthermore, specifications under which oscillator behavior is expected and suggest a new implementation to the existing model for further analysis.

Economics of Prison: Modeling the Dynamics of Recidivism

Alejandra Lopez, Naomi Moreira, & Ariana Rivera, Saint Joseph's College
Advisor: David Seppala-Holtzman, Saint Joseph's College

In Arizona each prisoner costs the state an average of $25,397 per year, the approximate cost of attending Arizona State University. Based on the current population of inmates this adds up to over 1 billion dollars annually. This figure is 5 times more than is spent on public assistance and about 70 percent of what is spent on transportation in the entire state. In addition to that, 40 percent of those who leave the prison return which further increases the costs on the state. In an effort to decrease costs the government of Arizona hopes to implement programs into their prison system in order to lower the recidivism rate and decrease costs. Multiple studies have shown recidivism is reduced when education and transition programs are incorporated. Currently, Arizona funds most of the GED program, excluding testing, while an inmate is incarcerated. Unfortunately, this education does not continue after the inmate is released. Meanwhile, other states have successfully incorporated education in order to reduce recidivism. In an effort to analyze recidivism in Arizona we have developed and analyzed a data-driven mathematical model that captures the dynamics of prisoners while in and out of prison based on their education status. This model, a system of differential equations, helped to estimate the cost associated with different educational programs in and outside of prison to the cost of recidivism. As a result, we were able to study the economic impact of implementing these transition programs which we proved to be cost efficient. We found that the transition programs would eventually pay for themselves as a higher proportion of inmates enroll in the program. We were also able to show that it was possible to completely eliminate recidivism as the length of the program increased and enough inmates enrolled in the transition program after being released.

Exploration of the Lessons Learned by Students Attending a Peer-led Workshop

Famida Akhter, NYC College of Technology, CUNY
Advisors: Nadia Kennedy, Armando Cosme, NYC College of Technology, CUNY

The study is conducted with students attending an additional one-hour a week peer-led workshop associated with their Pre-Calculus class. The study focuses on the following research questions: Do peer-led workshops help students become better at problem solving? What are the lessons learned from peer-led workshops that can be useful and applicable in future courses? Data will be collected through administering surveys to the students in the peer-led workshop. The data will be organized, analyzed and presented at the poster session.

Exploring the Role of Academic Emotions Enhancing Students' Mathematics Engagement Through Implementing 3D Mathematical Modeling Tasks

Matthew Meangru, Pace University

Researchers have shown students' academic emotions plays an important role in their classroom engagement (Pekrun & Linnenbrink-Garcia, 2012). Academic emotions can be defined as students' emotions that are connected to a classroom environment (Astleitner, 2000; Pekrum, Goetz, Titz, and Perry, 2002; Goetz, Zirngibl, Pekrun, & Hall, 2003). At Pace University, students enrolled in Algebra (MAT 103C) tend to have a negative academic emotion towards mathematics. To help students develop positive academic emotions in an Algebra classroom, they will engage in a group activity evolving a set of 3D mathematical Modeling tasks. Students will complete the tasks using 3D modeling software such as Tinkercad. The group activity will be an implemented project for the Algebra course. Students would potentially work on the group activity outside of the classroom and present their final production of their 3D mathematical model to the entire class. This proposed research would utilize a quantitative approach using survey and questionnaires. The goal is to investigate changes in students' academic emotions and effects on their mathematics engagement. I hypothesize that the 3D mathematical modeling activity can lead to positively changing students' academic emotions that can help increase their mathematics engagement.

Fully Augmented Links in the Thickened Torus

Alice Kwon, CUNY Graduate Center

Fully augmented links are obtained by taking the diagram of a link L (many knots linked together) and replacing all the crossings by crossing circles. An important invariant of the link is the volume of its complement, and the fully augmented link obtained from L gives an upper bound to the volume of the complement of L. I show that the volume density conjecture holds for fully augmented links. I will also demonstrate how one can use the online tool SnapPy to study volumes of link complements. Such analysis is very helpful for undergraduate math research in this area.

Influence of Extreme Weather Disasters on Maize Across the Globe During the Last Several Decades

Benjamin Pascal, Ehsan Najafi, & Indrani Pal, City College of New York, CUNY
Advisor: Ehsan Najafi, City College of New York, CUNY

The population of the world is ever growing and this in turn causes an increased demand of food to serve the populous. The climatic conditions such as extreme heat, floods and climate change in addition are making it more difficult to come up with a solution that addresses the problem. The goal is to show the association between reported extreme weather disasters and maize yield throughout the last decades. It is relevant to understand the effect of climate on crops since climate is directly linked to crop production. Using a correlation method called Spearman rank-order; we estimated the association between crop yields, area and maize production from Food and Agriculture Organization (FAO) of the United Nations (UN), across the globe and climate extremes from the Emergency Events database (EM_DAT) from 1961 to 2017. These results may help to guide the agricultural sector in the right direction in preparing and adapting for disasters so that risk can be reduced. (Supported by NSF REU Grant #AGS 1560050)

Investigating Seasonality in Forecasting Bias

Adrian Barros, Hunter College, CUNY
Advisor: Hannah Aizenman, City College of New York, CUNY

Model Output Statistics (MOS) are a class of statistical techniques where linear regression coefficients computed regionally are used to generate local weather forecasts. In order to compensate for the MOS forecasts regional bias, experienced forecasters often manually adjust the MOS's forecast using their knowledge of the local terrain. We used isomap clustering to identify stations having similar terrains and needing similar bias adjustments. When we did not find clustering by station and instead found seasonal clustering, we investigated why this pattern was not present in the bias using boxplots. (Supported by NSF REU Grant #AGS 1560050)

Effect of Extreme Weather Disasters on Global Crop Production of Wheat

Sharib Rizvi, Borough of Manhattan Community College, CUNY
Advisor: Indrani Pal, City College of New York, CUNY

Extreme climatic change brings up the extreme loss to the production of crops. It is important to understand the impact of extreme climate on crops because agriculture completely depends on the climate. Among the climatic variables that impact crops, droughts and floods are of great importance and are affecting the agricultural production globally. In this research we worked on impact of extreme flood and drought on global production of wheat. We used the annual data of flood and drought taken from https://www.emdat.be/, and data of production, yield and harvesting area of wheat from http://www.fao.org/statistics/databases/e/n from year 1961-2017. We used Spearmen's correlation coefficient method to do this research. We found out that the most effect of these disasters on wheat was on production of wheat in Africa. (Supported by NSF REU Grant #AGS 1560050)

Effect of Extreme Weather Disasters on Rice Production

Thierno Barry, City College of New York, CUNY
Advisor: Ehsan Najafi, City College of New York, CUNY

In recent decades, crops have experienced yield decrease due to extreme weather disasters (EWD). Understanding the influence of extreme weather disasters can help nations to mitigate its negative impacts more efficiently across the globe. In this research, we synthesized national rice production losses globally based on reported extreme weather disasters. Data of yield, area harvested, and production quantity are collected from the Food and Agriculture Organization of the United Nations website, while the extreme weather disasters data are gathered from Emergency Events Database (EM-DAT). We explored the linkages between drought, extreme heat, flood, and extreme cold on global rice production from 1964-2017. Our results show that there is a large association between EWDs and rice yield, area harvested, and production quantity. We found a strong negative correlation in Africa between drought and area harvested; in America, between drought and yield. Future research involves studying the influence of disasters occurring during the growing season on crop production within nations, findings that may help reduce disasters impact on crop production. (Supported by NSF REU Grant #AGS 1560050)

Enriching Math with Music and Technology

Samantha Lorenc & Thomas Vaccaro, Mercy College
Advisors: Sanjeevani Vaidya & Charles Li, Mercy College

The main goal of this project is to explore relationships between concepts in mathematics and music. We have been playing music for most of our lives. Since high school, we were both involved with playing instruments like guitar and clarinet. We were curious about different concepts presented in music from our experiences playing in school, with friends, and in local musicals. We explored applications of modular arithmetic in music along with the history and principles of synthesizers. For example, we explored the concepts of modular arithmetic that related to the concepts of key signatures in music, like transposing and inverting music. Additionally, we researched the

history of synthesizers from Thaddeus Cahill's invention to modern computer-based soft synthesizers. Moreover, we investigated integrating music with math class in a lesson plan for high school students to explain many concepts such as ratios, proportions, modular arithmetic and translating functions. We are fascinated by the deep connections among math, music, technology, and basic concepts of analog and digital synthesizers.

Generalization Theory of Linear Algebra I: An Embedding Algorithm

Christina Pospisil
Advisor: Eric Grinberg, University of Massachusetts Boston

An algorithm for multiplying and adding matrices regardless of dimensions via an embedding is presented. An equivalent embedding for a general determinant theory is also investigated. In future work there will be applications to physics and other natural sciences explored.

Geolocation Correction of Satellite Precipitation Estimates using a Radar-Gauge Product

Edgar Gomez & Andre Rodriguez, New York City College of Technology, CUNY
Advisor: Kibrewossen Tesfagiorgis, Borough of Manhattan Community College, CUNY

In order to improve hydrologic predictions, accurate precipitation estimates at fine scales (hourly time scale and few kilometers spatial scale) are required. Geostationary Satellites (GOES) Infrared (IR) based precipitation estimates are available at such scale. However, these satellite precipitation estimates (SPEs) are prone to spatial error and can be observed when compared with ground-based measurements. Detecting and applying correction of location error in IR based SPEs have been minimal. The research objective is to observe and assess location error within NOAA / NESDIS / STAR's satellite precipitation data fields, Hydro-Estimator (HE), Self Calibrating Multivariate Precipitation Retrieval (SCaMPR), and NOAA / NWS / NCEP / Climate Prediction Center's QMORPH against Stage-IV ground-based radar-gauge precipitation estimate (ST-IV). A series of MATLAB functions were created to measure SPEs' shifts in latitude, shifts in longitude, and combinations of them. The satellite data was then shifted in forty-nine different ways over ST-IV to calculate the minimum root-mean-square-error between SPEs and ST-IV estimates. Forty-nine frames were created by shifting the satellite data over calculated longitudinal and latitudinal directions ranging from -3 to +3 grid spaces. The study specifically focuses on tornado cases for the months of May 2010 and 2015. The geographic location of the study area consists of the states of Oklahoma, Kansas, and Nebraska within the region called "Tornado Alley." After correcting satellite estimations for spatial bias, significant improvements were found in correlation coefficients between satellite and ground radar.

Mathematical Modeling of Heating and Cooling of Solar Panels

Malgorzata Marciniak, Andrea Martinez, Delfino Enriquez-Torres, Abel Asfaw, Arame Sow, & Enmanuel Valdez, LaGuardia Community College, CUNY

The efficiency of solar panels is strongly influenced by their temperature. Continuing our previous research that analyzed the efficiency of solar panels based on the geometrical movement of the sun, we prepared a sequence of improvements of the model. The most significant aspect contains modeling the temperature of the panels. This presentation will contain a preliminary report on the results of the joint faculty and students project that analyzes the temperature of solar panels. Data collected by students using the thermal camera, temperature sensor and the LabQuest, is analyzed and fit into statistical and mathematical models based on Newton's Law of heating and cooling. This is the first step to make an attempt to simulate the panel's temperature based on the solar irradiance data.

Moving Away from Standardized Testing

Ryan Casale & Brodie Nuzzi, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

In making a general comparison of all the alternative methods of assessing students with the standardized approach the other approaches seem to be very helpful to the learners because they help in developing critical thinking abilities, problem-solving, decision making and analytical skills. This led to the need of experts and professionals to champion against the replacement of standardized test with the other alternative methods of assessment. With this replacement, research has indicated that alternative assessment has impacted the students positively because students have acquired all the necessary skills and expertise required for them in the outside world. In a general summary standardized tests were more used in school to test the performance of the people generally through making some mere comparisons of the scores. Some scholars and professionals rejected the approach because logically test scores cannot be used to measure the students' abilities and capacities because for any one student performance can be affected by many factors like illness, anxiety or even the method of testing which might be considered in analysis of the performance of the students. The standardized approach seemed to be more useful to the government and the school institutions as it tried to show the authenticity of the curriculum in use while still ignoring the fate of the students. The alternative methods seem to be important to the learners as they help improve their cognitive ability and other very important skills (Haney, Walter, and George Madaus, 685).

Observation of Aerosols and Characterizing Planetary Boundary Layer Using Ceilometers and LIDAR's

Akash Persaud, Bronx Community College, CUNY
Advisor: Mark Arend, City College of New York, CUNY

This project is an observation of regional (Ozone) pollution as well as measurement of the various precursors leading to the formation of Ozone. Ozone is created when a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOCS) takes place in the presence of sunlight. Ozone is a health problem as it can reduce lung function and harm lung tissue. These are risk factors for young children, the elderly, and those who suffer from diseases such as asthma. Ozone in the earth's lower atmosphere (troposphere) can be formed from pollutants released into the air from car exhausts, refineries, and power plants to name a few. Throughout the day the surface air is mixed within the planetary boundary layer through convection as the Earth's Surface heats up. In search of a solution to the regional air quality problem, various instruments such as LIDAR's, trace gas analyzers, and Ceilometers are used to gauge ozone and aerosols. Our mission is to identify aerosols and the precursors of ozone, and the effect they have on downwind areas such as Long Island, New York and Connecticut. We are also interested on how heat waves impact the regional air quality. With a better understanding of the air quality around us, we can help to promote cleaner and breathable air. (Supported by NSF REU Grant #AGS 1560050)

Ozone as a Health Hazard and How It Can be Reduced

Shawn Telesford, NYC College of Technology, CUNY
Advisor: Mark Arend, City College of New York, CUNY

This research was conducted to determine if ozone is truly a health hazard for the residents of states in the New England region. This study will emphasize atmospheric boundary layer dynamics in a complex urban coastal environment. Ozone is an invisible, toxic gas composed of three oxygen atoms (O3). The information gathered in this study can help those who are responsible for the regulation of O3 so that those who are living in areas with concentrated ozone will be less likely to be exposed to it. State Implementation Plans in the New England region will be more informed because of the information that this research provides. The experiments in this research project were done using equipment such as doppler lidars and other atmospheric monitoring tools and software applications developed using MATLAB and Python. With this new information, residents of states in the New England region will benefit from improved air quality. (Supported by NSF REU Grant #AGS 1560050)

Patterns in Pascal's Triangle

Nick Decresenzo, Brian Nelson, Alyssa Hande, Aaron Natividad & Conor Thomason, Suffolk County Community College
Advisor: Vera Hu-Hyneman, Suffolk County Community College

Pascal's triangle has been an area of mathematical discovery for centuries. There have been different variations studied in India, Iran, China, Germany, and Italy. The modern version of this triangle was constructed by Blaise Pascal, which is a seemingly simple arrangement of numbers where the ends of the rows are always 1. The other numbers in the rows are generated from the sum of the two closest numbers in the row above. Ever since then, there have been countless patterns and discoveries made from these numbers, including Fibonacci numbers and triangular numbers. Our goal was to find another such pattern. In order to establish a pattern that we could prove for all n(row) we used a few instances of n to get the general pattern and then applied that pattern as n goes to infinity. The pattern we proved which holds true for all n, is the sum of nth row is 2n. We proved that this holds true for any n by using mathematical induction with the binomial theorem. Using this proof of this pattern it can be assumed that there are other patterns which can be proved using the sum of nth row, and can have rooted applications in large scale probability.

Peer-Leaders' Learning: Is There a Difference Between What New and Experienced Peer-leaders Learn from Group Facilitation?

Ryan Chen & Bill Chinskul
Advisors: Nadia Kennedy & Armando Cosme, NYC College of Technology, CUNY

The study will focus on peer-leaders learning in the context of peer-led workshops, which they facilitate for one semester or more semesters. The study will focus on the following research questions: 1) What do peer-leaders learn in facilitating groups during peer-led workshops? And 2) Is there a difference between the learning of novice and experienced peer-leaders? The participants in this study will be the peer-leaders, who facilitate peer-led workshops at City Tech in Spring 2019. Some of them are novice peer-leaders, undergoing training in Spring 2019, and others are experienced peer-leaders, who have previously done the training and have facilitated groups for one or more semesters. Data will be collected through surveys, and organized, analyzed, and presented in a poster.

Proving the Cardinality of Infinite Sets of Numbers

Maya Arengo, High School Student
Advisor: Robert Gerver, Institute of Creative Problem Solving at SUNY Old Westbury

This paper describes an investigation of the different orders of infinity and the methods for determining the cardinalities of infinite sets of numbers. The possible cardinalities for infinite sets of numbers can have are also known as the orders of infinity. The cardinalities of the natural numbers, rational numbers, and the real numbers in the interval (0, 1) are determined and compared to each other. Since rules that apply to finite sets of numbers don't necessarily apply to infinite sets of numbers, the results obtained through the research seem counterintuitive. The research shows that certain infinite sets of numbers have a higher cardinality than other sets of infinite sets of numbers. Proving that for a given set, the cardinality of the power set is higher than the original set is one of the methods used to determine which infinite sets belong to the higher orders of infinity. An analysis of the first few orders of infinity determines whether there is a finite or infinite number of orders of infinity. Recommendations for further research include infinite sets that belong to the higher orders of infinity and the order of infinity, or lack of, between the first and second orders of infinity.

Signals in Urban Soils

Fatimata Dia, Bronx Community College, CUNY
Advisor: Prathap Ramamurthy, City College of New York, CUNY

The role played by soil in land-atmosphere coupling over forest, crop and rural canopies is well known and widely researched, however the relationship between soils in cities and the urban microclimate is not clearly determined and understood. An urban soil on a parcel in a metropolitan area has typically been moved, graded, and/or or compacted over time, often as a result of construction and demolition activity at the site resultant a variation the characteristics of soils. Soil studies in urban areas have found that soil compaction, low organic matter content, and low levels of contamination, usually from air deposition or from historical uses on site, are common attributes of urban soils. The primary goal of this study is to understand the spatial variability of soil characteristics in New York City (NYC) and to understand their impact on the local microclimate. The outcome from this work will aid in developing urban greening strategies to mitigate the adverse impacts of climate change in cities. Here we will conduct an extensive soil sample analysis from locations where the local microclimate is monitored. Our preliminary analysis found sand to be dominant component of the NYC soil. Sand is made up of quartz crystals which have high porosity compared to clay, which has the capacity to absorb and hold a considerable amount of water. Clay retains water more efficiently and supports plants and microorganisms. (Supported by NSF REU Grant #AGS 1560050)

Simulation as a Predictor in Probability

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

In this study we simulate bivariate normal data. We gain intuition about the bivariate normal distribution by comparing the generated data to the associated bivariate normal density surface. We also get results about covariance and correlation. We will use tools from linear algebra to discuss transformations of random normal vectors, and the use of contours.

Slow it Down to Speed Them Up: How Do We Change Curriculum for the Struggling Mathematics Student?

Noel King, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

While the world continues to progress in the STEM fields the United States continues to fall below average on international mathematics assessments according to the Organisation for Economic Co-operation and Development (OECD). Changing curriculums continue to push more complex materials earlier in hopes of raising scores for students who are struggling to keep up with the demands of harder coursework. This study examines the effects of pre-teaching course essentials and key topics to students identified as struggling or at risk of failure in two subjects; Geometry and Algebra 2. Students who took the hybrid courses scored better than they had on previous exams and overall had a better attitude towards mathematics. In particular the students who took the two-year Algebra 2 courses fared significantly better than they had in Algebra 1.

Stirling Numbers and Some of Their Amazing Properties

Sayef Iqbal & Je Kim, St. John's University
Advisor: Satyanand Singh, NYC College of Technology, CUNY

We will introduce Stirling numbers of the second and first kind. These numbers form an important class of numbers with important applications in discrete mathematics. In our study we will use counting techniques to unravel some of their properties. Our study will illustrate both a theoretical and targeted examples to support our results. We will culminate our study with some pertinent applications.

Student Perspective on Enjoyment in Mathematics Classes

Yasmine Soofi & Miralia Moreau, NYC College of Technology, CUNY
Advisor: Nadia Kennedy, NYC College of Technology, CUNY

The project will focus on students' perspective of enjoyment in mathematics.The research questions that will be explored are: 1) Do students enjoy math classes? If so, what aspects of the classes do they find enjoyable and why? If not, what aspects do they not enjoy and why? and 2) What do students think would make the math classes more enjoyable? Data will be collected by administering surveys to students from two mathematics courses. The data will be organized, analyzed and presented at the poster session.

Students' Perceptions of the Impact of Peer-led Workshops on their Team-working and Problem Solving Skills

David Mastalerz, NYC College of Technology
Advisors: Nadia Kennedy& Armando Cosme, NYC College of Technology, CUNY

The study will be centered on peer-leaders who conduct one-hour workshop, which represents a lab component of a Static course. The study will focus on the following research questions: a) Do peer-led workshops help students become better at team-working? and b) Do peer-led workshops help students develop problem solving skills? The participants in the study are the students taking part in the peer-led workshop. Data will be collected through surveys, and organized, analyzed, and presented in a poster.

Swarms and Group Theory

Isabella Diaz
Advisor: Meghan De Witt, St. Thomas Aquinas College

Group theory is used to describe and predict which countless events and swarms will be the next. Many of these biological groups exhibit behaviors that may be able to be connected by guidelines of algebraic group theory. These behaviors include a maximum and minimum distance between group members and a collective between them, such as direction of movement. These behaviors are currently being researched using differential equations. However, we believe that we are the first to study them using group theory. We investigate the group-like structure of swarms and seek to develop how these structures work with each other by taking advantage of the similarity to groups. The symmetrical tendencies behavioral patterns exhibit will be crucial in understanding the way swarms operate. Swarms often depend of environmental conditions and mate recognition with the largest density of individuals concentrated in the center of the swarm according to a 2009 study by Manoukis et. al.

The Catalan Mystery

John Gupta-She, Marie Curie MS 158Q
Advisor: Shamita Dutta Gupta, Pace University

In this poster, we will discuss Catalan numbers which are often encountered in Combinatorics. We will discuss applications of Catalan numbers in counting sets of objects. We will also see how Catalan numbers gives us deeper understanding in the fields of Combinatorics and Algebra.

The Consequences of Developmental Mathematics Placement on Community College Completion Outcomes

Heidi L Kiley, Suffolk County Community College, SUNY

There is some debate as to whether remediation is an effective means for preparing students for success in college. The significance of this mini study was to establish an argument that multiple pathways through remedial mathematics should be created, thereby enabling community college students to realize completion goals in an equitable manner compared to their N-RMP peers. Equitable mathematics pathways can be a fundamental part of attracting, encouraging, and otherwise facilitating RMP students to enroll and complete in an academic community. This researcher was compelled to investigate further the apparent penalties imposed upon community college student completion outcomes as a consequence of remedial-level mathematics placement. The purpose of this quantitative study was to examine remedial level mathematics placement on first college level mathematics course performance and degree completion for students from a large tri-campus suburban community college in the Northeast.

The Dionysus Project: Classifying and Monitoring Vineyards with Satellite Remote Sensing & Image Analysis

Evelin Perez-Flores & Nicole Flores, NYC College of Technology, CUNY
Advisors: Aaron Davitt & Kyle McDonald, City College of New York, CUNY

Climate change is expected to impact the wine industry by shifting suitable growing regions away from established regions and increasing the demand for freshwater supplies to maintain vineyard health. Vineyards require precise management of freshwater application and canopy management. Vineyards in the U.S. are typically monitored by vineyard managers. Unfortunately, since vineyards are large areas, it will require more vineyard managers to monitor and identify grapevine health which will cost more for resources and labor. Remote sensing provides coverage over large areas, a cost-effective tool to monitor large vineyard areas, giving growers informed decisions on irrigation timing and amounts related to vineyard grape development. By using remote sensing, it will allow vineyard managers to improve in decision-making. For our research, satellite remote sensing data was used to analyze two varietals - Chardonnay and Cabernet Sauvignon - at a vineyard in the North Fork of Long Island, NY during the 2017 and 2018 growing season. This research used Landsat-8 and Sentinel-2 satellite data to generate Normalized Difference Vegetation Index (NDVI), an indicator of vegetation "leafiness", for the following research goals. First, to identify how well each satellite tracks grapevine growth and health between the two-growing seasons (May to November 2017 and 2018) using differences maps and time-series analysis. Second, to use image classification to determine how well each satellite dataset identifies the vineyard by varietal type in terms of location and through the growing season. Ground data was collected during each growing season will verify the accuracy of Landsat-8 and Sentinel-2 observations. (Supported by NSF REU Grant #AGS 1560050)

The IDL Method

Jorge Vilca & Brandon Fitzgerald, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

We look at our students and see individuals with unique personalities and learning techniques. We encourage each student to embrace their own characteristics that influence their learning and critical thinking. With that, educators face the challenge of having a diverse classroom and accommodating each student's practical and individual needs while at the same time meeting the state's standards. That is when inclusion strategies, such as self-awareness to progression, varying instruction, and modeling, are tested to overcome different obstacles in the classroom. We studied and used real experiences and strategies from actual teachers across the United States, taking both the positives and negatives, to create a new method: Inclusivity of Deeper Learning (IDL). With the weaknesses these diverse learners face, there come some strengths that can support the classroom as a whole. The IDL method allows classrooms to create a problem that relates to the real world and their interests, which allows students to use what they know to find a solution. As a result, the diverse learners will learn the "essentials" like critical thinking, networking and communication. This method will be used in a Long Island high school setting.

The Dynamics of Canalizing Boolean Networks

William Qin & Elijah Paul, Millburn High School & Wayne Hills High School
Advisor: Gleb Pogudin, New York University

Boolean networks, dynamic systems defined by Boolean functions, are often used for modeling molecular regulatory networks. Many published models have a special common property, namely, they are defined by functions of positive canalizing depth. We conduct computational experiments to demonstrate that this property affects the dynamic of the model dramatically and the models with this property on average are "better suited" for modeling biological systems because of smaller number of attractors and short limit cycles.

The Impact of Peer-Led Workshops in an Intermediate Algebra Course for Women, Minorities, and First-Generation College Students

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

The implementation of the Peer-Led Team Learning (PLTL) instructional model have shown to increase student pass rates and decrease failure and withdrawal rates in foundational mathematics courses. New York City College of Technology has implemented mandatory PLTL workshops in selected sections of MAT 1275: Intermediate Algebra and Trigonometry. Students spend an hour working collaboratively with their classmates guided by peer leader. Results from this study showed gender, ethnicity, and first-generation college student differences in their responses on the effectiveness of peer supported groups in this fundamental mathematics course.

The Study of Group Work in Mathematics

Nikoletta Markoulli, Daniella Mottola, & Elena D'Ambrosio, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

Group work in a mathematics classroom can lead to higher student engagement and academic achievement when successfully implemented. It encourages peer team-work, sharing of new ideas, and learning from each other. However, collaboration in the classroom is not necessarily suitable for all types of learners. Through our research, we observe the potential benefits and drawbacks of implementing group work in the mathematics classroom. Specifically, our research focuses on the impact at the undergraduate level. We intend to compare the effects of structured and unstructured group work at the collegiate level in New York. Students will complete an initial and concluding survey that will reflect their perceptions about group work based on their experience. In a classroom of twenty undergraduates, students will experience working on mathematical problems in either structured or unstructured groups. Structured groups will involve assigning specific roles to students, meanwhile unstructured group work will involve students selecting their own peer group. Our research aims to demonstrate that the benefits of group work could have lasting benefits for students beyond graduation where communication skills are valued. After analyzing the gathered results in our studies, we were able to evaluate the strategies that proved to be either favorable or unfavorable in the classroom setting.

The Versatility of De Bruijn Sequences

Megan Gupta-She, Stuyvesant High School
Advisor: Aziz Jumash, Stuyvesant High School

This presentation will delve deeper into the applications of De Bruijn sequences and its variations. Applications include card tricks, DNA sequencing, lock picking, and more.

Understanding of Geometric Influenced Art and Architecture Through Tiled Research

Evelyn Richardson, NYC College of Technology, CUNY
Advisors: Anne Leonhardt & Satyanand Singh, NYC College of Technology, CUNY

In the past ornamentation held great significance for architecture. The great Roman historian of architecture, Vitruvius,… "advised architects to acquire extensive knowledge of history in order to realize underlying ideas through ornament as an expressive medium in architecture" [Khwarazm 227]. This project utilizes the tiling method of ornamentation as it evolved from mathematics as practiced by Islamic artisans to create highly complex effects. Persians believed the practice of geometry served as an intellectual means to conceive the order of the universe [Lawler 1982]. This geometry that aims to reveal the sublime and that appears throughout Islamic architecture, is particularly evident in the tile patterns. Some questions we will be considering in our study of these precedents involve: After one begins by generating the basic formula of a tiled pattern, how does one manipulate it rhythmically? In the absence of a written "recipe" for constructing this complex system of tiling, how were the tile patterns conceived and produced? How does one integrate design considerations beginning from the basic equation? And what can be learned and understood utilizing this arrangement of a pattern over a larger surface?

Using a Quantum Equilibrium Ensemble to Uncover the Effects of Cage Flexibility on the Diffusion of Hydrogen Gas in Clathrate Hydrates

Philip Brous, Bronx High School of Science
Advisor: Vladimir Shapovalov, Bronx High School of Science

Alternative energy research is turning towards hydrogen as a means of storing renewable energy sources, such as solar energy, and of providing clean fuel to motor vehicles. Storing the gas itself, however, proves to be a difficult task due to the small size of the atoms and low density of the gas. Scientists have expressed interest in clathrate hydrates, crystal lattices of cages made of water molecules, in the past twenty years for their potential to solve the issues of hydrogen storage. The goal is to eventually create a marketable product, but before this can be done, accurate data on clathrate hydrates must be obtained in order to prove their value. Until the cage-to-cage diffusion mechanism of hydrogen gas within the crystal lattice is fully understood, such data cannot be obtained. The flexibility of the clathrate cages has been theorized to play a role in diffusion, but this has yet to be verified. This study seeks to answer this problem. Using the theory of driven adiabatic free energy dynamics, programs were written to obtain the free energy profile for diffusion at several temperatures, assuming rigid cages. Using quantum transition state theory, rates were also obtained. Observation of the differences between the results of this study and a prior study, which obtained similar data but with flexible cages, led to the conclusion that flexibility does indeed play a role in diffusion. This indicates that scientists must take into account flexibility as a factor in future simulations.

Using Model Selection to Understand the Importance of Bariatric Surgery in Diabetes Management

Johane Simelane, Manhattan College
Advisor: Lawrence Udeigwe, Manhattan College

The task of selecting the best model for predicting glycated hemoglobin (HbA1C) level is considered in a statistical and machine learning framework. In recent years, bariatric surgery has been used in the treatment of obesity-with significant benefits for obese patients. Recent data shows that when compared to conventional medical care, surgical management for obesity leads to reduction in weight, decreased HbA1C level, diabetes remission, and reduction in cardiovascular risk factors. However, most of the studies have been short-term studies. As such, the long-term sustainability of the benefits associated with bariatric surgery is still not yet clearly understood. The current project sought to analyze 4-year data to understand the long term effects of bariatric surgery in type 2 diabetic patients as it relate to HbA1C levels. The best model for predicting HbA1C was determined for each of the 4 years. The features included in each model were compared to see when bariatric surgery was a significant predictor of HbA1C. The Forward Stepwise selection approach was used to select the ideal model to predict HbA1c from the other variables. The best model in each year was chosen based on the Mallow's Cp Statistic. The models for year 1 and 2 included bariatric surgery and had an R squared of approximately 0.6709. The 3rd and 4th year models did not include bariatric surgery as a predictor;they have R squared of approximately 0.5737.

Visualizations of Flowers Using Phyllotaxis

Gabrielle Langston & Meryem Elbaz
Advisor: Boyan Kostadinov, NYC College of Technology, CUNY

The goal of this project is to create mathematical art using the R programming language. The arrangement of leaves on a plant stem is controlled by spirals. This fact is called phyllotaxis and it is a good example of how mathematics can describe patterns in nature. In this project, we create visualizations of flowers using phyllotaxis.

SPONSOR PRESENTATION

1:40 PM – 2:00 PM

Presider: Nadia Benakli & Elena Goloubeva *Location: New Academic Building A105*

Review of MyLab Educator Efficacy Study and Feature Presentation

Marcus Scherer, *Pearson, Digital Sales Specialist*

The purpose of this presentation is to present the findings of a recent MyLab Math Educator Efficacy Study conducted during the Fall 2017 semester at Penn State University and to discuss the Pearson learning and assessment technology features used in the study.

MyLab Math brings consistency across sections of the Penn State College Algebra II course. While the pass rate for the Fall 2017 cohort of College Algebra II was 79%, the pass rate for students earning 85% or higher on MyLab homework was 52 percentage points higher than for those students who earned less than 85% on MyLab homework.

Several core features of MyLab Math contributed to the results of the study, with a specific focus on real-time student feedback and assistive learning tools accessible from within homework assignments. The presentation will review the correlation between MyLab homework scores and final course grades, and demonstrate the learning tools outlined in the study.

CONTRIBUTED PAPER SESSIONS II

3:15 PM – 4:30 PM

PEDAGOGY AFTERNOON SESSION I: MATHEMATICS EDUCATION

Presiders: Ariane Masuda & Andre Rodriguez *Location: New Academic Building A104*

3:15 p.m. **In and In Front of a Math for ESL Classroom**
Monica Morales Hernandez, Adelphi University
Authors: Monica Morales-Hernandez & Joshua Hiller, Adelphi University

It is no secret that ESL students face additional barriers to success in the math classroom; I should know because I was one. To help our students transition to their new educational environment Adelphi started a joint venture termed Adelphi University International (AUI). The main objective of AUI is to recruit and help international students with limited English skills by providing intensive non credit English language courses and smaller dedicated courses with a full time dedicated faculty line. In this talk I will provide my perspective as both a former ESL student and the current Math faculty for AUI. In particular I will explore challenges and strategies that may be implemented in other classrooms.

3:30 p.m. **Newton's Way to Pi and Teaching Calc II**
Sam Ferguson, New York University
Author: Scott Armstrong, New York University

How should we teach integration by trig substitution? Our students often say that standard textbook lessons on this topic are unmotivated. Recently, the speaker motivated this technique with an activity on the integral that Newton used to calculate pi. While trig substitution wasn't Newton's go-to method at the time, it seems eminently possible to apply this method to confirm Newton's initial results. The speaker shares his reflections on using the activity in the classroom and using history in the teaching of Calc II.

3:45 p.m. **Learning How to Learn Mathematics in a Rapidly Changing Future World of Artificial Intelligence**
Alexander Atwood, Suffolk County Community College

In the next twenty years our students will have to thrive in a rapidly changing world due to advances in Artificial Intelligence and Automation. Learning how to learn mathematics is one of the most important intellectual skills we can nurture in our students so that they can excel in their future lives. What should we be teaching and how should we be teaching in our math courses if Artificial Intelligence will radically change the nature of employment and citizenship?

4:00 p.m. **Remedial Math: Challenges and Obstacles**
Grazyna Niezgoda, NYC College of Technology, CUNY

The main obstacles to student's success in developmental math courses are lack of math study skills and poor self-efficacy judgment. The presenter will share some ideas and strategies that are used to help students develop and evaluate effective study techniques, increase their self-efficacy judgment and finally become more successful learners.

PEDAGOGY AFTERNOON SESSION II: MATHEMATICS EDUCATION

Presiders: Nan Li, Sydney Umana, & Julia Rivera *Location: New Academic Building A103*

3:15 p.m. **A Geoscience Research Experience: Assessing its Impacts on Math and Engineering Majors via Gender, Ethnicity, and First-Generation College Status**

Janet Liou-Mark, Reginald Blake, and Julia Rivera, NYC College of Technology, CUNY

Over the last two decades, undergraduate research experiences have gained prominence in attracting and retaining students in the STEM disciplines. A study was conducted to examine the effects of gender, ethnicity, and first-generation college status on 34 mathematics and engineering majors who participated in a summer National Science Foundation Research Experiences for Undergraduates (REU) program at New York City College of Technology during a span of five years. The participants were trained in geoscience research using satellite and ground-based remoting sensing techniques over a nine-week period in the summer. Survey responses before and after the geoscience research program were collected and analyzed. Results showed statistically significant gains for underrepresented minority and first-generation college students in their confidence to conduct research, to communicate science, and to be interested in applying for graduate schools in a geoscience discipline. Female students enjoyed the research experience more than male students did, and more so than their female counterparts, male students found the research experience more arduous and challenging than they first expected.

3:30 p.m. **WeBWorK on the OpenLab: Leveraging City Tech's Open Digital Platform to Create a Community Space for Homework Help**

Andrew Parker, Charlie Edwards, & Jonas Reitz, NYC College of Technology, CUNY

WeBWorK, an open-source online homework system supported by the MAA and the NSF, provides a platform for students to practice and engage with their mathematics studies. WeBWorK offers a number of advantages over traditional pencil-and-paper homework, including instant, customized feedback and error-recognition. But how do we help students when they get stuck? At City Tech a team of faculty and developers has worked to bridge WeBWorK and the OpenLab, our open digital platform for teaching, learning and collaboration. Students seeking help on a WeBWorK problem are directed to an OpenLab community space where they can review answers to previous questions about their problem or ask their own. By moving the conversations around homework help into a public space we increase transparency, reducing the repetitious explanations that can occur in one-on-one support models, such as email, where many students can ask very similar questions, each requiring a near-identical response from the instructor. Want to bring this technology to your own institution? We will discuss how you can set up your own OpenLab, free, through Commons in a Box OpenLab, and our planned release of the WeBWorK OpenLab bridge. Join us to learn more and see the project in action.

3:45 p.m. **The Math Behind the Stock Market Game at Hostos Community College**

Ruben Worrell & Vincent Young, Hostos Community College, CUNY

The SIFMA Foundation's Stock Market Game program provides students with a unique opportunity to see the math that they are learning in the classroom as applied to the real world. It is an opportunity as well for students to apply what they've learned to the essential life skill of investing and saving. The program's Math Behind the Market student's activity book provide students with some ideas for making the transition from a regular math textbook to applications in the real world. A FINRA- funded study by the American Institute for Research found that students who participates in the SIFMA Foundation's Stock Market Game program performed much better on math assessment tests than other students. Students will review concepts such as slopes, trends, expectations, Odds in favor and against, and the statistics of their investments in their respective ePortfolio at the end of the semester.

4:00 p.m. **Good Math Notes**

Andrew Vaughn & Thomas Cheung, NYC College of Technology, CUNY

The purpose of public schools and Colleges is to create an environment where young people can choose and seek their interest, as well as teach young people how to live pragmatically and immediately in their current environment. As Educators, our goal is to strive for progress from our students, not perfection. Each of our students is unique and has different circumstances and experiences. Good Math Notes is free tutoring service that provides help in all areas of mathematical subjects from grade school through college. Good Math Notes promotes self-worth, integrity, diversity, academic achievement, and empowerment. We want to create a safe-haven where students can ask question and share ideas without feeling doubts and uncertainty. We encourage students to further their education and expand their knowledge in mathematics. We are committed to excellence in the service we provide, our goal is to impart knowledge and present opportunity. Creating models that can provide better visuals for students to grasp the concept by incorporating active learning into the curriculum. As a result, we can transform the classroom into an exciting, dynamic learning environment. Using teaching models that encourage debates, brainstorming sessions, assessments, and group discussions are all great ways to actively engage students in learning. These methods are very good ideas to help students retain important information if they find it interesting or relatable. We believe, when students try to memorize information, it is better for them to relate it to something meaningful rather than repeat it again-and-again to make it stick. Come and learn from our experience.

PEDAGOGY AFTERNOON SESSION III: MATHEMATICS EDUCATION

Presiders: Holly Carley & Farjana Shati *Location: New Academic Building A105*

3:15 p.m. **NYCMT@CityTech Supporting Diverse Prospective Mathematics Teachers**
Saloua Daouki, Armando Cosme, and Nadia S. Kennedy, NYC College of Technology, CUNY

New York City Men Teach (NYCMT) Program is a CUNY-wide program, which supports diverse prospective teachers--with a primary focus on men-- through their teacher preparation and state certification. This presentation will focus on the NYCMT@CityTech, and will discuss its goals, activities and outcomes.

3:30 p.m. **Developing an OER for Quantitative Reasoning for an Urban Community College**
Johannes Familton, Borough of Manhattan Community College, CUNY

Quantitative Reasoning was first introduced to Borough of Manhattan Community College which is a part of the City University of New York in 2007 by Professors Teixeira and Reese. This is a one semester credited math course that was originated an alternative to Statistics or Foundation of mathematics for liberal arts students. Quantitative Reasoning focuses on helping students to think critically and solve problems in everyday life. It used the standard Quantitative Reasoning textbook, at the time, by Bennett and Briggs, Using and Understanding Mathematics: A Quantitative Reasoning Approach, with a price tag now of almost $200, more than most liberal arts students want to pay for a one semester math course. Over the summer of 2018 Dr. Familton with the help of colleagues developed an OER version of BMCC's Quantitative Reasoning course. The course materials include an workbook (OER, developed by Familton) and an online homework platform developed by Professor Xin (open access). In this talk Dr. Familton will talk about his experience developing this OER for Quantitative Reasoning and his experience piloting this course for the past two semesters.

3:45 p.m. **Novice Peer-Leader Learning**
Yasmine Soofi, Armando Cosme, and Nadia S. Kennedy, NYC College of Technology, CUNY

This presentation focuses on novice peer-leaders' learning during their training activities. We present a case study of one cohort of novice peer-leaders during their training, and reflect on how their conceptions of their role and the role of the students in the peer-led team learning (PLTL) have changed.

4:00 p.m. **Embedding an Upper-class Student in a Calc I Class to Promote Equity in the Classroom**
Behailu Mammo & Phil Mann, Hofstra University

One plausible explanation for the alarming achievement gap in college classrooms is that some students are not well prepared for a college course. But what do we do once these "underprepared" students are in our classrooms? More often than not, our instruction is tailored for the "well-prepared" students, worsening the gap. In STEM gateway courses, such as Calc I, the stakes are so high that struggling students may ultimately change their major. Obviously, there is no panacea, but as a potential solution, I have an embedded student in my Calc I class whose primary goal is to help maintain an equitable classroom where all students are positioned to have equitable access to content. This initiative is supported by a Hofstra University Research and Development grant. In this preliminary research report, we will share what evidence-based practices we are employing to align what we do with research in learning mathematics.

STUDENT/FACULTY SESSION II

Presiders: Lin Zhou & Makini Valentine *Location: New Academic Building A106*

3:15 p.m. **Slow it Down to Speed Them Up: How Do We Change Curriculum for the Struggling Mathematics Student?**
Noel King, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

While the world continues to progress in the STEM fields the United States continues to fall below average on international mathematics assessments according to the Organisation for Economic Co-operation and Development (OECD). Changing curriculums continue to push more complex materials earlier in hopes of raising scores for students who are struggling to keep up with the demands of harder coursework. This study examines the effects of pre-teaching course essentials and key topics to students identified as struggling or at risk of failure in two subjects; Geometry and Algebra 2. Students who took the hybrid courses scored better than they had on previous exams and overall had a better attitude towards mathematics. In particular the students who took the two-year Algebra 2 courses fared significantly better than they had in Algebra 1.

3:30 p.m. **The IDL Method**

Jorge Vilca & Brandon Fitzgerald, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

We look at our students and see individuals with unique personalities and learning techniques. We encourage each student to embrace their own characteristics that influence their learning and critical thinking. With that, educators face the challenge of having a diverse classroom and accommodating each student's practical and individual needs while at the same time meeting the state's standards. That is when inclusion strategies, such as self-awareness to progression, varying instruction, and modeling, are tested to overcome different obstacles in the classroom. We studied and used real experiences and strategies from actual teachers across the United States, taking both the positives and negatives, to create a new method: Inclusivity of Deeper Learning (IDL). With the weaknesses these diverse learners face, there come some strengths that can support the classroom as a whole. The IDL method allows classrooms to create a problem that relates to the real world and their interests, which allows students to use what they know to find a solution. As a result, the diverse learners will learn the "essentials" like critical thinking, networking and communication. This method will be used in a Long Island high school setting.

3:45 p.m. **The Study of Group Work in Mathematics**

Nikoletta Markoulli, Daniella Mottola, & Elena D'Ambrosio, Molloy College
Advisor: Elizabeth Vidaurre, Molloy College

Group work in a mathematics classroom can lead to higher student engagement and academic achievement when successfully implemented. It encourages peer team-work, sharing of new ideas, and learning from each other. However, collaboration in the classroom is not necessarily suitable for all types of learners. Through our research, we observe the potential benefits and drawbacks of implementing group work in the mathematics classroom. Specifically, our research focuses on the impact at the undergraduate level. We intend to compare the effects of structured and unstructured group work at the collegiate level in New York. Students will complete an initial and concluding survey that will reflect their perceptions about group work based on their experience. In a classroom of twenty undergraduates, students will experience working on mathematical problems in either structured or unstructured groups. Structured groups will involve assigning specific roles to students, meanwhile unstructured group work will involve students selecting their own peer group. Our research aims to demonstrate that the benefits of group work could have lasting benefits for students beyond graduation where communication skills are valued. After analyzing the gathered results in our studies, we were able to evaluate the strategies that proved to be either favorable or unfavorable in the classroom setting.

4:00 p.m. **Patterns in Pascal's Triangle**

Nick Decresenzo, Brian Nelson, Alyssa Hande, Aaron Natividad, & Conor Thomason, Suffolk County Community College
Advisor: Vera Hu-Hyneman, Suffolk County Community College

Pascal's triangle has been an area of mathematical discovery for centuries. There have been different variations studied in India, Iran, China, Germany, and Italy. The modern version of this triangle was constructed by Blaise Pascal, which is a seemingly simple arrangement of numbers where the ends of the rows are always 1. The other numbers in the rows are generated from the sum of the two closest numbers in the row above. Ever since then, there have been countless patterns and discoveries made from these numbers, including Fibonacci numbers and triangular numbers. Our goal was to find another such pattern. In order to establish a pattern that we could prove for all n(row) we used a few instances of n to get the general pattern and then applied that pattern as n goes to infinity. The pattern we proved which holds true for all n, is the sum of nth row is 2n. We proved that this holds true for any n by using mathematical induction with the binomial theorem. Using this proof of this pattern it can be assumed that there are other patterns which can be proved using the sum of nth row, and can have rooted applications in large scale probability.

4:15 p.m. **Assessment of Undergraduate College Curriculum Using Statistical Methods**

Nicholas DeMarco, Adelphi University
Advisor: Salvatore Petrilli, Adelphi University

Currently, Adelphi University has no formal assessment plan that can be applied to all majors within its College of Arts and Sciences. The university currently has a process however; it is too vague and lacks the specific details needed for successful application and effective results. We will investigate and analyze the types of data and procedures that are necessary for conducting and determining effective assessment by analyzing the effective methods done by larger institutions and determine how to apply them to Adelphi's smaller learning community. Additionally, we will devise a formal assessment plan for the university that utilizes data analysis that can be easily implemented and deliver accurate results on the university's different programs.

STUDENT SESSION II

Presiders: Kate Poirier & Justine Ginchereau *Location: New Academic Building A703*

3:15 p.m. **Do Multiple Head Injuries Increase the Likelihood of Post Traumatic Stress Disorder (PTSD) and Depression?**
Tavianne Kemp, Manhattan College
Advisor: Angel Pineda, Manhattan College

Using data from a published article entitled Traumatic Brain Injury in Iraq and Afghanistan Veterans: New Results from a National Random Sample Study by Lisa K. Lindquist, MD, Holly C. Love, MD, and Eric B. Elbogen, Ph.D., we will reproduce their results on PTSD and depression. We will use bootstrap methods in Matlab to simulate the results from the paper in a difference of proportions test. This analysis will test the relationship between multiple head injuries and higher percentages of PTSD and depression in veterans from Iraq and Afghanistan.

3:30 p.m. **Can We Predict the Way You will Vote?**
Alexandra O'Neill & Claire Kang, Manhattan College
Advisor: Angel Pineda, Manhattan College

It is evident that there are many different factors that influence the political affiliation of a person. College major, gender, and race are just a few of the different factors that contribute to someone's political beliefs and in turn the way they vote. That being said, we are exploring if there is a way to predict how students at Manhattan College will vote. We will collect data on Manhattan College students on these variables and use a mathematical model to see if we can predict who a person will vote for.

3:45 p.m. **Patterns Between the Number of Cevians or Caliians and the Regions That They Form in Polygons**
Calia Kugler, Half Hollow Hills High School East
Advisor: Robert Gerver, Institute of Creative Problem Solving

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

4:00 p.m. **An Exploration of the Relationship Between Consecutive Coefficient Factorable Quadratic Equations and the Fibonacci Sequence**
Michelle Serban
Advisor: Robert Gerver, Institute of Creative Problem Solving

Not all quadratic equations can be factored. Those that are not require the usage of the quadratic equation or completing the square to find the roots. However, this study delves into quadratic equations that are factorable. The quadratics that are analyzed contain consecutive absolute value coefficients or consecutive absolute value even or odd coefficients. In each situation, the discriminant of the quadratic is taken to determine whether or not it is factorable. It turns out that quadratics with consecutive absolute value coefficients or consecutive absolute value even or odd coefficients are not factorable when the c term is a positive value. When looking at the differences between the values that can be plugged into the respective discriminant expressions, it is noticeable that the differences end up being every other term in the Fibonacci sequence. Additionally, after studying these quadratics in standard and factored form, a relationship can be observed between them and the Fibonacci and Lucas number sequences. In the factored form of consecutive absolute value coefficient quadratic equations, one set of parentheses always contains consecutive Lucas numbers while the other one has consecutive terms from the Fibonacci sequence. Also, the same two term numbers from both sequences are within the parentheses. By using this pattern and working backwards, Fibonacci and Lucas numbers can be used to produce consecutive absolute value coefficient quadratic equations that are factorable.

4:15 p.m. **Enriching Math with Music and Technology**
Samantha Lorenc & Thomas Vaccaro, Mercy College
Advisors: Sanjeevani Vaidya & Charles Li, Mercy College

The main goal of this project is to explore relationships between concepts in mathematics and music. We have been playing music for most of our lives. Since high school, we were both involved with playing instruments like guitar and clarinet. We were curious about different concepts presented in music from our experiences playing in school, with friends, and in local musicals. We explored applications of modular arithmetic in music along with the history and principles of synthesizers. For example, we explored the concepts of modular arithmetic that related to the concepts of key signatures in music, like transposing and inverting music. Additionally, we researched the history of synthesizers from Thaddeus Cahill's invention to modern computer-based soft synthesizers. Moreover, we investigated integrating music with math class in a lesson plan for high school students to explain many concepts such as ratios, proportions, modular arithmetic and translating functions. We are fascinated by the deep connections among math, music, technology, and basic concepts of analog and digital synthesizers.

MISCELLANEOUS SESSION

Presider: Boyan Kostadinov & Edgar Gomez *Location: New Academic Building A705*

3:15 p.m. **The Value of Industry-informed STEM Curriculum and Pedagogy**
Robert J. Domanski, New York City Government, Tech Talent Pipeline

A brief description of the "CUNY 2x Tech" mayoral initiative and the utility of its model as an academic-industry-government partnership. Learnings from this initiative are applicable to all STEM fields both at a Departmental level, i.e. the value of industry engagement, as well as at an individual faculty level, i.e. pedagogy and the importance of imparting applied knowledge to students.

3:30 p.m. **Mathematical Art and the Lights Out Game Visualizations**
Boyan Kostadinov, NYC College of Technology, CUNY

The goal of this talk is to showcase some mathematical art projects as well as some visualizations for the Lights Out game, using the R programming language. We developed these projects for a summer coding workshop (and may use some of them for our newly developed course on computational science), with the idea of mixing mathematics and computer experimentation in order to inspire our students' creativity and get them more excited about coding, by appealing to their artistic side. Our hope is that building coding skills could improve our students' chances of getting internships and full-time jobs. This work has been supported in part by a MSEIP Grant from the Department of Education.

3:45 p.m. **Generalization Theory of Linear Algebra I: An Embedding Algorithm**
Christina Pospisil
Advisor: Eric Grinberg, University of Massachusetts Boston

An algorithm for multiplying and adding matrices regardless of dimensions via an embedding is presented. An equivalent embedding for a general determinant theory is also investigated. In future work there will be applications to physics and other natural sciences explored.

4:00 p.m. **Teaching Inside: The Experience of a Math Professor Inside Maximum Security**
Meghan De Witt, St. Thomas Aquinas College

As part of the Hudson Link program, St. Thomas Aquinas College has partnered with a maximum security prison to offer the incarcerated men a Bachelor's Degree. We describe the lessons learned from teaching college level mathematics inside with no resources (and no calculators!) to a wide range of students of varying mathematical preparedness. We offer tips and advice for others who may be considering working with such a program.

4:15 p.m. **What's So Special About the Numbers 1 and 2?**
Chris Roethel & Ron Skurnick, Nassau Community College

The numbers 1 and 2, respectively, are the first two positive integers, respectively. It turns out that the numbers 1 and 2 enjoy certain special properties not found in other positive integers. In this talk, we will discuss some of these special properties of the numbers 1 and 2.

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METROPOLITAN NEW YORK SECTION OF THE MAA
TREASURER'S REPORT

ASSETS	BALANCE	BALANCE
	04/27/18	**04/29/19**
Chase Business Classic	$8,682.80	$3,762.06
Chase Business Select High Yield Savings	$15,082.10	$15,085.58
NY Metro Section Total Assets	**$23,764.90**	**$18,847.64**

CHASE BUSINESS SELECT HIGH YIELD SAVINGS (0366)

Credits

Date	Description	Amount
04/28/18-04/29/19	Interest (does not include 4/19)	$3.48
Total Credits		**$3.48**

CHASE BUSINESS CLASSIC (0365)

Deposits/Credits

Check #	Date	Description	Amount
	05/15/18	Registration cash and checks (MAA 2018 Annual Meeting including a $100 book table fee for Math, Computer Science & Information Systems)	$1,290.00
	09/23/18	Registration PayPal-MAA 2018 Annual Meeting	$1,939.80
	02/01/19	Subvention and MathFest contribution (2018)	$1317.00
	04/21/19	Graph Theory Day 77 registration	$455.00
720	**04/26/19**	Angel Pinede-Fortin (Manhattan College Newsletter ad)	$50.00
Total Credits			**$5,051.80**

Checks Paid/Debits

#	Date	Description	Amount
914	05/13/18	Mandy Mei (Program design MAA 2018 Annual Meeting)	$50.00
915	05/13/18	Garrett Norman (Book room monitor)	$65.00
916	05/13/18	Elena Goloubeva (Annual Meeting food expense)	$85.25
917	05/13/18	Armen Baderian (Annual Meeting guest dinner expense)	$409.55
918	05/20/18	Armen Baderian (Annual Meeting name badges)	$73.84
919	05/20/18	Abraham Mantell (Newsletter, plaques)	$1,054.82
920	05/21/18	Nathan Kallus (Annual Meeting guest speaker)	$412.26
921	05/21/18	Steven Krantz (Annual Meeting guest speaker)	$918.66

922	05/21/18	Lionel Levine (Annual Meeting guest speaker)	$672.91
923	05/21/18	Joseph Mitchell (Annual Meeting guest speaker)	$400.00
924	10/01/18	Abraham Mantell (Plaques)	$700.00
925	10/01/18	New York University (catering for Metro NExT Workshop)	$361.50
926	10/01/18	Mutiara Sondjaja (gifts for Metro NExT Workshop)	$300.00
927	10/23/18	Janet Liou-Mark (food for Delegate Assembly)	$377.78
928	01/02/19	Florin Catrina (Putnum mugs)	$192.00
929	02/20/19	Mandy Mei (Flier design)	$100.00
931	04/15/19	Culinart Group (GTD 77 food expense)	$520.90
933	04/16/19	Armen Baderian (GTD 77 badges)	$36.92
934	04/16/19	AEB of the NYCCT (2019 Annual Meeting facility expense)	$2,482.00
935	04/19/19	Abraham Mantell (2019 Annual Meeting gifts)	$794.65
936	04/26/19	Abraham Mantell (Unitech Print LLC. books)	$209.00
937	04/26/19	Abraham Mantell (Crown Trophy award plaques)	$115.00
925		New York University (Metro NExT Workshop) not cashed	-$361.50
Total Debits			**$9,972.54**

GRAPH THEORY DAY FUND (CONTAINED WITHIN 0365)

Deposits/Credits

	Date	Description	Amount
	04/12/19	GTD 77 Registration	$455.00
Total Credits			**$455.00**

Checks Paid/Debits

Check #	Date	Description	Amount
931	04/15/19	Culinart Group (GTD 77 food expense)	$520.90
Total Debits			**$520.90**

	BALANCE	BALANCE
	04/27/18	**04/29/19**
Graph Theory Day Fund	**$1,797.41**	**$1,731.51**

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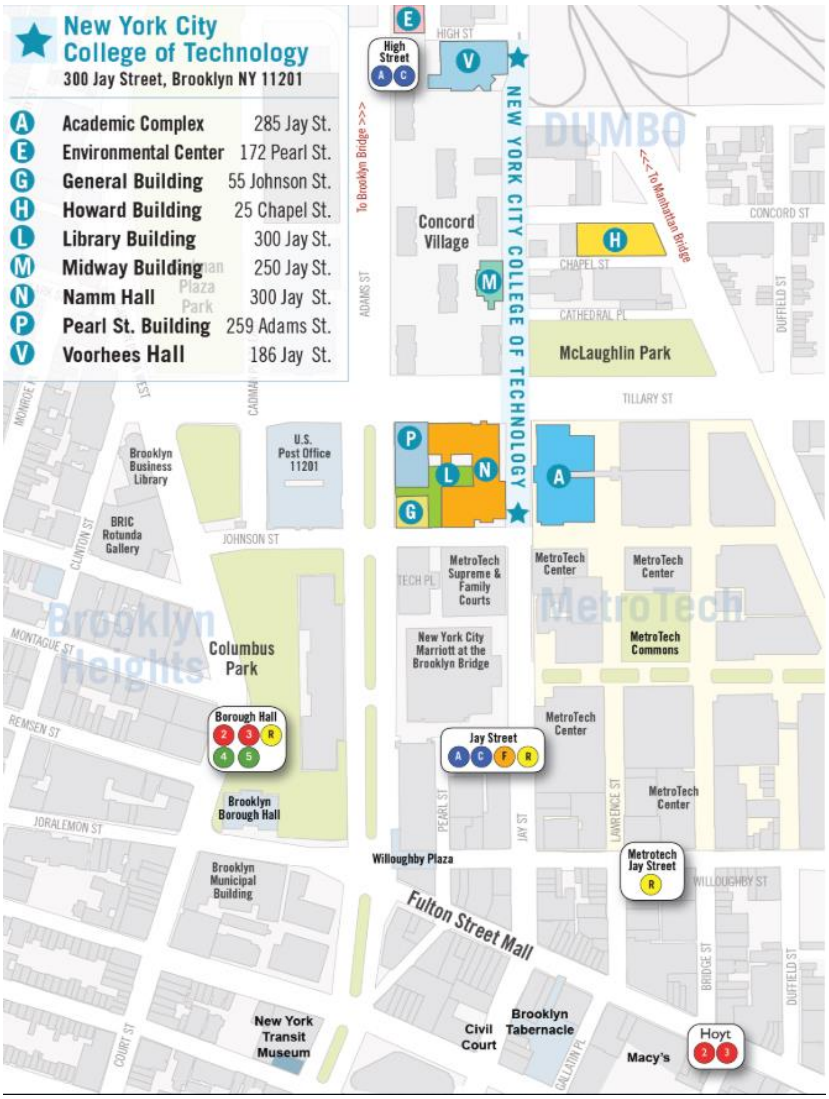
Campus Map



SAVE THE DATE

Joint MAA New Jersey Section and Metropolitan New York Section Meeting
Essex County Community College
Newark, New Jersey
Saturday, October 26, 2019
For more information: http://sections.maa.org/newjersey/Main/

Many thanks to:

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