
THE • MATHEMATICAL • ASSOCIATION • OF • AMERICA •
MAA - FL
MCMLXVII
FLORIDA SECTION

2023 Joint Meetings

Of The

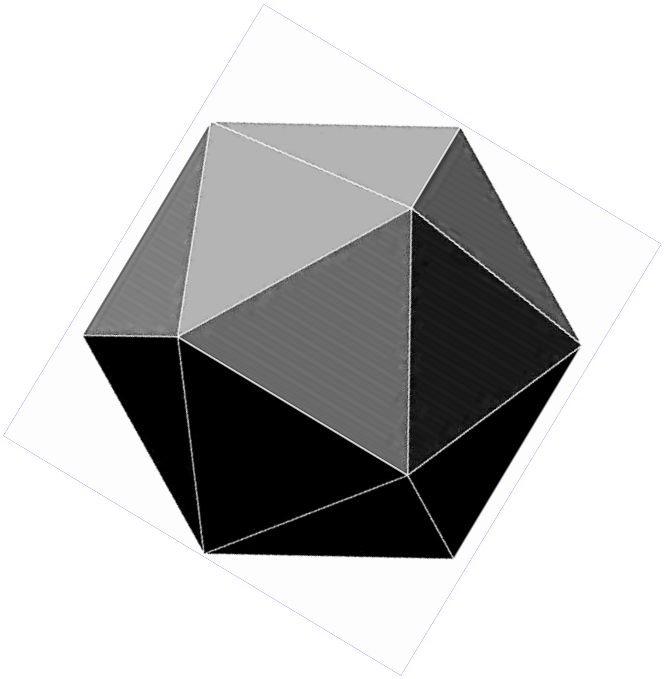
Florida Section

Of The

Mathematical Association of America

And

The Florida Two-Year College Mathematics Association



Virtual Meeting

February 17-18, 2023

Florida Section of the Mathematical Association of America

2022 – 2023

Section Representative	Monika Kiss, Saint Leo University
President	Lubomir Markov, Barry University
Past President	Anthony Okafor, University of West Florida
Vice-President for Programs	Ryan Kasha, Valencia College
Vice-President for Site Selection	Keshav Acharya, Embry-Riddle Aeronautical University
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President-elect	Sean Murphy, Eckerd College
VP for Programs-elect	Kevin Murphy, Saint Leo University
VP for Site Selection-elect	Gregory McColm, University of South Florida

Florida Two-Year College Mathematics Association

2022-2023

President	Sybil Brown, Lake-Sumter State College
Past President	Joni Pirnot, State College of Florida
Vice-President for Programs	Don Ransford, Florida SouthWestern State College
Secretary	Rebecca Williams, State College of Florida
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Newsletter Editor	Sandra Seifert, Florida SouthWestern State College
Membership Chair	Dennis Runde, State College of Florida
Webmaster	Altay Özgener, State College of Florida
President-elect	Sidra Van De Car, Valencia College
Historian	Robert Shollar, State College of Florida

PROGRAM

Friday, February 17, 2023

11:00 – 7:00 EST Main Room open for conference participants to join **Main Room**

FTYCMA

11:00 – 12:30 **FTYCMA Annual Business Meeting**

GRADUATE RECRUITMENT FAIR

11:30 – 1:30 Students are welcome to visit the virtual booths of the universities listed below to learn more about their graduate programs. Feel free to join and leave at any time.

University of North Florida **B/O Room 1**
Hosted by Mahbubur Rahman

Florida Atlantic University **B/O Room 2**
Hosted by Hongwei Long and Maria Provost

University of Central Florida **B/O Room 3**
Hosted by Qiyu Sun

University of Florida **B/O Room 4**
Hosted by Miklós Bóna

Florida State University **B/O Room 5**
Hosted by Francis Baffour-Awuah and Elizabeth Scott

University of South Florida **B/O Room 6**
Hosted by Seung Yeop Lee

University of West Florida **B/O Room 7**
Hosted by Aletheia Zambesi

FL – MAA

12:30 – 1:30 **FL-MAA Executive Committee Meeting**

Please note that for the duration of the conference we created *Breakout Room 10* as a room where you can meet with old friends and make new friends, if you want to take a short break. We also created *Breakout Room 11* for students to mingle. Enjoy the conference!

All times are in Eastern Standard Time (EST)

Friday, February 17, 2023

WELCOME

1:45 – 2:00 **Welcoming Remarks** **Main Room**

Lubomir Markov, President, FL-MAA
Sybil Brown, President, FTYCMA
Hortensia Soto, President, MAA

2:00 – 2:50 **Plenary Session** **Main Room**

Hortensia Soto, MAA President
Colorado State University

***C**ompassion in & **A**ccess to **L**earning **M**athematics (**CALM**)*

3:00 – 5:00 **Student Events** **B/O Room 8**

In order to be considered for award recognition in the Integration Contest or the Problem-Solving Contest you will need to have your camera on and aimed at your workspace. Your camera must be far enough away that both arms are visible for the duration of the contest. Once you have completed the exam, you will need to use a document scanning app (like CamScanner) to scan your solutions and email your completed submission to Jacob Aguilar (Jacob.Aguilar@saintleo.edu) within 10 minutes of the closure of the contest. Any submissions received after these 10 minutes have passed will not be deemed eligible.

3:00 - 3:50 **Student Integration Contest**

Put your integration skills to the test! This 50-minute competition will feature integration problems requiring a variety of calculus techniques. Calculators and notes are not allowed. Undergraduate students of any background are welcome to participate and the top three scores will receive Amazon Gift Cards in addition to being recognized for the achievement.

4:00 – 4:50 **Student Problem-Solving Contest**

Put your reasoning skills to the test! This 50-minute competition will feature a variety of fun problems spanning the gamut of the field of mathematics. Calculators and notes are not allowed. Undergraduate students of any background are welcome to participate and the top three scores will receive Amazon Gift Cards in addition to being recognized for the achievement.

Please note that we are using *Breakout Room 11* as our Student Hospitality "room". Feel free to come and join other students in here.

3:00 – 3:45 Contributed Papers Session I

Full Session

Scott Hochwald **B/O Room 1**
University of North Florida

Almost Everything Fibonacci

Sybil Brown **B/O Room 2**
Lake Sumter State College

Individualized Assignments with Minimal Grading Time

Mihhail Berezovski **B/O Room 3**
Embry-Riddle Aeronautical University

Evidence-Based Strategies for Improving Diversity and Inclusion in Undergraduate Research

Session A 3:00-3:20

Anil Devarapu **B/O Room 4**
University of North Georgia

Generalization of Blasius and Sakiadis problems

Max Sehaumpai, Chuantian Lin, Yue Qian (Undergraduate Students), and Amal Almansour **B/O Room 5**
City College of New York

Using Machine Learning to Detect Fake Online Reviews

Kathleen Guy and Shivanni Jagessar **B/O Room 6**
Florida International University

Using PlayPosit for Student Engagement and Learning

Arthur David Snider **B/O Room 7**
University of South Florida

Motivating Linstedt's Method Using Multiple Time Scales

Session B 3:25-3:45

Jonathan Guy **B/O Room 4**
Northwest Florida State College

Designing Exams in LaTeX

Andre K. Waschka **B/O Room 5**
Mercer University

Simulating Data using the Existing Data Set

Donald McGinn **B/O Room 6**
University of West Florida

Egyptian Fractions and Rational Equations

Arthur David Snider **B/O Room 7**
University of South Florida

Tychonov's Solution: An Overlooked Opportunity to Blend Pure Mathematics into Mechanical Engineering Education

4:00 – 4:45 Contributed Papers Session II

Full Session

Robert Cappetta **B/O Room 1**
Florida SouthWestern State College

Active Learning in Calculus

James Condor **B/O Room 2**
State College of Florida

Creative Data Visualization

Session A 4:00-4:20

Justin Hoffmeier **B/O Room 3**
Florida Polytechnic University

Exact zero-divisor subgraphs

George Prodanoff (Undergraduate Student) **B/O Room 4**
University of Florida

Skewness and Kurtosis in Flow Cytometry Analysis Results of Targeted Melanoma Therapy

Lindsey Fox and Sean Murphy **B/O Room 5**
Eckerd College

AP Precalculus: Gift or Gimmick?

Albert Madinya (Graduate Student) **B/O Room 6**
Florida Atlantic University

Topologizing the Space of Minimal Primes of an M-Frame

Matthew Brenneman and Rebecca L. Pierce **B/O Room 7**
Embry-Riddle Aeronautical University
Ball State University

We Teach the Wrong Things, In the Wrong Order, in the Wrong Way

Session B 4:25-4:45

Cameron Fraize (Graduate Student) **B/O Room 4**
University of Florida

Extraction Rates of Random Continuous Functionals

Lindsey Fox **B/O Room 5**
Eckerd College

The effect of governance structures on optimal control of two-patch epidemic models

Oday Hazaimah **B/O Room 6**
Saint Louis University

Gradient Methods in Non-smooth Optimization

5:00 – 5:45 Section Representative's Session **Main Room**

Monika Kiss
Saint Leo University

What can the MAA do for you and what can you do for the MAA?

6:00 – 7:00 Plenary Session **Main Room**

Talithia Williams, MAA Pólya Speaker
Harvey Mudd College

Power in Numbers: The Rebel Women of Mathematics

Saturday, February 18, 2023

8:45 – 9:00 Welcome back **Main Room**

9:00 – 9:45 Contributed Papers Session III

Full Session

Deborah Howard **B/O Room 1**
Valencia College

Making a Difference through a Professional Development Experience

Dennis Perusse **B/O Room 2**
University of North Florida

Examples, results, and ideas for high impact practices in mathematics focusing on student engagement, learning, and achievement

Mohammad Mahabubur Rahman (Graduate Student) **B/O Room 3**
Texas Tech University

Remarks on the global regularity issue of the two-and-a-half dimensional Hall-magnetohydrodynamics system

Session A 9:00-9:20

Jared Fletcher (Undergraduate Student) **B/O Room 4**
University of North Florida

Graph-based Groups or Group-based Graphs?

Jacob B. Aguilar **B/O Room 5**
Saint Leo University

On the Solutions of Nonlinear Dispersive Water Wave Models

Megan Bennett (Undergraduate Student) **B/O Room 6**
Nova Southeastern University

Minimum k-Blockers of 123-Avoiding Permutation Matrices

Matthew Kimm, Gary Marmon, Jay Sparks and Anthony Okafor **B/O Room 7**
University of West Florida

Network Recommendation Methods for Higher Education Applications

Session B 9:25-9:45

Furio Gerwitz (Undergraduate Student) **B/O Room 4**
University of North Florida

Vertex Coloring and its Application in Code Optimization

Weston Dell (Graduate Student) **B/O Room 5**
University of Notre Dame

Financial Literacy and the High School Math Classroom

Aaron Stringfellow (Undergraduate Student) and Shusen Pu **B/O Room 7**
University of West Florida

Ristić-Balakhrishman-Harris-G Family of Distributions with Applications

10:00 – 11:15 Workshop Talk and Discussion **B/O Room 9**

Cathie Herzog and Caroline Sampson
Florida State College at Jacksonville

An Overview of MGF 1130 and MGF 1131: Mathematical Thinking in Context

10:00 – 10:45 Contributed Papers Session IV

Full Session

Michelle Karkkainen **B/O Room 1**
Valencia College

Creating a "Science Ready" Math Student

Jacci White and Monika Kiss **B/O Room 2**
Saint Leo University

How do we assess students to encourage learning and discourage cheating?

Vincent J. Matsko **B/O Room 3**
Eckerd College

Making Calculus Accessible

Session A 10:00-10:20

Kyle Ambrose (Undergraduate Student) **B/O Room 4**
University of North Florida

Regular Expressions Converted to Finite State Automata

Jaffar Ali Shahul Hameed **B/O Room 5**
Florida Gulf Coast University

Positive Solutions for a Derivative Dependent - Laplacian Equation with Riemann-Stieltjes Integral Boundary Conditions

Karin Ebey, Mariana Olivares-Cely (Undergraduate Students), and Lindsey Fox **B/O Room 6**
Eckerd College

Optimal Control Theory to Mitigate the Effects of Resistance to Disinfectants

Gary Marmon, Matthew Kimm, Jay Sparks, Brian Le, Kelie Kan and Anthony Okafor **B/O Room 7**
University of West Florida

Identifying previous course contributions to target course grade prediction

Session B 10:25-10:45

Ryan Farrell (Undergraduate Student) **B/O Room 4**
University of North Florida

Mobius Functions and Inversions for Posets

Mozhgan Nora Entekhabi **B/O Room 5**
Florida A & M University

Inverse Problems for Wave and Plates Equations

Francis Baffour-Awuah Junior (Graduate Student) **B/O Room 6**
Florida State University

Proteomic clusters of septic patients using spectral clustering

L.H. Kuo **B/O Room 7**
University of West Florida

Modified Knot Insertion for solving RBF interpolation problems

11:00 – 11:45 Contributed Papers Session V

Full Session

Joseph Ours **B/O Room 1**
State College of Florida

Student and Instructor Indicators of the Mathematical Processes

Jay Sparks, Anthony Okafor, and Josaphat Uvah **B/O Room 2**
University of West Florida

Targeting First Semester Math Courses Based on Probability of Passing

Chuck Lindsey **B/O Room 3**
Florida Gulf Coast University

Trigonometry: From Chords to Verses

Session A 11:00-11:20

Chris Johnson (Graduate Student) **B/O Room 4**
University of North Florida

The Use of Double Sequence Notions to Establish Multidimensional Summability test for Singular Points of a Double Power Series

Kevin Murphy **B/O Room 5**
Saint Leo University

Mathematics in Video Games

Caroline Johnson (Undergraduate Student) **B/O Room 6**
University of California Berkeley

Prime, Nonprime Number Patterns, Gaps and Prime Number Conjectures

Bariaa Shatila and Michael Insalaca **B/O Room 7**
Flagler College

Using Inquiry-based approach in College Algebra courses at Flagler College

Session B 11:25-11:45

Dylan Strickley (Undergraduate Student) **B/O Room 4**
University of North Florida

Polynomial Representations of Integer Partitions

Channa Navaratna and Menaka Navaratna **B/O Room 5**
Indiana University of Pennsylvania
Florida Gulf Coast University

Recursive approximation filtering in source localization

Susan Krage (Undergraduate Student) **B/O Room 6**
Eckerd College

Optimal Harvesting in an Epidemic Model of Koi Herpesvirus (KHV)

Matthew Chin (Graduate Student) **B/O Room 7**
Embry-Riddle Aeronautical University

A Statistical Learning Regression Model utilized to determine predictive factors of social distancing during COVID-19

12:00 – 12:25 Contributed Posters Session **Main Room**

Elly Ben Simon (Undergraduate Student) and Dennis Perusse
University of North Florida

Two for Two: an analysis of the univariate multivariable Cobb-Douglas production function

Clayton Jowers (Undergraduate Student), Matthew E. Wolak and Jessica McDonald
University of West Florida

Connections in Graph Theory and Population Pedigrees

Mingfang Huang (Undergraduate Student) and Jia Liu

University of West Florida

IoT-based Epidemic Monitoring via Improved Gated Recurrent Unit Model

Ihsan E. Buker (Undergraduate Student), and Samantha Seals
University of West Florida

Jackknife Variance Estimator for Datasets Containing Multiply Imputed Outcome Variables Under Uncongeniality: A Monte Carlo Simulation Study

12:30 – 12:55 Student Kahoot! Challenge **Main Room**

How can you get any better than combining mathematics and video games? Race against others and the clock to try and quickly and accurately solve some quirky and entertaining mathematical puzzles.

1:00 – 1:50 **Plenary Session** **Main Room**

Keshav Acharya, FL State Speaker
Embry-Riddle Aeronautical University

On the spectral theory of canonical system

1:50 – 2:00 **Closing Remarks** **Main Room**

Sybil Brown, President, FTYCMA
Lubomir Markov, President, FL-MAA

2:00 – 3:00 **Award Ceremony and** **Main Room**
FL-MAA Business Meeting

ABSTRACTS

Contributed Papers Session I

Full Session

Scott Hochwald – University of North Florida

Almost Everything Fibonacci.

The Fibonacci Sequence will be the starting point for a journey that will highlight identities, geometry, irrationality, a paradox, number theory, probability, infinite series including a detour to the Harmonic Series. Hence the title, Almost Everything Fibonacci.

Sybil Brown – Lake Sumter State College

Individualized Assignments with Minimal Grading.

Assessments done outside of class offer an opportunity for students to collaborate with peers and complete assignments in a less stressful environment than the testing environment. These experiences can lead to a more in-depth look at topics as students discuss concepts together. To encourage collaboration, individualized assignments can be created so that each student can discuss the concepts in general, but still complete their unique assignments. Grading individualized assignments can be very time-consuming. In this session, examples of individualized assignments used in STA2023 (Elementary Statistics) and MAC1114 (Trigonometry) will be presented along with the method used to grade the assessments. In addition, attendees will be invited to share their strategies for take-home assessments that don't require a tremendous amount of grading time.

Mihhail Berezovski – Embry-Riddle Aeronautical University

Evidence-Based Strategies for Improving Diversity and Inclusion in Undergraduate Research

Higher education institutions strive to support diversity and inclusion initiatives because they recognize the benefits at the undergraduate, graduate, and faculty levels. Opportunity and mentoring are especially important for underrepresented students. While many mentors may want to help minority student researchers, they may not know how. For the last seven years, we have developed an innovative and successful model that provides students from underrepresented groups in STEM with an opportunity to perform data-enabled industrial mathematics research by exposing them to problems outside of academia that are mathematical and data-driven in nature. In this talk, we will address the evidence-based strategies we learned from these activities, including quantitative analysis of student exit surveys, significant outcomes, and structural analysis of research projects. Our study based on 38 major projects with 10 different companies, businesses, and government labs involving over 120 undergraduate students.

Session I-A

Anil Devarapu – University of North Georgia

Generalization of Blasius and Sakiadis problems

In this talk, we provide a gentle introduction to boundary layer theory and explain the Blasius and Sakiadis problems. Then we formulate a problem in a more general settings by using the parameter λ. When λ=0, we have the case of stationary flat plate in a moving stream (Blasius problem), whereas when λ=1 we have the case of moving plate with no external motion imposed on the free stream (Sakiadis problem). For the other values of λ we have the case of simultaneous motion of the flat plate and the free stream. The governing boundary layer equations (nonlinear coupled PDEs) are solved by shooting method. Fluid flow characteristics for a variety of situations are discussed.

Max Sehaumpai, Chuantian Lin, Yue Qian (Undergraduate Students), and Amal Almansour – City College of New York

Using Machine Learning to Detect Fake Online Reviews

There has been a significant increase in online reviews of products and services on various platforms. Although these reviews may help consumers make better decisions and provide feedback for businesses and manufacturers, many of these reviews could be fake and, therefore, deemed unreliable. In our project, we implemented various machine learning models to detect computer-generated fake reviews. We applied review-centric methods, whereby we focused on raw text attributes of the reviews. We performed our analysis on an open-source dataset containing both original reviews, which are presumed to be real, and computer-generated fake reviews. The dataset spans many product categories such as books, movies, pet supplies, and electronics among others. In this talk, we will discuss our research framework, data exploration, and results. We will also explain the fundamental text processing techniques and some of the supervised learning models used.

Kathleen Guy and Shivanni Jagessar – Florida International University

Using PlayPosit for Student Engagement and Learning

In this talk, we will discuss how implementing PlayPosit videos, an interactive video platform, into our active learning mathematics curriculum has allowed us to increase our students' preparedness to participate in group work and maximize in-class activities. We will share the methods used prior to implementing PlayPosit and the impetus for making the decision to switch to PlayPosit. Additionally, we will show examples of the structure of our videos, the different types of questions embedded, and how we hold the students accountable for taking notes. We will also highlight some of the biggest strengths and weaknesses we believe the program has. Lastly, we will share feedback we have received from students regarding PlayPosit through anonymous surveys administered at the end of the semester and discuss how switching to an interactive video platform has changed the pre-class experience for our students.

Arthur David Snider – University of South Florida

Motivating Linstedt's Method Using Multiple Time Scales

Although the mathematical simulation of nonlinear devices can be numerically implemented using software, for design tradeoff analyses it is essential to have closed-form formulas, even if they are only approximations to the solutions. The regular perturbation series method often provides such formulas in a straightforward manner, but frequently it spawns secular terms, which severely limit the usefulness of the formulas. Poincare and Linstedt devised tricks that avoid secular terms by invoking the concept of strained time. However, motivating these tricks for students is a daunting undertaking. This paper conducts a tutorial/review of these notions in the context of the diode and the Duffing spring, explicates the relatively recent notion of multiple scale analysis, and shows how the latter provides a neat and straightforward rationale for the strained-time approach. It also offers insight into why the method does not enjoy all the convergence features of the power series method.

Session I-B

Jonathan Guy – Northwest Florida State College

Designing Exams in LaTeX

Creating your own course content can be tricky. I use LaTeX for making all my exams, quizzes, class notes, and in-class assignments. I have for the last two year wrote all the content for NWFSC Math Bowl Competition, which consists of a 45-question exam and a ciphering competition both with some abnormal figures that I code. LaTeX can help your exams look clean and clear, making them easier to read with room and space for students to answer each question. It's easy to add more space between questions, or add in a graph for your students to fill in. I will cover my tips and tricks I use in exam design, from making tables to complex figures. I will provide the LaTeX files as easy to use templates after, so you too can start designing beautiful exams.

Andre K. Waschka – Mercer University

Simulating Data using the Existing Data Set

We describe a simulation method (based on resampling and machine learning) that generates data closely matching the original, existing longitudinal data set. The importance of this approach is that it preserves the characteristics of the existing set, making the statistical analysis more realistic and applicable to real world problems. Typical applications are in medical studies where electronic medical records data are readily available and this simulation method can be used as a valuable tool in precision medicine research. An example will be presented.

Donald McGinn – University of West Florida

Egyptian Fractions and Rational Equations

An Egyptian fraction is a rational number whose numerator is 1. In this talk, we discuss formulas, theorems, and open problems related to Egyptian fractions. One of the results on Egyptian fractions leads to creating rational equations involving real and complex numbers, as well as real and complex valued functions.

Arthur David Snider – University of South Florida

Tychonov's Solution: An Overlooked Opportunity to Blend Pure Mathematics into Mechanical Engineering Education

Tychonov's 1935 solution of the heat equation, exhibiting nontrivial heat fluxes spontaneously appearing along an isolated conducting rod initially held at zero degrees, has intrigued some specialists for almost a century. No doubt those practicing heat engineers who took mathematics seriously were initially relieved to learn that the construction was valid only for infinitely long rods; the integrity of their published exchanger designs could be defended by citing this weakness, together with the known discrepancies between the heat equation and physical reality. Some mathematicians contrived additional hypotheses to disqualify the Tychonov solution. Recently a computer simulation was executed, revealing just how astonishingly unbridled the solution is. But there remain incongruities in this singular example that invite metaphysical speculation. We fuel the latter with a recap of the history from a lighthearted perspective, providing heat transfer engineering students with a rare insight into the practical value of the mathematicians' exacting obsession with generality.

Contributed Papers Session II

Full Session

Robert Cappetta - Florida SouthWestern State College

Active Learning in Calculus

The leaders of AMATYC, MAA and other mathematics professional societies have concluded that effective active learning is essential to improving student performance and confidence. The Conference Board of the Mathematical Sciences (CBMS) defined active learning as, "Classroom environments in which students are provided opportunities to engage in mathematical investigation, communication, and group problem-solving, while also receiving feedback on their work from both experts and peers, have a positive effect on learning." This presentation will examine the evidence that supports active learning, and it will share suggestions and sample problems for implementation. Additionally, participants will have opportunities to discuss and share strategies and concerns regarding active learning in the calculus curriculum.

James Condor – State College of Florida

Creative Data Visualization

Data literacy is recognized as a key twenty-first century skill. The presentation will be on the creation of a Creative Data Visualization course that I taught at the Ringling College of Art and Design during the Fall 2022 semester. The course explores a variety of interdisciplinary topics while focusing on building skills in quantitative and scientific literacy such as interpretation of different forms of evidence, data visualization and use, and creative way to present the data visually. Students focus on applying learned concepts and skills to visualize their own data, interpret the findings, and examine the impacts on data-driven decisions. The purpose and creation of the data visualization course and the current state of how this course is being implemented into the general education curriculum at colleges across the country will be open for participants to discuss. An opportunity for questions and answers will be available throughout the time period for attendees.

Session II-A

Justin Hoffmeier – Florida Polytechnic University

Exact zero-divisor subgraphs

In algebra we often use the zero product property that states two non-zero complex numbers cannot have a product that is zero. However, there are many mathematical systems where this statement fails: if the product of two non-zero elements is zero then they are called zero-divisors. For a zero-divisor x, the annihilator of x is the set of all elements whose product with x is zero. In some cases, the annihilators are generated by just one element and can exhibit a certain duality which leads to the notion of an "exact" zero-divisor. In this talk we will identify these types of annihilators from a graph of zero-divisors. By focusing on the integers modulo n, this talk is very accessible for those of all backgrounds.

George Prodanoff (Undergraduate Student) – University of Florida

Skewness and Kurtosis in Flow Cytometry Analysis Results of Targeted Melanoma Therapy

Conventional chemotherapy uses mainly alkylate and anthracyclines as antimetabolic agents to kill all cells that divide quickly leading to treatment failure. Newer, targeted cancer drugs invoke primarily the death of cancer cells while selectively limiting death of healthy cells, but individual treatment success still varies greatly between patients. In this brief study, we quantified the response profiles of eight melanoma patients treated with the same targeted anti-PD immunotherapy and assessed the applicability of using third momentum and higher-order statistics for categorical classification of each patient's response by using results from flow cytometry. The data set used has been previously produced by researchers from the Institute of Experimental Immunology at the University of Zurich and is publicly available from flowrepository.org. Our visualizations demonstrate that distribution shapes of therapy-induced cell apoptosis vary between patients and hence skewness and kurtosis may be used to model those differences.

Lindsey Fox and Sean Murphy – Eckerd College

AP Precalculus: Gift or Gimmick?

As of the 2023-2024 academic year, the College Board will offer a new AP course in Precalculus (cb.org/ap-precalculus). The College Board indicates this course will be accessible to a broader range of students than other AP courses, thus increasing equity and inclusion. Additionally, a national body of high school teachers trained to teach a designated curriculum may improve the overall quality of high school precalculus. However, some have concerns about the ambitious list of topics in the curriculum. Others have concerns about offering college credit for what has traditionally been a high school course. What are your thoughts? Does your institution offer a Precalculus course? If so, how does the curriculum list compare to the material covered in your course? Will your institution be offering college credit for students with appropriate test scores in AP Precalculus? What are appropriate scores? How will this affect placement into Calculus I? We will facilitate a roundtable discussion on these pertinent questions/concerns during this session.

Albert Madinya (Graduate Student) – Florida Atlantic University

Topologizing the Space of Minimal Primes of an M-Frame

An M-frame is an algebraic frame possessing a unit and satisfying the Finite Intersection Property. Given an M-frame, call it L, we can topologize the set of minimal prime elements of L, which we will denote by Min(L). One such way we could topologize Min(L) is with the Zariski topology as is done with the prime ideals of a commutative ring. The other is the inverse topology which has a similar construction to that of the Zariski topology. Our aim in this talk to is to study these topological spaces and the interplay that exists between the topological properties of Min(L) and the frame-theoretic properties of L.

Matthew Brenneman and Rebecca L. Pierce
Embry-Riddle Aeronautical University
Ball State University

We Teach the Wrong Things, In the Wrong Order, in the Wrong Way

The title of our talk is a quote made by Dick DeVeaux over seven years ago as a call-to-action that we rethink how we teach statistics. Although the guidelines from the Guidelines for Assessment and Instruction in Statistics Education (GAISE) report have been published over a decade ago and are now part of practically every introductory statistics textbook, we will present results that suggest DeVeaux was right. Our survey of students in an introductory statistics course reveals they are not learning the first (and most important) GAISE guideline, "to teach statistics as an investigative process of problem-solving and decision-making"? We show that students seem to know the steps but not the purpose of the statistical process. We present an underlying cause for this educational disconnect and a solution in the form of a new pedagogical framework for statistics, we call QED (Question, Explain, Do).

Session II-B

Cameron Fraize (Graduate Student) – University of Florida

Extraction Rates of Random Continuous Functionals

We study the extraction rate, or output/input rate, on algorithmically random continuous functionals on the Cantor space 2^{w}. It is shown that random functionals have an average extraction rate of producing a single bit of output, and that this average rate is attained for any (relatively) random input.

Lindsey Fox – Eckerd College

The effect of governance structures on optimal control of two-patch epidemic models

Infectious diseases continue to pose a significant threat to the health of humans globally. While the spread of pathogens transcends geographical boundaries, the management of infectious diseases typically occurs within distinct spatial units, determined by geopolitical boundaries. The allocation of management resources within and across regions (the "governance structure") can affect epidemiological outcomes considerably, and policy makers are often confronted with a choice between applying control measures uniformly or differentially across regions. Here, we investigate the extent to which uniform and non-uniform governance structures affect the costs of an infectious disease outbreak in two-patch systems using an optimal control framework. We compare results from two systems of differential equations representing transmission of cholera and Ebola, respectively, to understand the interplay between transmission mode, governance structure and the optimal control of outbreaks. Understanding how governance structure affects both the optimal control functions and epidemiological outcomes is crucial for the effective management of infectious diseases going forward.

Oday Hazaimah – Saint Louis University

Gradient Methods in Non-smooth Optimization

Optimization algorithms are at the core of machine learning models in which gradients play a crucial role for solving convex optimization problems and their dual variational inequalities. Preliminaries and relations between optimization and inclusion problems are introduced. Classical Gradient-based methods and their variants find the solution by evaluating the smooth operator twice per iteration. Our goal is to avoid evaluating an extra-gradient step per iteration with strong convergence for non-smooth problems. This can be done through the lens of cutting-plane methods, that is, by finding a suitable hyperplane that separates the solution from the current iterate.

Contributed Papers Session III

Full Session

Deborah Howard - Valencia College

Making a Difference through a Professional Development Experience

Want to Make a Difference? Are You Seeking to Create a Professional Development Experience? This talk will focus on the best practices around creating and implementing a successful professional development opportunity. In addition, the presenter will share experiences of an NSF-funded faculty PD program intended to create institutional change in the incorporation of active learning in the mathematics classroom through peer-mentorship.

Dennis Perusse – University of North Florida

Examples, results, and ideas for high impact practices in mathematics focusing on student engagement, learning, and achievement

This talk focus on lessons learned implementing undergraduate research, case study/contextualized take home exams, place-based learning, 3d printing, civic engagement, and several other exciting buzz words while teaching in Hawaii. This talk will also include brief mention of current innovations on incorporating lessons on encoding braille, using the chat GPT AI, and the utility of an occasional TikTok reference or video. Possible tips on how to make easy loaded dice and a great video to demonstrate translations will also be included.

Mohammad Mahabubur Rahman (Graduate Student) – Texas Tech University

Remarks on the global regularity issue of the two-and-a-half dimensional Hall-magnetohydrodynamics system

Whether or not the solution to the two-and-a-half dimensional Hall-magnetohydrodynamics system starting from smooth initial data preserves its regularity for all time remains a challenging open problem. Although the research direction on component reduction of regularity criterion for Navier-Stokes equations and magnetohydrodynamics system has caught much attention recently, the Hall term has presented many difficulties. In this manuscript, we discover a certain cancellation within the Hall term and obtain various new regularity criteria: first, in terms of a gradient of only the third component of the magnetic field; second, in terms of only the third component of the current density; third, in terms of only the third component of the velocity field; fourth, in terms of only the first and second components of the velocity field. As another consequence of the cancellation that we discovered, we can prove the global well-posedness of the Hall-magnetohydrodynamics system with hyper-diffusion only for the magnetic field in the horizontal direction; we also obtained an analogous result in the 3-dimensional case via the discovery of additional cancellations. These results extend and improve various previous works. This is the joint work with Prof. Kazuo Yamazaki.

Session III-A

Jared Fletcher (Undergraduate Student) – University of North Florida

Graph-based Groups or Group-based Graphs?

In the first known textbook on Graph Theory, Denes Konig posed the question: "When can an abstract group be interpreted as the group of a graph and if this is the case, how can the corresponding graph be constructed"? We address the parallels between graphs and groups through the concepts of morphism and isomorphism, and discuss Frucht's Theorem, which allows finite groups to be characterized by simple graphs. We present examples, which include a graph construction for the Klein Four-Group.

Jacob B. Aguilar – Saint Leo University

On the Solutions of Nonlinear Dispersive Water Wave Models

The Benjamin-Bona-Mahony equation has proven to be a good approximation for the unidirectional propagation of small amplitude long waves in a channel where the crosswise variation can be ignored. The Benjamin-Bona-Mahony-Kadomtsev-Petviashvili equation is the regularized version of the Kadomtsev-Petviashvili equation which arises in modeling scenarios corresponding to nonlinear dispersive waves that propagate principally along the x-axis with weak dispersive effects undergone in the direction parallel to the y-axis and normal to the primary direction of propagation. There is much literature regarding these well-known equations, however the relationship between the solutions of their underlying pure initial value problems is not fully understood. In this talk, it is shown that the solution of the Cauchy problem for the BBM-KP equation converges to the solution of the Cauchy problem for the BBM equation in a suitable function space, provided that the initial data for both equations are close as the transverse variable $y \to \pm\infty$.

Megan Bennett (Undergraduate Student) – Nova Southeastern University

Minimum k-Blockers of 123-Avoiding Permutation Matrices

A blocker of $n \times n$ permutation matrices is a set of positions in an $n \times n$ matrix that intersects each permutation matrix at least once. A blocker is minimum if removing any position makes it no longer a blocker. Each minimum blocker of 123-avoiding permutation matrices must have a cardinality of at least n, and minimum blockers containing exactly n positions are minimal blockers. The well-known Frobenius-König theorem characterizes the minimal blockers of permutation matrices: any $r \times s$ submatrix is a minimal blocker of all permutation matrices if and only if $r+s=n+1$. Recently, Brualdi and Cao characterized minimal blockers of 123-avoiding permutation matrices, focusing on L-shaped blockers. We continue their study by defining minimum flag-shaped blockers, which we show are generalizations of L-shaped blockers. We investigate the upper and lower bounds of the dimensions of faces, determined by the minimum blockers, of the polytope generated by 123-avoiding permutation matrices.

Matthew Kimm, Gary Marmon, Jay Sparks and Anthony Okafor – University of West Florida

Network Recommendation Methods for Higher Education Applications

We describe network recommendation topics including ranking, personalization, and link prediction along with methods to accomplish these aims. Then, we discuss the current applications of network recommendation in higher education along with our investigations and applications including course ranking, student ranking, student similarity, and personalized course recommendation. We conclude with a discussion on the future possibilities of using network recommendation methods for student success in higher education.

Session III-B

Furio Gerwitz (Undergraduate Student) – University of North Florida

Vertex Coloring and its Application in Code Optimization

A vertex coloring of a simple graph is a function mapping each vertex in the graph to one of a set of unique colors, such that no two adjacent vertices share the same color. The NP-Complete problem of k-colorability concerns determining whether a vertex coloring of a given graph using k colors exists. In this presentation, we will explore the concept of vertex coloring of simple graphs, proving graph-theoretic upper and lower bounds which characterize the chromatic number, or smallest k such that a k-coloring exists for a particular graph. We will demonstrate applications in optimizing compilers, where minimizing the colors used in the coloring function equates to removing redundant variables in the source code of a program.

Weston Dell (Graduate Student) – University of Notre Dame

Financial Literacy and the High School Math Classroom

Florida Governor Ron DeSantis recently passed the Financial Literacy Bill in March of 2022, mandating high school students to take at least one personal finance course for graduation. This begs the question of whether personal finance courses are the best way to improve financial literacy and, ultimately, financial outcomes for young people. In this presentation, I will offer a research-based argument for why it would be a better idea to focus instead on math-based courses that incorporate financial content and applications. More specifically, I argue that math courses can improve both financial literacy rates and financial outcomes with specific changes to curriculum and types of problems solved. As additional evidence, I will reference my own teaching practice as a high school math teacher and education graduate student of two years. This presentation offers interesting, valuable, and important ideas to administrators, teachers, and students at the high school and collegiate level.

Aaron Stringfellow (Undergraduate Student) and Shusen Pu – University of West Florida

Ristić-Balakhrishman-Harris-G Family of Distributions with Applications

In this project, we introduce a new family of distributions that generalizes the Harris-G family of distributions. This new distribution is named the Ristić-Balakhrishman-Harris-G (RB-Harris-G) family of distributions. Statistical and mathematical properties such as reliability measures, incomplete and conditional moments, Reńyi entropy, distribution of order statistics, stochastic orderings, and probability weighted moments of the new family of distributions are discussed. Estimation of the parameters of the Ristić-Balakhrishman-Harris-G family of distributions is performed via the maximum likelihood estimation method. The performance of the estimates is assessed via a Monte Carlo simulation study. The goodness-of-fit of the new distribution is examined via four real data applications.

WORKSHOP TALK and DISCUSSION

Cathie Herzog and Caroline Sampson – Florida State College at Jacksonville

An Overview of MGF 1130 and MGF 1131: Mathematical Thinking in Context

Mathematics Pathways: Algebra, Statistics, and Mathematical Thinking, oh my! FSCJ had the honor to work on two Curriculum Outlines for Florida's third pathway. Introducing MGF 1130, Mathematical Thinking, and MGF 1131, Mathematics in Context. Come and learn about these new courses emphasizing methods of mathematical thinking and mathematics within the context of college, career, and life.

Contributed Papers Session IV

Full Session

Michelle Karkkainen – Valencia College

Creating a "Science Ready" Math Student

What if math and science were not viewed as isolated subjects, but rather as in conjunction with one another? What if students understood, as Roger Bacon expressed it, that "Mathematics is the gateway and key to all sciences?" What if students left their math classes able to recognize and apply the math they had learned in their physics, chemistry or biology course? What if math teachers were able to motivate their students by demonstrating how they would be applying the math they are learning in their next science course and in the real world? The Valencia Math/Science collaboration team has been busy working toward all of these goals. Come and see the progress that has been made so far and consider joining in this effort.

Jacci White and Monika Kiss – Saint Leo University

How do we assess students to encourage learning and discourage cheating?

Students are completing their problem sets online using MyLab Math, Cengage, or some other publisher software. In many cases, students also take exams using these tools. Do they know anything? Learn anything? The number of apps students can use to complete their assignments is staggering. What strategies can we come up with to encourage students to think and learn? What kind of assessment strategies can we implement? How does technology change what we must, want to, and need to have our students be able to do? This session is planned as an open sharing session for participants to contribute what they have tried, both what might work and what has not worked.

Vincent J. Matsko – Eckerd College

Making Calculus Accessible

Many students find mainstream calculus textbooks unreadable. Learn about a project to create an open-source textbook which (1) emphasizes concepts over algebraic manipulation, (2) uses informal language rather than precise mathematical language, (3) illustrates extensively with graphs (static and interactive), and (4) organizes concepts pedagogically rather than adhering to mathematical formalism.

Session IV-A

Kyle Ambrose (Undergraduate Student) – University of North Florida

Regular Expressions Converted to Finite State Automata

We discuss regular expressions, finite state automata, and their applications in string parsing and data validation. The connection between regular expressions and finite state automata was given by Stephen Kleene in 1956 and is now known as Kleene's Theorem. This theorem shows that both regular expressions and finite state automata define the same class of languages. We provide and discuss the proof of Kleene's Theorem with examples.

Jaffar Ali Shahul Hameed - Florida Gulf Coast University

Positive Solutions for a Derivative Dependent - Laplacian Equation with Riemann-Stieltjes Integral Boundary Conditions

Using Banach's contraction principle and Schauder's fixed point theorem, we establish results on the existence and uniqueness of solutions to a fractional boundary value problem of the 1^{st} order and the 2^{nd} order. We also use the Avery–Peterson fixed point theorem to prove the existence of multiple positive solution to the problem. As an application, we prove the existence of at least two positive solutions to a model of hematopoiesis (red blood cell production).

Karin Ebey, Mariana Olivares-Cely (Undergraduate Students), and Lindsey Fox – Eckerd College

Optimal Control Theory to Mitigate the Effects of Resistance to Disinfectants

This study explores how resistance to disinfectants affects disease transmission in long term care facilities and the best disinfectant use strategy. An ODE compartmental model was created describing the transmission of two strains of a pathogen, resistant and susceptible to disinfectants with transmission through direct and surface contact, and evolution of resistance through mutation and horizontal gene transfer. An optimal control problem was set up to determine the best disinfectant use strategy under different cost schemes and resistance levels to minimize costs and cases. The disinfectant strategy depends on whether the system is open or closed and the cost scheme. The epidemic dies out in the closed system but becomes endemic in the open system. The amount of disinfectant used is directly related to the cost of disinfectant. More people become infected at higher levels of resistance. These results have implications for infection management.

Gary Marmon, Matthew Kimm, Jay Sparks, Brian Le, Kelie Kan, and Anthony Okafo – University of West Florida

Identifying previous course contributions to target course grade prediction

A student's course performance can be estimated based on accumulated knowledge components in a course history (course, grade). Course grade prediction assumes that every course in a student's course history is important in the prediction of the target course. Students typically take courses from different departments, however not all the courses or knowledge gained from them directly impact the successful completion of future courses. Using learned parameters from a neural network, we discover the value of the courses in a student's course history and significance of those courses relative to a target course.

Session IV-B

Ryan Farrell (Undergraduate Student) – University of North Florida

Mobius Functions and Inversions for Posets

Like the partial sum of a sequence, many areas of mathematics define functions as cumulative sums over partially ordered sets. This presentation discusses methods for calculating the inverse of such a function using a technique known as mobius inversion. We define the mobius function of a poset, demonstrate the method of mobius inversion, and use it to prove an alternative formula for the Euler phi-function involving primes.

Mozhgan Nora Entekhabi – Florida A & M University

Inverse Problems for Wave and Plates Equations

Inverse source scattering problem and uniqueness of the source arises in many areas of science. It has numerous applications to surface vibrations, elasticity and acoustical and bio-medical industries and medical imaging. In particular, inverse source problem seeks the radiating source which produces the measured wave field. The study aims to provide a technique for recovering the source function of the classical elasticity system and the Helmholtz equation from boundary data at multiple wave numbers when the source is compactly supported in an arbitrary bounded C^2 – boundary domain, establish uniqueness for the source from the Cauchy data on any open non-empty part of the boundary for arbitrary positive K, and increasing stability when wave number K is getting large. Various studies showed that the uniqueness can be regained by taking multifrequency boundary measurement in a non-empty frequency interval (0, K) noticing the analyticity of wave-field on the frequency. This type of inverse source problem is also motivated by the wide applications in antenna synthesis, medical imaging and geophysics.

Francis Baffour-Awuah Junior (Graduate Student) – Florida State University

Proteomic clusters of septic patients using spectral clustering

Sepsis is a syndrome possibly resulting in life-threatening organ dysfunction caused by a dysregulated host response to infection. Early detection and diagnosis can allow for treatment interventions such as antibiotics and intravenous fluids, but this can be inhibited by the heterogeneity surrounding host responses to the syndrome. Heterogeneity in the host response from sepsis is multifaceted resulting from differences in infection source, type of microorganism, patient comorbidities and host genetic factors. The Austere environments Consortium for Enhanced Sepsis Outcomes (ACESO) is conducting an observational study. One aim is to define subgroups of a septic population that follow similar trajectories over time. Here, we quantified concentrations of 28 pro-inflammatory and immune modulatory biomarkers from blood samples of 566 septic patients collected over a year. Subgroups were derived by comparing trends in each patient-biomarker information and using spectral clustering to group similar trends. Several distinct clusters were identified, and a statistical analysis of these clusters revealed significant physical, biological, and clinical differences among them. Taking these subgroups into account may help in the early diagnosis of the syndrome and allow for a more effective identification of treatment and intervention strategies to improve survival of patients.

L.H. Kuo – University of West Florida

Modified Knot Insertion for solving RBF interpolation problems

In recent years, Kernel Based Collocation method utilizing Radial Basis Functions (RBFs) has shown the potential to be a universal mesh-free method for solving interpolation problems and differential equations with highly accurate results. For RBF approximation, the accuracy relies on 1) the value of the shape parameter and 2) the collocation points that are adapted. In this presentation, we introduced a newly developed algorithm, Modified Knot Insertion (MKI), to improve the accuracy of the approximation.

Contributed Papers Session V

Full Session

Joseph Ours – State College of Florida

Student and Instructor Indicators of the Mathematical Processes

The National Council of Teachers of Mathematics (2000) identified five mathematical processes — problem solving, reasoning and proof, communications, connections, and representations — that successful K-12 mathematics students obtain. The Mathematical Association of America and the American Mathematical Association of Two-Year Colleges have recommended these five processes should also be attended to in undergraduate mathematics education, but the field has not established what instructor practices provide students with opportunities to engage in the processes. In this talk, a tool is presented that connects instructor indicators of pedagogical practices with student indicators of the mathematical processes.

Jay Sparks, Anthony Okafor, and Josaphat Uvah – University of West Florida

Targeting First Semester Math Courses Based on Probability of Passing

The success of first-time-in-college (FTIC) students in their first mathematics course is a significant factor for college retention and degree completion. STEM students who attempt, and do well in higher level math in their first year are more likely to earn a higher GPA and be retained the following academic year. Not all students have the same level of math readiness, and the varying math courses offered might not all fit their abilities. Gaps can exist between the different levels of math skills students have upon entering college and the requirements of their chosen major. This research suggests a method for identifying who will pass their first math course based on a student's pre-college factors, demographic factors, and entry major. Assessing a student's probability of success in their first math course will allow advisors to identify those who may be at risk or will need additional support to succeed in their first semester.

Chuck Lindsey – Florida Gulf Coast University

Trigonometry: From Chords to Verses

This talk will go on a rapid-paced excursion through the development of trigonometry, from Hipparchus to the present. This will examine things that have entered the field along the way such as series representations of various kinds, and Fourier Transforms both continuous and discrete. We will also remember and mourn the passing of things that have been mostly left behind, such as versed sine and…tables.

Session V-A

Chris Johnson (Graduate Student) – University of North Florida

The Use of Double Sequence Notions to Establish Multidimensional Summability test for Singular Points of a Double Power Series

It is clear that the closest singular point to the origin of the power series $f(z) = \infty$ as $n \rightarrow 0$ is on the disc of convergence. The difficulty occurs when one tries to identify which point on the disc of convergence is a singular point. In 1965 J.P. King established tests using Taylor and Euler summability methods to identify singular points of power series. The goal of this paper includes but not limited to the use of double sequence notions and to establish multidimensional summability test for singular points of a double power series.

Kevin Murphy – Saint Leo University

Mathematics in Video Games

This talk will discuss a variety of mini-games from the Final Fantasy video game series. Most notably it will dissect the Hands of Time mini-game from Final Fantasy XIII-2 and show how it is really just a graph theory problem with underlying Hamiltonian paths. Does being good at math make you better at video games, and can faculty use video games to help teach mathematical principles in a more enjoyable way?

Caroline Johnson (Undergraduate Student) – University of California Berkeley

Prime, Nonprime Number Patterns, Gaps and Prime Number Conjectures

In this talk we examine counts of the primes and non-prime odd numbers as we look for a pattern or trend in their counts. We examine the gaps of differences between consecutive primes and the gaps of differences between consecutive non-prime odd numbers. We comment on the patterns found as we increase n and examine the counts for equal size of intervals. We explore Nicholson's conjecture and find unusual downward spikes on the right hand side (RHS) of the inequality determining the supremum for the conjecture. Feliksiak (2021) discusses the supremum on the difference of terms of the Nicholson's conjecture. These spikes are phenomenon that should be examined and explored, especially as we widen the scope, increase n and look for the spikes within the windows of larger prime numbers.

Bariaa Shatila and Michael Insalaca – Flagler College

Using Inquiry-based approach in College Algebra courses at Flagler College

In our presentation, we will share some of the inquiry-based lessons that we use in our College Algebra courses that helped our students understand and enjoy learning the material. We will demonstrate why this approach has been successful and why should other mathematics professors adopt it.

Session V-B

Dylan Strickley (Undergraduate Student) – University of North Florida

Polynomial Representations of Integer Partitions

Integer partitions are useful for describing any situation in which indistinguishable objects are placed into indistinguishable boxes. In this presentation, we discuss methods for the enumeration of integer partitions with recurrence relations, generating functions, and exact formulas when the number of boxes is restricted. We show how recurrence relations of integer partitions can be found with Ferrer's shapes and how these recurrence relations connect to the generating functions for integer partitions. We also discuss examples of integer partitions within Diophantine equations, finite Abelian groups, and cyclic forms of Permutation groups.

Channa Navaratna and Menaka Navaratna
Indiana University of Pennsylvania
Florida Gulf Coast University

Recursive approximation filtering in source localization

Technological advances have brought many comforts to mankind, but not without unintended harmful side effects. For example, manufacturing plants constantly produce chemical agents that eventually find their way into the environment. Advancements in chemical and biological technologies have produced many products that in the wrong hands have had devastating results in the past. It is vital to develop methods to quickly and efficiently track and trace the origin of hazardous contaminant particles in order to minimize the damages, as well as to enable location and apprehension of culprits. We investigate ways to use recursive approximation filtering techniques to estimate the origin of contaminant particles using noisy measurements gathered at fixed time intervals.

Susan Krage (Undergraduate Student) – Eckerd College

Optimal Harvesting in an Epidemic Model of Koi Herpesvirus (KHV)

Koi herpesvirus (KHV) is a highly transmissible disease that infects common carp (Cyprinus carpio) and koi, which are carp selectively bred for their aesthetics. Due to the high mortality of the virus (80-100%), ornamental fisheries can suffer economic losses if an outbreak occurs. In this study we use ordinary differential equations to model the transmission dynamics of KHV within and between two pools of koi fish: a juvenile pool, which contain fish too small to be sold, and a market pool, which contain fish that are large enough to be sold and bred. In each pool we include four classes to describe disease status, as well as an environmental reservoir. Since seasonal water temperature plays a vital role in KHV outbreaks and disease severity, many of the disease-related transition rates are dependent on time and temperature. Further, we consider an optimal fishery harvesting problem during an outbreak of KHV.

Matthew Chin (Graduate Student) – Embry-Riddle Aeronautical University

A Statistical Learning Regression Model utilized to determine predictive factors of social distancing during COVID-19

In an application of the mathematical theory of statistics, predictive regression modelling can be used to determine if there is a trend to predict the response variable of social distancing in terms of multiple predictor input "predictor" variables. In this study the social distancing is measured as the percentage reduction in average mobility by GPS records, and the mathematical results obtained are interpreted to determine what factors drive that response. This study was done on county level data from the state of Florida during the COVID-19 pandemic, and it is found that the most deterministic predictors are county population density along with median income.

Contributed Posters Session

Elly Ben Simon (Undergraduate Student) and Dennis Perusse – University of North Florida

Two for Two: an analysis of the univariate multivariable Cobb-Douglas production function

The Cobb-Douglas production function was used and tested by Charles Cobb and Paul Douglas between the years of 1927 and 1947. This function portrays the ratio between two or more inputs and their effect on output and productivity, ceteris paribus. The Cobb-Douglas production function is of the form $P=ALaKb$, where A,, b are positive constants and the variables labor (L) and capital (K) are the inputs in question. Increasing, diminishing, and constant returns to scale are defined and the conditions for a and b in each case are determined. Additionally, a general form of the function P = f(L, K) is examined along level curves to define the marginal product of labor, marginal product of capital, and the marginal rate of technical substitution.

Clayton Jowers (Undergraduate Student), Matthew E. Wolak and Jessica McDonald – University of West Florida

Connections in Graph Theory and Population Pedigrees

In biology, a population pedigree is a diagram of familial history that organizes the relationship among individuals of a population. In mathematics, Graph Theory is the study of graph objects which formalize relations among sets of points (called vertices) and lines that connect two points (called edges). Population pedigrees can be modeled by a particular set of graphs such that the vertices represent the individuals in the population, and the edges dictate the parent-offspring relationship between two vertices. Our aim is to bring these two subjects together so that we may describe phenomena in biology with graphs, discover if natural biological processes give rise to innovative ideas in graph theory, and to otherwise create language that fosters communication and collaboration between biologists and graph theorists on this topic. To that end, we have developed a formal definition of pedigrees as graphs, found metrics known in graph theory to

correlate with values that describe population pedigrees, and began exploring various properties that our defined pedigree graph might hold.

Mingfang Huang (Undergraduate Student) and Jia Liu – University of West Florida

IoT-based Epidemic Monitoring via Improved Gated Recurrent Unit Model

During the Coronavirus Disease 2019 (COVID-19) pandemic, non-contact health monitoring and human activity detection by various sensors have attracted tremendous attention. Robotic monitoring will lessen the danger to medical professionals during the COVID-19 pandemic period. Improving the monitoring model's performance and generalization is a critical but difficult task. This paper constructs an epidemic monitoring architecture based on multi-sensor information fusion and applies it to medical robot services such as patient care, disinfection, garbage disposal, etc. We propose a gated recurrent unit model based on a genetic algorithm (GA-GRU) to realize effective feature selection and improve the effectiveness and accuracy of localization, navigation, and activity monitoring for indoor wireless sensor networks (WSNs). By using two GRU layers in the GA-GRU, we enhance the generalization capability in multiple WSNs. With all these benefits, GA-GRU outperforms other representative algorithms in a variety of evaluation metrics. The experiments on the WSNs verify the proposed GA-GRU leads to successful runs and provides optimal performances. These findings suggest that the GA-GRU method may be preferable for epidemic monitoring in medical and related fields, particularly in relation to controlling epidemics or pandemics like the COVID-19 pandemic.

Ihsan E. Buker (Undergraduate Student), and Samantha Seals – University of West Florida

Jackknife Variance Estimator for Datasets Containing Multiply Imputed Outcome Variables Under Uncongeniality: A Monte Carlo Simulation Study

Missing data is an issue ubiquitous in statistics. Today, multiple imputation (MI) is one of the most commonly utilized approaches to provide valid statistical inferences in the presence of missing data. Accompanying MI is the issue of uncongeniality, which occurs when the imputation model and the analysis model make different assumptions. A set of rules proposed by Rubin to pool parameter estimates was shown to produce biased point estimates under uncongeniality and either conservative or anti-conservative variance estimates. Combined MI and resampling methods have been proposed as robust estimators. Bootstrapping, one of the most commonly utilized resampling methods alongside MI to obtain proper estimates, has its basis in asymptotic theory. As such, the need for a robust estimator remains in small samples frequently encountered in biological studies. We propose a jackknife estimator for small, multiply imputed datasets, the performance of which is investigated using a Monte Carlo simulation study. Accordingly, the recommendation is made to replace Rubin's rules as the de facto standard. An implementation of the proposed jackknife variance estimator in R is provided.

Plenary Sessions

Hortensia Soto, MAA President – Colorado State University

Bio: Hortensia Soto is a Professor of Mathematics at Colorado State University. She has been a member of the MAA since 1989. In 1996, as a Project NExT fellow, she became an involved member and in 2002 she began her role as a working member of the MAA. Her first working role was as the Governor for the Rocky Mountain Section; this led to serving on numerous MAA committees. Such committees include the Strategic Planning Committee Finance Working Group, the Minicourse Committee, and the Carriage House Advisory Board. She later served as secretary/treasurer of her section and the Governor for Minority Representation, which led to serving on the Committee for Professional Development.

She first became a member of the Executive Committee in 2013, when she began her 4-year term as the Associate Treasurer, which included serving on the Budget Committee (as chair), the Investment Committee, and the Compensation Committee. Currently, she serves as the Associate Secretary where she primarily organizes the annual meetings. She has also served as the Chair and Treasurer of the SIGMAA on RUME. Furthermore, her expertise in mathematics education was instrumental in creating the MAA Instructional Practices Guide. Most recently, she received the MAA Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics. As a mathematics educator, Hortensia has published in various areas of mathematics education including assessment, mathematical preparation of elementary teachers, outreach efforts for high school girls, and especially in the area of teaching and learning of undergraduate mathematics. Her current research efforts are dedicated to investigating the teaching and learning complex analysis, where she adopts an embodied cognition perspective and is part of the Embodied Mathematics Imagination and Cognition community. Since her days as an undergraduate student, Hortensia has mentored young women and promoted mathematics via summer outreach programs. She has also been involved with facilitating professional development for K-16 teachers in Nebraska, Colorado, and California. Currently, she is delivering professional development to collegiate teachers as part of Project PROMESAS SSC (Pathways with Regional Outreach and Mathematics Excellence for Student Achievement in STEM).

***C**ompassion in & **A**ccess to **L**earning **M**athematics (**CALM**)*

Research indicates that students from minoritized groups are more likely to pursue STEM degrees if they can see how these fields benefit their communities and if they are in classrooms where they experience micro or macro-affirmations. In this presentation, I will share my perspectives, based on research and personal experiences, on how we can create learning environments that provide our students access to learning mathematics. I argue that we can help students see the value of mathematics by challenging them, providing a supportive learning environment, and creating a space where they have a voice in their learning.

Talithia Williams, MAA Pólya Speaker – Harvey Mudd College

Bio: Talithia Williams is a host of the PBS series NOVA Wonders, a groundbreaking professor, popular TED speaker, inspiring author and passionate STEM/STEAM advocate. She has made it her life's work to get people of all ages and backgrounds excited about the bold possibilities of a STEM education and to "STEMpower" women and minorities to enter these professions. Her latest book, Power in Numbers: The Rebel Women of Mathematics reflects Williams' passion to re-brand the field of mathematics as anything but dry, technical or male-dominated. Renowned for her popular TED Talk, "Own Your Body's Data," she advocates for all of us to deploy data as a way of taking charge of our own health. A vibrant, engaging and energizing speaker, Dr. Williams demystifies data, statistics, probabilities and the mathematical process in amusing and insightful ways. She also passionately champions the contributions of scientists, technologists, engineers and mathematicians and their vital role in transforming our future.

Dr. Williams is Associate Dean for Faculty Development and Diversity and Associate Professor of Mathematics at Harvey Mudd College, where she develops statistical models which emphasize the spatial and temporal structure of data, applying them to real world problems. Focused on data analytics, mathematics, statistical modeling and STEM outreach, she is the first African-American woman to achieve tenure at the college. She hosts NOVA Wonders, a PBS mini-series that explores the biggest questions on the frontiers of science. The Los Angeles Times praised the show for sending the message "that scientists come in a range of ages, genders, colors and hairstyles." She also appeared in NOVA's Prediction by the Numbers, a series exploring the history of probabilities and gambling which Forbes called, "an entertaining, fun piece that conveys her knowledgeable and deep interest in this predictive method." In addition to her teaching and television work, she has partnered with the World Health Organization in developing a cataract model used to predict the cataract surgical rate for countries in Africa. Her professional experiences include research appointments at NASA's Jet Propulsion Laboratory, NASA's Johnson Space Center, and the National Security Agency.

An exceptional communicator and gifted teacher, Dr. Williams won the Mathematical Association of America's Henry L. Alder Award for distinguished teaching. She also developed a 24-part college level lecture series, "Learning Statistics: Concepts and Applications in R", for The Great Courses, an online platform for lifelong learners. Dr. Williams earned a bachelor's degree in mathematics from Spelman College, a master's degree in mathematics from Howard University and a PhD in statistics from Rice University. In 2019, she received an honorary doctorate from Fielding Graduate University for her "substantial impact on higher education" and for "championing the development of women in the STEM professions." Described by audiences as engaging, relevant, funny, accessible, and a joy to work with, Dr. Williams captivates and inspires with her contagious enthusiasm for STEM in general and math in particular. Applying the data-driven approach made famous in her TED talk to a range of subjects, she takes sophisticated numerical concepts and makes them understandable to a wide audience, debunking perceptions with an energizing call to "show me the data!"

Power in Numbers: The Rebel Women of Mathematics

The movie "Hidden Figures" brought visibility to the lives of African American women who served as NASA "human computers" in the 1960s, women who dreamed the impossible in a field where their presence was lacking. When it comes to inspiring the future productivity and innovation of our nation, women mathematicians are on the front lines. In this talk, I'll discuss my personal journey as a woman of color in mathematics and share ways we can excite public interest in mathematics, building upon the rich legacy of the Hidden Figures that have come before us. As we shift the fixed mindset around mathematics ability, we can begin conversations that improve public perception of STEM and bring people from all backgrounds into this important work.

Keshav Acharya, FL State Speaker – Embry-Riddle Aeronautical University

Bio: Keshav Acharya is an associate professor in the Department of Mathematics at Embry-Riddle Aeronautical University, Daytona Beach Campus. Before joining Embry-Riddle, he was a lecturer at Kennesaw State University at Kennesaw, Georgia (2013-2015). He received a Ph. D. in Mathematics from the University of Oklahoma in 2013 and MSc from the Norwegian University of Science and Technology, Norway in 2005. He earned his BA and MA from Tribhuvan University, Nepal. His area of research broadly lies in functional analysis, operator theory and differential equations and their applications. More specifically, he focuses on the spectral analysis of Schrödinger operator, Jacobi operator, and canonical systems.

On the Spectral Theory of Canonical Systems

Canonical systems are systems of first order differential equations which generalize Schrödinger, Jacobi, Dirac and Sturm-Liouville equations, fundamental equations in quantum mechanics. These systems play central role in the spectral theory of the operators induced from these equations as the systems realize arbitrary spectral data. In this talk, I will discuss on the spectral theory of canonical systems. Further, some interesting properties of fundamental solutions of 2N dimensional canonical systems including a Floquet theory of periodic canonical systems will be presented.

SPECIAL THANKS TO

The Organizing Committee

Keshav Acharya
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