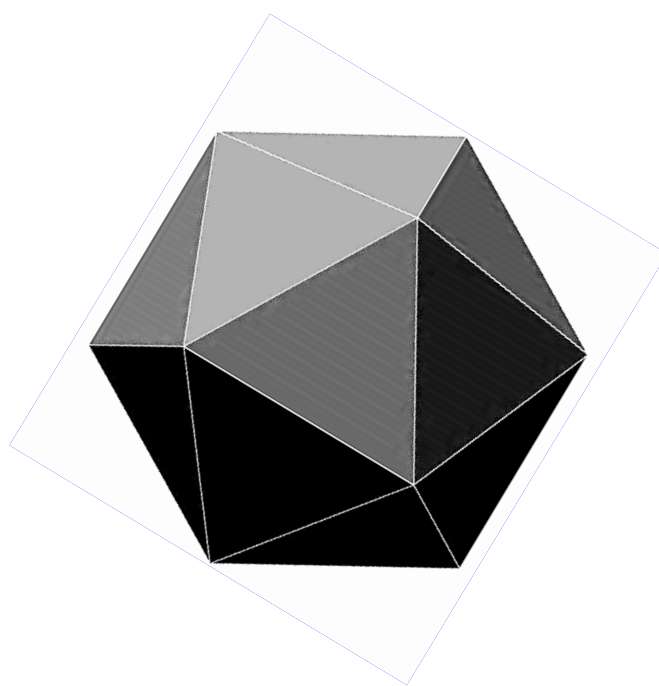




**2024 Joint Meetings
Of The
Florida Section
Of The
Mathematical Association of America
And
The Florida Two-Year College Mathematics
Association**



Florida Gulf Coast University

February 23-24, 2024

Florida Section of the Mathematical Association of America

2023 – 2024

Section Representative	Monika Kiss, Saint Leo University
President	Sean Murphy, Eckerd College
Past President	Lubomir Markov, Barry University
Vice-President for Programs	Kevin Murphy, Dominican University
Vice-President for Site Selection	Gregory McColm, University of South Florida
Secretary-Treasurer	Sidra Van De Car, Valencia College
Newsletter Editor	Daniela Genova, University of North Florida
Coordinator of Student Activities	Jacob Aguilar, Saint Leo University
Webmaster	Altay Özgener, State College of Florida
President-elect	Chuck Lindsey, Florida Gulf Coast University
VP for Programs-elect	Anthony Okafor, University of West Florida
VP for Site Selection-elect	Joseph Ours, State College of Florida

Florida Two-Year College Mathematics Association

2023-2024

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
Treasurer	Ryan Kasha, Valencia College
Newsletter Editor	Sandra Seifert, Florida SouthWestern State College
Membership Coordinator	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 23, 2024

FL – MAA

10:00 – 12:00	FL-MAA Executive Committee Meeting	AB9 209
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FTYCMA

11:00 – 12:30	FTYCMA Annual Business Meeting	AB9 207
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CONFERENCE

11:00 – 6:00	Registration and Hospitality Room	AB9 214
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Please note that for the duration of the conference we have designated **AB9 214** as the *Hospitality Room* where you can meet with old and new friends. Enjoy the conference! **The Guest Wifi is fgcu-campus**

WELCOME

1:45 – 2:00	Welcoming Remarks	AB9 106
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Dr. Mark Rieger, Provost, Florida Gulf Coast University
 Sean Murphy, President, FL-MAA
 Sybil Brown, President, FTYCMA

2:00 – 2:50	Plenary Session	AB9 106
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Allen Butler, MAA Board of Directors
 Daniel H. Wagner Associates

Bayes' Theorem – Making Rational Decisions in the Face of Uncertainty

3:00 – 4:50	Student Events	SRHM 110
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3:00 – 3:50	Student Integration Contest	
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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 their achievement.

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

3:00 – 3:45 Contributed Papers Session I

Full Session

Susan Bryan and Whitney Porter **AB9 111**
Wiley

*Bridging the Knowledge Gap and Encouraging Equity
with Alta's Dynamic Remediation*

Dennis Runde **AB9 207**
State College of Florida

*From Babylon to Fort Myers: How Mathematics Forges Connections
Across the Bounds of Time, Culture, and Geography!*

Ted Andresen **SRHM 111**
Honeywell Aerospace & SPC

Using Statistical and Mathematical Tools for Investing in the SPY

Session A 3:00–3:20

Shaikh Obaidullah **AB9 106**
Florida State University

*Computational Analysis of Polyethylene Glycol (PEG)'s
Impact on Gut Microbiota*

John Diller (Undergraduate Student) **AB9 113**
University of North Florida

Ramsey Theorem and Erdős-Szekeres Theorem

Bariaa Shatila and Michael Insalaca **AB9 209**
Flagler College

*The Effectiveness of Thoughtful Test Corrections on Students'
Attitudes and Learning Outcomes in Mathematics Courses*

Sam Northshield **AB9 309**
SUNY-Plattsburgh Emeritus

A Short Proof of Fermat's Two-Square Theorem (Using Graph Theory)

Session B 3:25–3:45

Peng Feng AB9 106
Florida Gulf Coast University

*A Spatial Model to Understand Tuberculosis Granuloma
Formation and Disease Progression*

Vi Nguyen (Undergraduate Student) AB9 113
University of North Florida

The Domination Number of a Graph

Bariaa Shatila and Michael Insalaca AB9 209
Flagler College

*Discover the Power of Inquiry-Based Mathematics Instruction:
Unveiling Students' Attitudes*

Justin Hoffmeier and Mathew Deltano AB9 309
Florida Polytechnic University

*Computational Progress and Conjectures for Exact Zero-Divisor
Subgraphs*

4:00 – 4:45 Contributed Papers Session II

Full Session

Megan McDaniel AB9 111
Hawkes Learning

Mastering MGF 1130 & 1131: A Turnkey Solution for Florida Educators

Mike Long AB9 207
Polk State College

Beyond the Number Line

Scott Hochwald SRHM 111
University of North Florida

Mathematical Surprises

Session A 4:00 – 4:20

Jaffar Ali Shahul-Hameed
Florida Gulf Coast University

AB9 106

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

Kayla Taylor and Mackenzie Meni (Undergraduate Students)
Florida Institute of Technology

AB9 113

PEEKing into the Universe for a Talk

Milé Krajcevski
University of South Florida

AB9 209

*Implementing Drawing as a Predictive and Productive Tool
in Undergraduate Vector Calculus*

Donald McGinn and Ross Belgram
University of West Florida

AB9 309

Hyper Face-Magic Graphs

Session B 4:25 – 4:45

Emma Sandidge
Florida Institute of Technology

AB9 106

*An Implementation of 3D Gaussian Splatting
for Characterizing Satellite Geometries*

Blake Gisclair and Alex Merino (Undergraduate Students)
Florida Institute of Technology

AB9 113

*Classification of Infrasonic Signals under Imbalanced
Training Sets with Boosted Trees*

Mozhgan Nora Entekhabi
Florida A & M University

AB9 209

Inverse Problems for Wave Propagation in 2 and 3 Dimensions

Thomas Luckner
Flagler College

AB9 309

Widely Digitally Delicate Brier Primes

5:00 – 5:45	Section Representative’s Session	AB9 106
	<p>Monika Kiss Saint Leo University</p> <p><i>What Can the MAA Do for You and What Can You Do for the MAA?</i></p>	
5:00 – 5:50	Publisher and Sponsor Exhibits	AB9 211
	Browse the displays of participating publishers and learn about their new textbooks and online platforms. Stop by and thank our sponsors for supporting our conference and students.	
5:00 – 5:50	Graduate Recruitment Fair	SRHM 111
	Students are invited to visit the booths of the participating universities to learn more about their graduate programs.	
6:00 – 6:50	Plenary Session	AB9 106
	<p>Emilie Purvine, MAA AWM Speaker Pacific Northwest National Laboratory</p> <p><i>Graphs and Hypergraphs and Topology, Oh My!</i></p>	
7:00 – 8:30	Dinner Banquet	SRHM 114

Saturday, February 24, 2024

8:45 – 9:00	Welcome back! Registration open	AB9 214
9:00 – 9:45	Contributed Papers Session III	
	Session A 9:00 – 9:20	
	<p>Dennis Perusse University of North Florida</p> <p><i>What is the Difference Between What a Student Sees and a Math Teacher Sees?</i></p>	AB9 106
	<p>Vincent Stafford (Undergraduate Student) Wilkes Honors College of Florida Atlantic University</p> <p><i>A Mathematical Approach of Cost Optimization Algorithms on Quantum Computers</i></p>	AB9 111

Jay Sparks, Matthew Kimm and Anthony Okafor AB9 112
University of West Florida

Understanding the Impact of College Variables on On-Time Graduation

Faysal Chowdhury AB9 113
Florida Gulf Coast University

Inference on Two-Parameter Maxwell Distributions

Zhisheng Shuai AB9 207
University of Central Florida

*Advancing Mathematical Modeling: Innovative Courses
and Training at the University of Central Florida*

Yuanchang Sun AB9 209
Florida International University

Enhanced Peak Separation in Overlapped and Noisy Spectral Data

Joy D'Andrea AB9 222
University of South Florida

A Glimpse of Duality of Isohedral and Isogonal Solids

Michael Schroeder AB9 309
Stetson University

Transversals in Cayley Tables

Session B 9:25 – 9:45

Dennis Perusse AB9 106
University of North Florida

*Increasing Student Engagement by Incorporating Uncommon but
Effective Undergraduate Research In and Outside of Math Classes*

Megan Bennett (Undergraduate Student) AB9 111
Nova Southeastern University

Flag-Shaped Blockers of 123-Avoiding Permutation Matrices

Matthew Kimm, Jay Sparks, Gary Marmon and Anthony Okafor AB9 112
University of West Florida

Course Recommendation Using Co-HITS

Shimin Zhang (Graduate Student) AB9 113
University of South Florida

Review for Deep Reinforcement Learning in Portfolio Optimization

Laura Yang AB9 207
University of Central Florida

*Math Knights: UCF's Premier Program for Excelling in
High School Math Competitions and Enrichments*

Channa Navaratna and Menaka Navaratna AB9 209
Indiana University of Pennsylvania and Florida Gulf Coast University

*Enhancing Computational Efficiency in Source Localization
Through Particle Filtering*

Milo Schield AB9 222
New College of Florida

*Weighted Averages: A Simple Tool for Teaching
an Advanced Topic – Confounding*

Bernadette Mullins AB9 309
Florida Polytechnic University

The Impact of Inquiry-Based Learning on Numerical Reasoning

10:00 – 11:45 Workshop Talks and Discussion

Milo Schield AB9 222
New College of Florida

Teaching Confounder-Based Statistical Literacy

Jared Bunn and Manoj Lamichhane AB9 309
Florida Polytechnic University

Team-Based Inquiry Learning Workshop

10:00 – 10:45 Contributed Papers Session IV

Full Session

Jerome Tuttle AB9 112
Southern New Hampshire University

Data Analysis of Credit Score

Robert Cappetta
Florida SouthWestern State College

AB9 207

*Using Artificial Intelligence to Improve
Teaching and Learning Mathematics*

John Shea
Lake Sumter State College

AB9 209

A New Way to Characterize Cusps and Corners of Curves

Session A 10:00 – 10:20

Jenna Bradley, Dennis Perusse and Salika Sar
University of North Florida

AB9 106

*Where Are All the Proofs?! Three UNF Math Instructors Discuss
Their Experiences Being New Education Doctoral Students Living
and Working in the Liminal Space Between Two Disciplines*

Diana Dancea (Undergraduate Student)
Nova Southeastern University

AB9 111

*Marriage and Math? Establishing Connections Between
Hall's Marriage Theorem and Birkhoff's Theorem*

Albert Madinya (Graduate Student)
Florida Atlantic University

AB9 113

Topologizing the Space of Minimal Primes of an Algebraic Frame

Session B 10:25 – 10:45

Joseph Ours
State College of Florida

AB9 106

Strengthening Academic Integrity in Online Testing

Donn Christy (Undergraduate Student)
University of North Florida

AB9 111

Word Splicing with Membrane Systems

Dilara Vefa Ayyildiz (Graduate Student)
Florida Polytechnic University

AB9 113

*Enhancing Autonomous Driving AI Models for Emergency Vehicle
Recognition Through Data-Driven Synthesis:
A Case Study on 911 Call Records*

11:00 – 11:45 Contributed Papers Session V

Full Session

Duval Zephirin AB9 112
Florida SouthWestern State College

*Portfolio Maximization for Investors in Fads Models
Driven by Lévy Processes*

Maggie Swanson, Nicole Legge, Rita Morgan and Abbey Misirian AB9 207
Florida Gulf Coast University

Exploring A Flipped Model Classroom

Shibo Liu AB9 209
Florida Institute of Technology

*Surjections Between Euclidean Spaces, Changing Variable Formula
and Brouwer Fixed Point Theorem*

Session A 11:00 – 11:20

Jacci White, Monika Kiss, and Abby Burrows AB9 106
Saint Leo University

*Artificial Intelligence: How it Can Enhance Rather than
Replace Intelligence in Math*

Jessica Marconi (Undergraduate Student) AB9 111
University of North Florida

Bezout's Theorem

Kun Bu (Graduate Student) AB9 113
University of South Florida

*Comparative Analysis of Sentiment in Original and Summarized
Tweets: Leveraging Transformer Models for Enhanced NLP Insights*

Session B 11:25 – 11:45

Sidra Van De Car AB9 106
Valencia College

Peer Review as a Tool to Improve Inclusive Active Learning Lessons

Daniela Genova
University of North Florida

AB9 111

Engaging Students Through Class Projects and Presentations

Sameer Anand (Graduate Student)
University of South Florida

AB9 113

Real Data-Driven Analytical Modeling of Social Media stocks

12:00 – 12:50 Contributed Posters Session

AB9 211

Donn Christy, Furio Gerwitz, and Jacob Sutton (Undergraduate Students)
University of North Florida

Perfect Codes and Error-Correcting Codes

John Diller (Undergraduate Student)
University of North Florida

Matchings and The Marriage Theorem

Ryan Farrell (Undergraduate Student)
University of North Florida

Using Matrix Grammars to generate the Fibonacci Sequence

Kristian Hayward (Undergraduate Student)
Florida Atlantic University

An Elementary Approach to Tensors with Applications

Jessica Marconi and Dylan Strickley (Graduate Students)
University of North Florida

The St. Petersburg Problem

12:00 – 12:50 Graduate Recruitment Fair

AB9 138

Students are invited to visit the booths of the participating universities to learn more about their graduate programs.

1:00 – 1:50

Plenary Session

AB9 106

Derek Buzasi, FL State Speaker
Florida Gulf Coast University

The Mathematics and Music of the Stars

1:50 – 2:00	Closing Remarks	AB9 106
	Sybil Brown, President, FTYCMA Sean Murphy, President, FL-MAA	
2:10 – 3:30	Luncheon, Award Ceremony and FL-MAA Business Meeting	AB9 138

ABSTRACTS

Contributed Papers Session I

Full Session

Susan Bryan and Whitney Porter – Wiley

Bridging the Knowledge Gap and Encouraging Equity with Alta's Dynamic Remediation

The mission of Wiley's affordable, accessible, and adaptive learning platform, Alta, is to bridge knowledge gaps and put achievement within reach for all students. In this presentation, we will explore how the power of adaptive learning can bridge prerequisite knowledge gaps and address state curriculum requirements without asking instructors to stretch themselves even further than they already do. Integral to this discussion will be an exploration of the qualitative and quantitative data about the success of Alta and adaptive learning as an equitable solution for students across all levels of math in higher education. We will give special attention to courses that are under review as a part of the Florida math redesign.

Dennis Runde – State College of Florida

From Babylon to Fort Myers: How Mathematics Forges Connections Across the Bounds of Time, Culture, and Geography!

Mathematics is based on a rich and diverse history. The ten (or more) vignettes presented will focus on some lesser known, but very lively and interesting, stories that highlight the universality and diversity of mathematics. The presentation will allow participants to do historical mathematics and to share their own knowledge and experiences. Participants should bring some paper and a pencil...and maybe a calculator!

Ted Andresen – Honeywell Aerospace & SPC

Using Statistical and Mathematical Tools for Investing in the SPY

The SPY is the largest Exchange Traded Fund (ETF). Its value is set to equal 10% of the Standard & Poor's 500. It and the DOW have crashed several times since 1987. The industry's statistics, orders (tools) and math-based tools will be presented to help investors anticipate crashes, and carefully grow their investment during a recovery. The Linear Least Squares slope will be compared to the industry's commonly cited 50-day and 200-day moving averages. Mathematical tools such as the greater and less than inequalities are similar to the industry's Stop-Buy and two types of Stop-Sell orders. How the tools were used before and after the COVID-19 crash will be covered. A handout summarizing all the terminology in mathematical and "investing service" terms will be provided at the end to all attendees.

Session I-A

Shaikh Obaidullah – Florida State University

Computational Analysis of Polyethylene Glycol (PEG)'s Impact on Gut Microbiota

This presentation focuses on the computational analysis of the impact of Polyethylene Glycol (PEG), a widely used osmotic laxative, on gut microbiota, particularly examining the response of two significant bacterial families, Bacteroidaceae and Muribaculaceae. The study employs a mathematical modeling approach, integrating the competitive exclusion principle to explore the dynamics of these bacterial families under varying concentrations of PEG. The models are refined and validated using advanced optimization techniques like Differential Evolution, ensuring accuracy in parameter estimation and prediction alignment with empirical data. Key observations include the resilience of Bacteroidaceae to PEG-induced osmotic stress and the vulnerability of Muribaculaceae, highlighting their distinct adaptive strategies. This research provides a deeper understanding of microbial interactions in response to osmotic challenges. It sheds light on the broader implications of PEG on gut health, offering valuable insights for future therapeutic strategies and microbiota management.

John Diller (Undergraduate Student) – University of North Florida

Ramsey Theorem and Erdős-Szekeres Theorem

We explore Ramsey Theorem for graphs, discuss different versions of it and their proofs: for two groups and a generalization for three or more groups. We also discuss how Ramsey Theorem is used to prove the Erdős-Szekeres Theorem. We conclude by presenting various applications of Ramsey Theorem.

Bariaa Shatila and Michael Insalaca – Flagler College

The Effectiveness of Thoughtful Test Corrections on Students' Attitudes and Learning Outcomes in Mathematics Courses

This study aims to investigate the effectiveness of test corrections as a learning tool and explore students' attitudes toward them in undergraduate mathematics courses. Additionally, the study will examine the impact of test retakes on student academic performance and determine which approach is more beneficial. The study will offer a comparative evaluation of the two practices and their effects on students' learning outcomes.

Sam Northshield – SUNY-Plattsburgh Emeritus

A Short Proof of Fermat's Two-Square Theorem (Using Graph Theory)

In 1990, Zagier provided a one sentence proof that every prime congruent to 1 modulo 4 is a sum of two squares. While attempting to understand Zagier's proof, I came up a short proof of my own.

A consequence is an easily implemented algorithm for finding the two numbers whose squares sum to a given prime.

Session I-B

Peng Feng – Florida Gulf Coast University

A Spatial Model to Understand Tuberculosis Granuloma Formation and Disease Progression

Tuberculosis (TB) is caused by a bacterium called *Mycobacterium tuberculosis* (Mtb). When Mtb enters inside the pulmonary alveolus, it is phagocytosed by the alveolar macrophage, followed by a cascade of immune responses. This leads to the recruitment and accumulation of additional macrophages and T cells in the pulmonary tissues. A key outcome of this is the formation of granuloma, the hallmark of TB infection. In this talk, we present a mathematical model of the evolution of granuloma by a system of partial differential equations that is based on the classical Keller-Segel chemotaxis equation. We investigate the effect of different parameters on the formation of granuloma. We present numerical simulation results that illustrate the impact of different parameters. The implication of our result on the disease progression is also discussed.

Vi Nguyen (Undergraduate Student) – University of North Florida

The Domination Number of a Graph

A dominating set in a graph is a subset of the vertices in the graph such that every vertex of the graph is either in the dominating set or is adjacent to a vertex in the dominating set. The minimum size of a dominating set for a particular graph is its domination number. We discuss some well-known results and provide several applications.

Bariaa Shatila and Michael Insalaca – Flagler College

Discover the Power of Inquiry-Based Mathematics Instruction: Unveiling Students' Attitudes

Join us on an exciting journey towards a more effective and enjoyable way of teaching Mathematics. Our presentation will showcase the incredible power of inquiry-based learning in College Algebra and Pre-Calculus courses. By adopting this approach, you can inspire your students and witness their growth in engagement, understanding, and practical application of mathematical concepts. Collaborative and active discovery-based learning has transformed our classrooms. Now, we want to share our success with you. Don't miss out on the opportunity to revolutionize your teaching. Join us and learn how to make Mathematics enjoyable for everyone!

Justin Hoffmeier and Mathew Deltano – Florida Polytechnic University

Computational Progress and Conjectures for Exact Zero-Divisor Subgraphs

In the integers modulo n , x and y are a pair of exact zero-divisors if the multiples of x are exactly the elements whose product with y is zero. The exact zero-divisor graph displays these exact pairs as a subgraph of the well-known zero-divisor graph. In this talk, we discuss recent progress for computing exact zero-divisor graphs in Mathematica and state conjectures based on examples now easily accessible from this computation. Many of the concepts discussed here also have relevant counterparts for rings other than the integers modulo n .

Contributed Papers Session II

Full Session

Megan McDaniel – Hawkes Learning

Mastering MGF 1130 & 1131: A Turnkey Solution for Florida Educators

Join us as we showcase a custom-built course tailored for the new MGF 1130 & 1131 standards in Florida. Learn how our ready-made solution, coupled with proven mastery learning courseware, eliminates content curation stress for instructors. Attendees will be entered to win one of three \$25 gift cards!

Mike Long – Polk State College

Beyond the Number Line

With inspiration from the National Museum of Mathematics, this interactive session will take a basic number line and expand it to something more than a counting tool in a classroom. The number line will be the centerpiece of the session as we explore properties of number theory, special sequences of numbers, relationships between those sequences, geometric representations of numbers, some mathematics history, and of course Pascal's Triangle. All of this will happen while taking the number line beyond how it has likely looked to you in the past. You might even find yourself wanting a number line like this of your own.

Scott Hochwald – University of North Florida

Mathematical Surprises

This talk will be comprised of results I didn't expect to be true, proofs that shouldn't work, proofs that seem like magic, and hard questions with unforeseen answers. The content will come from Number Theory, Linear Algebra, Calculus, and Geometry.

Session II-A

Jaffar Ali Shahul-Hameed – Florida Gulf Coast University

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

In this talk, we will discuss the existence of two non-trivial positive solutions to a class of boundary value problems (BVP), involving a p -Laplacian of the form:

$$\left(\Phi_p(x')\right)' + g(t)f(t, x, x') = 0, t \in (0,1),$$

$$x(0) - ax'(0) = \alpha[x],$$

$$x(1) + bx'(1) = \beta[x],$$

where $\Phi_p(x) = |x|^{p-2}x$ is a one-dimensional p -Laplacian operator with $p > 1$, a, b are real constants. Here α, β are given by Riemann-Stieltjes integrals

$$\alpha[x] = \int_0^1 x(t) dA(t), \quad \beta[x] = \int_0^1 x(t) dB(t),$$

where $A(t)$ and $B(t)$ are functions of bounded variations. We will use the fixed-point index theory to establish our results.

Kayla Taylor and Mackenzie Meni (Undergraduate Students) – Florida Institute of Technology

PEEKing into the Universe for a Talk

Over the past two decades, advancements in imaging technology have enhanced astronomers' capabilities in observing and categorizing galaxies. There has been a shift from manually analyzing data towards employing deep learning techniques for the classification of astronomical data. Deep learning significantly improves the processing speed of astronomical information, fostering greater discoveries. This research demonstrates that deep learning models are both precise and efficient in identifying various galaxy types. Although the complexity of deep learning models often makes them difficult to interpret, this study introduces the use of Probabilistic Explanations for Entropic Knowledge extraction (PEEK) to scrutinize how information is processed within these models. This approach not only improves galaxy classification accuracy but also makes the reasoning process behind the deep learning models' decisions more transparent.

Milé Krajcevski – University of South Florida

Implementing Drawing as a Predictive and Productive Tool in Undergraduate Vector Calculus

When it comes to how to support and develop spatial ability among undergraduate STEM majors, benefits of drawing go beyond mere instructional aid for presenting concepts or guiding reasoning behind formal analytical arguments. In this talk I will present drawing activities as a potent tool for predicting constructive pathways in problem solving activities, and as a generator

of new ideas. Specifically, my focus is on a productive use of drawing in Vector Calculus course where 3D object visualization serves as a scaffolding tool for enhancing problem-solving activities. We will see drawing as a predictive instrument, and we will emphasize its role in fostering deeper understanding of Vector Calculus concepts and cultivating students' problem-solving skills.

Donald McGinn and Ross Belgram – University of West Florida

Hyper Face-Magic Graphs

For a planar graph G of order n whose vertices are distinctly labeled by elements from the set $\{1, 2, \dots, n\}$, we define the face-value of each face to be the sum of the labels of its boundary vertices. The graph is said to be hyper face-magic if there exists a vertex labeling such that the face-value of each face is equal. In this talk, we state various properties of hyper face-magic graphs and construct several classes of hyper face-magic graphs.

Session II-B

Emma Sandidge – Florida Institute of Technology

An Implementation of 3D Gaussian Splatting for Characterizing Satellite Geometries

The increasing numbers of spacecraft in orbit, along with issues they face, have generated interest in the development of autonomous chaser satellites for on-orbit servicing, active debris removal, and satellite inspections. These operations require accurate estimation and characterization of target geometry. This talk discusses a recent method for mapping geometries of satellites on orbit based on 3D Gaussian Splatting. We present the training methods and the model's 3D rendering abilities using a realistic satellite mock-up, testing it across various authentic lighting and motion scenarios. Our model is capable of training on-board and produces high-quality renders of novel views of an unknown satellite, achieving a rendering speed nearly two orders of magnitude faster than previous NeRF-based methods. These abilities play a crucial role in subsequent machine intelligence tasks involving autonomous navigation and control tasks.

Blake Gisclair and Alex Merino (Undergraduates) – Florida Institute of Technology

Classification of Infrasonic Signals under Imbalanced Training Sets with Boosted Trees

Over the past two decades, advancements in imaging technology have enhanced astronomers' capabilities in observing and categorizing galaxies. There has been a shift from manually analyzing data towards employing deep learning techniques for the classification of astronomical data. Deep learning significantly improves the processing speed of astronomical information, fostering greater discoveries. This research demonstrates that deep learning models are both precise and efficient in identifying various galaxy types. Although the complexity of deep learning models often makes them difficult to interpret, this study introduces the use of

Probabilistic Explanations for Entropic Knowledge extraction (PEEK) to scrutinize how information is processed within these models. This approach not only improves galaxy classification accuracy but also makes the reasoning process behind the deep learning models' decisions more transparent.

Mozhgan Nora Entekhabi – Florida A & M University

Inverse Problems for Wave Propagation in 2 and 3 Dimensions

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.

Thomas Luckner – Flagler College

Widely Digitally Delicate Brier Primes

Making use of covering systems we show there exists an arithmetic progression containing infinitely many primes that are both widely digitally delicate and Brier numbers. As a consequence of a result of D. Shiu, we get there exists k consecutive primes that are both widely digitally delicate and Brier numbers. This presentation will provide a background in constructive proof using covering systems, how these techniques apply to this result, and some undergraduate work to come from this.

Contributed Papers Session III

Session III-A

Dennis Perusse – University of North Florida

What is the Difference Between What a Student Sees and a Math Teacher Sees?

Years of working one-on-one with students led to questioning why they struggled with topics that seemed “obvious” to math teachers. In this talk I share a story about how working with one student led to at least one answer to the question, one of the simplest and most effective questions you can

ask your students who are struggling with their algebra skills, and how it will help them to see math more like a math teacher.

Vincent Stafford (Undergraduate Student) – Wilkes Honors College of Florida Atlantic University

A Mathematical Approach of Cost Optimization Algorithms on Quantum Computers

Cost Function Optimization plays an integral role in Machine Learning. In this talk we analyze the general approaches and complexity advantages of variational quantum algorithms in a mathematical light. We cover the modelling of quantum states as eigenvectors, representing entanglement mathematically, and how variational quantum algorithms mitigate for the low coherence times of modern Quantum Computers. We will also use the development of the Variational Quantum Eigensolver and the Quantum Approximate Optimization Algorithm as examples of how these approaches are realized physically. This talk will equip mathematicians and other subject experts alike with the tools required to understand how these Quantum Algorithms operate.

Faysal Chowdhury – Florida Gulf Coast University

Inference on Two-Parameter Maxwell Distributions

The problem of constructing statistical intervals for a two-parameter Maxwell distribution is considered. An appropriate method of finding the maximum likelihood estimators (MLEs) is proposed. Constructions of confidence intervals and one-sided tolerance limits based on suitable pivotal quantities are described. Pivotal quantities based on the MLEs and moment estimators are proposed and compared with the statistical intervals based on them in terms of expected widths. Comparison studies indicate that these above statistical intervals based on the MLEs offer some improvement in interval estimates when sample sizes are small, and all intervals are practically the same, even for moderate sample sizes. The methods are illustrated using one example involving an actual data set.

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

Understanding the Impact of College Variables on On-Time Graduation

As research on college retention and graduation has deepened, institutions are better able to predict which students are more likely to complete their degree – yet it remains difficult to model who among them will finish on-time. Several studies have identified meaningful factors affecting student success, including college-preparation, demographics, financial status, enrollment choices, and academic performance. Additional research has observed that the importance of pre-college factors like high school GPA declines over the duration of a student's enrollment. A gap remains in connecting student success factors with durational variations in their significance regarding on-time graduation. This study fills the gap by measuring the varying importance of baseline student factors (i.e. high school GPA, transferred credit hours, cumulative GPA, etc.) from the first to fourth fall of their enrollment. The results provide a basis for the more sophisticated modelling on-

time graduation rates by accounting for the declining significance of some factors and the increasing importance of others.

Zhisheng Shuai – University of Central Florida

Advancing Mathematical Modeling: Innovative Courses and Training at the University of Central Florida

This presentation provides an in-depth exploration of the advanced Mathematical Modeling courses and training programs available at the University of Central Florida (UCF). With a focus on equipping students with practical skills and theoretical knowledge, UCF's Mathematical Modeling curriculum is designed to meet the evolving demands of industries and research sectors. The demonstrated success is underscored by the impressive rankings achieved by UCF teams in various modeling competitions. The session will extensively cover the diverse array of courses, spanning applied mathematics, statistics, and computational mathematics. Attendees will gain valuable insights into the hands-on approach embedded in these courses, complemented by immersive experiences in training sessions leading up to modeling competitions. Emphasizing real-world problem-solving and fostering interdisciplinary collaboration, the presentation highlights the comprehensive approach of UCF's Mathematical Modeling programs in preparing students for the dynamic challenges in both academia and industry.

Yuanchang Sun – Florida International University

Enhanced Peak Separation in Overlapped and Noisy Spectral Data

Substances such as chemical compounds and biological agents are invisible to human eyes, they are usually captured by sensing equipment with their spectral fingerprints. The work in this talk is motivated by the analysis of Nuclear Magnetic Resonance (NMR) spectra, which presents challenges due to signal overlap and the presence of noise. In this talk, we propose a novel approach for enhancing peak separation and signal recovery in overlapped and mixing noisy NMR spectra without the knowledge of the mixing process and the mixing substances (so called blind source separation).

Joy D'Andrea – University of South Florida

A Glimpse of Duality of Isohedral and Isogonal Solids

In this talk we will show the interesting isohedral (face transitive) and isogonal (vertex transitive) relationship of the Catalan and Archimedean solids. We will present the basic duality of their relationship and show the extension of their orbits of vertices and faces, using the Euler Polyhedron Theorem. We will discuss the small cataloging system that we have created and the future of this process.

Michael Schroeder – Stetson University

Transversals in Cayley Tables

A Cayley table is a generalization of an addition table of integers, and a transversal is collection of entries in a grid of numbers in which no two entries have the same value, belong to different rows, and belong to different columns. In this talk, we investigate what is known about building transversals in Cayley tables which include specified entries. We relate this to the completion of partial Latin squares which are diagonally cyclic, and highlight some recent results in this area.

Session III-B

Dennis Perusse – University of North Florida

Increasing Student Engagement by Incorporating Uncommon but Effective Undergraduate Research In and Outside of Math Classes

In this talk I discuss my experiences incorporating undergraduate research into statistics and STEM track courses, and how ignoring excellent advice led to increased student engagement, learning and achievement. Examples of student poster projects across a variety of disciplines will be shown and resources for project ideas will be shared. And how these methods can be enhanced by including ChatGPT as one of your first assignments.

Megan Bennett (Undergraduate Student) – Nova Southeastern University

Flag-Shaped Blockers of 123-Avoiding Permutation Matrices

A blocker of 123-avoiding permutation matrices refers to the set of zeros contained within an $n \times n$ 123-forcing matrix. Recently, Brualdi and Cao provided a characterization of all minimal blockers, which are blockers with a cardinality of n . Building upon their work, a new type of blocker, flag-shaped blockers, which can be seen as a generalization of the L -shaped blockers defined by Brualdi and Cao, are introduced. It is demonstrated that all flag-shaped blockers are minimum blockers. The possible cardinalities of flag-shaped blockers are also determined, and the dimensions of subpolytopes that are defined by flag-shaped blockers are examined.

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

Course Recommendation Using Co-HITS

Recommendation tasks of all sorts are of growing interest due to increases in data and choices. General recommendations for all users are often a good starting point but recommender systems should be personalized to the user. While many methods are used for recommendation tasks, we propose to use Co-HITS to demonstrate simple techniques for customizing the resulting

recommended items and yielding a personalized course recommendation for students. The Co-HITS recommender is then compared with other recommender systems.

Shimin Zhang (Graduate Student) – University of South Florida

Review for Deep Reinforcement Learning in Portfolio Optimization

Portfolio optimization involves allocating weights to assets to maximize return or minimize risk. Traditional mean-variance analysis is constrained by assuming a normal return distribution. Reinforcement learning (RL) for portfolio optimization is gaining interest. Proximal Policy Optimization (PPO) outperforms mean-variance analysis, as indicated by annual return and Sharpe ratio. Incorporating Long Short-Term Memory (LSTM) and fully connected layers into Deep Deterministic Policy Gradient (DDPG) suggests enhanced performance. Combining mean-variance analysis and DDPG through Tucker decomposition yields higher profits. DDPG, incorporating Sortino ratio and rate of return as reward functions, outperforms mean-variance analysis. Gated Recurrent Unit (GRU) combined with Deep Q Network (DQN) and Deterministic Policy Gradient (DPG) surpasses individual GRU and DQN performance. Using Convolutional Neural Network (CNN) and Bidirectional Long Short-Term Memory (BiLSTM) to extract features and combining them as input for Double Deep Q Network (Double DQN) and Dueling Deep Q Network (Dueling DQN) results in increased profits.

Laura Yang – University of Central Florida

Math Knights: UCF's Premier Program for Excelling in High School Math Competitions and Enrichments

This presentation aims to introduce the Math Knights Training Programs, a dynamic initiative hosted by the University of Central Florida (UCF) designed to empower high school students in excelling at math competitions and fostering a deeper understanding of mathematical concepts. The program is tailored to cultivate the mathematical prowess of motivated students, equipping them with the skills and strategies necessary to excel in various competitive settings. The Math Knights Training Programs offer a comprehensive curriculum that covers a spectrum of mathematical topics, spanning algebra, geometry, number theory, probability and combinatorics. Emphasis is placed on problem-solving techniques, logical reasoning, and creative thinking, aligning with the requirements of renowned math competitions such as the American Mathematics Competitions (AMC), American Invitational Mathematics Examination (AIME), and others.

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

Enhancing Computational Efficiency in Source Localization Through Particle Filtering

Source localization, a crucial aspect in various fields such as acoustics, robotics, and environmental monitoring, often involves computationally intensive processes. In this study we explore techniques to improve the computational time in source localization using particle filtering techniques. Particle filtering, a Bayesian filtering method, has shown promise in accurately

estimating the source location by propagating a set of particles through a dynamic model. However, its application has been hindered by the substantial computational resources required. Techniques such as parallelization, adaptive resampling, and model simplification are explored to streamline the computational burden while maintaining the reliability of the localization results. The findings indicate a substantial reduction in computational time without compromising, and in some cases improving, the accuracy of source localization.

Milo Schield – New College of Florida

Weighted Averages: A Simple Tool for Teaching an Advanced Topic – Confounding

Statistical Literacy focuses on what it means to “take into account” the influence of a quantitative confounder on a statistical association. In Calculus 3 (differential equations), this is the difference between a total and a partial derivative. Teaching multivariate regression is normally considered an advanced topic in Statistics. However, the 2016 update to the ASA GAISE guidelines recommends that students be introduced to multivariate thinking – and confounding – in introductory statistics. When the predictor and confounder are both binary, a differential equation reduces to a two-group weighted-average. Students can work multivariate problems without needing calculus or algebra. Statistical Literacy was introduced at the University of New Mexico in 2021 and at New College of Florida in 2023. Students saw how a statistical disparity was influenced (reversed) by what was taken into account. With more data coming from large observational studies, small-sample randomness is less important while confounding is increasingly important.

Bernadette Mullins – Florida Polytechnic University

The Impact of Inquiry-Based Learning on Numerical Reasoning

We describe inquiry-based activities used in a numerical reasoning course for K-8 pre-service teachers on topics including fractions, ratio, and proportional reasoning. Students worked in groups and individually on tasks intended to promote conceptual understanding and productive disposition. We share results of an IRB-approved pre-post assessment and student reflective writing on the impact of the experience.

Workshop Talks and Discussion

Milo Schield – New College of Florida

Teaching Confounder-Based Statistical Literacy

(1) Overview of confounder-based Statistical Literacy course taught at University of New Mexico (Albuquerque where it satisfies a math requirement in their General Education curriculum and is being required by all graduate students in statistics) and New College of Florida (Sarasota). This statistics course is different: designed for students in non-quantitative majors; has less than

a 30% overlap with any traditional course. Review Kendall-Hunt textbook. Distinguish association from causation (disparity from discrimination). Work "Take care" problems. (2): Teach conditional probability using ordinary English. Read percentage tables. Solve problems involving everyday statistics using weighted averages. Show how taking into account a measured confounder can change the direction of an association (Simpson's paradox), influence the number of cases attributed to a predictor, and transform statistical significance into statistical insignificance. (3): Critical thinking about everyday statistics in news stories, tables and graphs. Students think Statistical Literacy should be required for graduation: 35-65%.

Jared Bunn and Manoj Lamichhane – Florida Polytechnic University

Team-Based Inquiry Learning Workshop

Team-Based Inquiry Learning (TBIL) is a new way to engage students in mathematics by combining Inquiry-Based Learning and Team-Based Learning. This workshop, led by two 2022 TBIL fellows, provides a brief introduction to TBIL followed by an interactive demonstration of TBIL in the context of Calculus I and Linear Algebra. In the introduction, we discuss TBIL preparation, supporting materials, and a typical day using TBIL. In the demonstration, we will divide the audience into teams, and each team will get to test drive parts of two TBIL lessons. The first lesson will be on the product and quotient rules from Calculus 1, and the second lesson will be on linear combinations from Linear Algebra.

Contributed Papers Session IV

Full Session

Jerome Tuttle – Southern New Hampshire University

Data Analysis of Credit Score

You have a credit score. You never asked to have one, but organizations have collected financial and demographic data on you and used it to assign a numerical score that purports to rate your ability to repay a loan on time. Lenders use your credit score to help decide whether to offer you a loan and if so, whether to offer you favorable or unfavorable terms. Have you ever thought about how your credit score is calculated? The speaker, who is an actuary and a math instructor, will present a hypothetical example of how he would develop a mathematical model that predicts the probability that an individual would default on their loan. He will then use these probabilities to create credit score intervals and a model that could be deployed to assign each applicant a credit score interval for a lender to make a yes or no loan decision.

Robert Cappetta – Florida SouthWestern State College

Using Artificial Intelligence to Improve Teaching and Learning Mathematics

How can instructors use AI resources to deepen student understanding? "Explain why", "construct an example", "use simpler language" are prompts that enable AI systems to generate results that focus on concepts rather than rules and procedures. In addition, instructors can direct students to: (1) complete a traditional homework set, check the answers, learn from the errors; (2) compare strategies from multiple AI platforms and determine which techniques are best and why; (3) searching for errors on AI systems and try to understand why they were made; (4) construct practice tests so that students can self-assess knowledge. (5) ask follow-up questions to get deeper results. Furthermore, AI tools can be used to assist students to improve study skills, to manage test anxiety, and to recognize the beauty and utility of mathematics.

John Shea – Lake Sumter State College

A New Way to Characterize Cusps and Corners of Curves

I will present a new framework for analyzing kinks (cusps and corners) of a curve. A curve has a kink at a given point if \mathbf{r}' is undefined or $\mathbf{0}$ there for *every* parameterization of the curve. (At a point where the curve is smooth, \mathbf{r}' might be $\mathbf{0}$ under some parameterizations and nonzero under others.)

My framework does not require consideration of alternative parameterizations. The key to this approach is to adopt a generalized conception of the unit tangent vector, $\mathbf{T}(t)$. I will propose a definition that agrees with the traditional definition whenever $\mathbf{r}'(t) \neq \mathbf{0}$, but $\mathbf{T}(t)$ will exist at a point where $\mathbf{r}'(t) = \mathbf{0}$ and the curve is smooth. In contrast, $\mathbf{T}(t)$ will not exist at a point where $\mathbf{r}'(t) = \mathbf{0}$ and the curve is kinked. Thus, the curve will be smooth wherever $\mathbf{T}(t)$ exists and kinked wherever $\mathbf{T}(t)$ does not exist.

Session IV-A

Jenna Bradley, Dennis Perusse and Salika Sar – University of North Florida

Where Are All the Proofs?! Three UNF Math Instructors Discuss Their Experiences Being New Education Doctoral Students Living and Working in the Liminal Space Between Two Disciplines

A discussion including diverse perspectives from three UNF math instructors enrolled in their second semester of UNF's Curriculum and Instruction doctoral program. In this talk we discuss what we've experienced so far, how the program is laid out, the similarities and differences to a math graduate program, and our tentative dissertation ideas.

Diana Dancea (Undergraduate Student) – Nova Southeastern University

Marriage and Math? Establishing Connections Between Hall's Marriage Theorem and Birkhoff's Theorem

We consider Hall's Marriage Theorem (HMT) and its connection to Birkhoff's Theorem (BT). What sets HMT apart is its logical equivalence to several other renowned combinatorial theorems. It originated from pondering whether, with an equal number of eligible men and women seeking marriage, if we can establish a stable match for each pairing. As one of the theorems equivalent to HMT, BT asserts that every doubly stochastic matrix is a convex combination of permutation matrices. HMT is frequently used to prove BT, but there is no proof of Hall's Marriage Theorem using Birkhoff's. We explore the converse and aim to find a correlation in Birkhoff's Theorem to prove Hall's Marriage Theorem. Our approach involves utilizing the Python programming language and the NumPy library to construct code that tests input matrices under the given conditions. This theorem holds numerous real-world applications, from time scheduling and job shifts to general perfect pairings.

Albert Madinya (Graduate Student) – Florida Atlantic University

Topologizing the Space of Minimal Primes of an Algebraic Frame

An algebraic frame L is a partially ordered set in which every subset of L has a supremum and infimum and satisfies the strong distributive law. Given an algebraic frame L , we can topologize the set of minimal prime elements of L , which we will denote by $\text{Min}(L)$. One such way we could topologize $\text{Min}(L)$ is with the Hull-Kernel 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 Hull-Kernel topology. Our aim in this talk is to study these topological spaces and the interplay that exists between the topological properties of $\text{Min}(L)$ and the frame-theoretic properties of L .

Session IV-B

Joseph Ours – State College of Florida

Strengthening Academic Integrity in Online Testing

Online courses offer valuable benefits to our students such as flexibility. They, however, present additional challenges such as academic integrity. Maintaining flexibility and academic integrity can pose a challenge. In this talk, methods for strengthening academic integrity are presented that go beyond the features already present in an online proctoring system.

Donn Christy (Undergraduate Student) – University of North Florida

Word Splicing with Membrane Systems

Membrane systems are a framework for parallel computing models, inspired from biological cellular membranes. In this presentation, a membrane system, combined with splicing system rules, is used to demonstrate splicing within a single word input. This is done by defining a hierarchy of membranes, with splicing rules defined within each enclosed membrane, and target word patterns to be passed into and out of membranes. This framework is used to prove the hierarchy of splicing P -system languages of degree at most n , where $n \geq 1$.

Dilara Vefa Ayyildiz (Graduate Student) – Florida Polytechnic University

Enhancing Autonomous Driving AI Models for Emergency Vehicle Recognition Through Data-Driven Synthesis: A Case Study on 911 Call Records

This work addresses the challenge of insufficient image data for emergency vehicles like ambulances in the context of autonomous driving AI models. To ensure the synthetic image data created is closely related to real-world scenarios, an initial step involved detailed data analysis of 911 call records obtained from the Orange County Government. The primary objective of this analysis was to understand real-life emergency situations and their characteristics, providing a solid foundation for generating realistic synthetic images. Machine learning methods were applied for data mining on these records, enabling a thorough extraction and interpretation of patterns and insights that are crucial for developing AI models capable of recognizing and responding to emergency vehicles effectively in a variety of traffic situations.

Contributed Papers Session V

Full Session

Duval Zephirin – Florida SouthWestern State College

Portfolio Maximization for Investors in Fads Models Driven by Lévy Processes

In recent years, there has been a growing interest in the use of Lévy processes to model stock market behavior. Empirical studies of stock prices indicate distributions with heavy tails, which are incompatible with a Gaussian distribution and a more realistic approach is to allow small jumps in small time intervals. Lévy processes are used to model stock prices for informed and uninformed investors. We derive the optimal portfolio for the informed investor in a Fads model driven by Lévy processes under asymmetric information and stochastic volatility of the stock price. We employ methods of stochastic calculus namely Hamilton-Jacobi-Bellman equation, instantaneous centralized moments of returns and three-level Crank-Nicolson method. We solve numerically the partial differential equation associated with the optimal portfolio. Under the

power utility function, analogous results to those obtained in the jump-diffusion model under logarithmic utility function and deterministic volatility are obtained.

Maggie Swanson, Nicole Legge, Rita Morgan and Abbey Misirian – Florida Gulf Coast University

Exploring A Flipped Model Classroom

In our 45-minutes session, faculty can engage with faculty and students who have experienced a flipped classroom – providing advice on the hurdles and successes from both newly hired and first-time flippers to veteran faculty who have used this technique for years. We will discuss the positive outcomes as well as the challenges and downfalls to a flipped model classroom, provide advice for transitioning any course from a traditional lecture to the active flipped model. A student panel will also allow interested participants the opportunity to hear student opinions on ways that faculty can make this an exceptional learning experience and discover tools to best support student success. From final grade comparisons to attendance patterns, this interactive session will explore the results from several flipped model classrooms.

Shibo Liu – Florida Institute of Technology

Surjections Between Euclidean Spaces, Changing Variable Formula and Brouwer Fixed Point Theorem

The talk will be accessible to students who have taken multivariable calculus and linear algebra. We briefly review differential calculus and the inverse function theorem. Aiming at giving another calculus proof of the fundamental theorem of algebra, we present our result on the question: when will a map between Euclidean spaces (of different dimension) be surjective. Then, using divergence theorem and some well-known results in linear algebra (including the Cauchy-Binet formula) we prove the changing variable formula for multiple integrals without cutting the domain into small pieces and estimate their volume. As an easy byproduct of our proof, we obtain the Brouwer fixed point theorem.

Session V-A

Jacci White, Monika Kiss and Abby Burrows – Saint Leo University

Artificial Intelligence: How it Can Enhance Rather than Replace Intelligence in Math

In this session, we'll introduce ChatGPT's capabilities for interactive math lessons, focusing on real-time feedback and personalized tutoring. We'll delve into practical applications such as adaptive learning paths and collaborative environments, emphasizing the role of AI in fostering peer-to-peer knowledge exchange. The presentation will conclude with a discussion on ethical considerations, showcasing successful case studies, and providing educators with actionable strategies for immediate implementation in their math classrooms.

Jessica Marconi (Undergraduate Student) – University of North Florida

Bezout's Theorem

In this talk we prove Bezout's theorem which claims that the number of points of intersection between two algebraic curves in the projective plane, counted with multiplicity, is equal to the product of their degrees. Working in the projective plane allows us to identify undefined solutions as points at infinity. Thus, we can include points of intersection at infinity. We use the notion of varieties, ideals, and projections but the main tool we use in the proof is the resultant.

Kun Bu (Graduate Student) – University of South Florida

Comparative Analysis of Sentiment in Original and Summarized Tweets: Leveraging Transformer Models for Enhanced NLP Insights

This paper investigates the sentiments of Twitter users towards the emergent topic of ChatGPT, leveraging advanced techniques in natural language processing (NLP) and sentiment analysis (SA). Our approach uniquely incorporates a dual setting for sentiment analysis: one analyzes the sentiments of original, full-length tweets, while the other first condenses these tweets into succinct summaries before performing sentiment analysis. Employing this dual approach, we conducted a comparative analysis of sentiment assessment pre- and post-text summarization, exploring the accuracy and reliability of the summarized sentiments. Key to our methodology is the application of Transformer models, specifically ProphetNet, facilitating a deeper understanding of the text. Unlike traditional methods that rely on keyword extraction, our approach generates coherent summaries, offering a novel lens for sentiment analysis. Our findings reveal that the NLTK method achieves a sentiment analysis accuracy of 94.8% and an AUC value of 0.863, significantly outperforming the Transformer-based method, which recorded an accuracy of 92.7% and an AUC of 0.763. This research contributes to the field by presenting a comprehensive study comparing sentiment analysis outcomes between original texts and their summarized counterparts, examining the effectiveness of different NLP techniques. The statistical analysis underscores the efficacy of the NLTK method in providing more accurate and reliable sentiment analysis compared to the advanced Transformer method, challenging assumptions about the superiority of state-of-the-art NLP technologies in handling complex, real-world data. These insights are invaluable for understanding the dynamics of sentiment analysis on social media and the potential of various NLP technologies in sophisticated data processing scenarios.

Session V-B

Sidra Van De Car – Valencia College

Peer Review as a Tool to Improve Inclusive Active Learning Lessons

Through an NSF grant, mathematics faculty at Valencia College are transforming their classes and actively engaging students in the learning process. Faculty participants use a reflective lesson template and peer review to build dynamic classroom lessons for a variety of instruction

formats (online synchronous, online asynchronous, mixed mode, and face-to-face). Experience the peer review process and explore our repository of over 200 inclusive active learning lessons.

Daniela Genova – University of North Florida

Engaging Students Through Class Projects and Presentations

Teaching mathematics one textbook section after another can become quite tedious for students. This talk discusses my efforts and related challenges to incorporate projects and presentations in my classes. Student research projects can be a part of any math course, from freshman to graduate level. I will discuss various forms that these projects may take and the enormous benefits to students, professors, departments, and even institutions. Some unexpected ones will be discussed. The talk includes samples of student project presentations.

Sameer Anand (Graduate Student) – University of South Florida

Real Data-Driven Analytical Modeling of Social Media Stocks

In recent years, social media has increasingly become one of the most attractive areas for investors due to high returns. Our study involves developing financial returns of social media companies. The data was collected for 5 companies from the S&P500 – Meta, Etsy, Match, Pinterest, and Alphabet. The predictive model utilizes real data which consists of six financial, four economic indicators and accurately predicts the weekly closing price of the social media companies by 95%. In addition, we ranked the statistically significant indicators along with their interactions in terms of their contribution towards the Social Media stock price.

Contributed Posters Session

Donn Christy, Furio Gerwitz, and Jacob Sutton (Undergraduate Students) – University of North Florida

Perfect Codes and Error-Correcting Codes

Rooted in the principles of algebra and combinatorics, coding theory describes fundamental techniques and limitations regarding the representation, storage, and transmission of information. In this poster, we first define codes algebraically, before introducing two well-known types of codes. We discuss error correcting codes, where encodings may still be correctly decoded despite characters potentially being changed, as long as the total number of errors is within a certain threshold. Directly following from this, we present perfect codes, which utilize all words over an alphabet of a given length either as codewords or as fail-safes in the case of errors. We incorporate examples which demonstrate the practical applications of these topics in computing.

John Diller (Undergraduate Student) – University of North Florida

Matchings and the Marriage Theorem

This poster discusses matchings in bipartite graphs. We present Hall's Condition and the Marriage Theorem. An independent set is a set of vertices no two of which are adjacent. The independence number of a graph is the size of the largest independence set. We explore the relationship between the independence number, Hall's Condition, and perfect matchings and discuss some applications.

Ryan Farrell (Undergraduate Student) – University of North Florida

Using Matrix Grammars to Generate the Fibonacci Sequence

Formal grammars are tools used to construct words in formal languages. This poster discusses how the generating power of such grammars can be strengthened using matrix grammars, which utilize sequences of production rules to create words that regular grammars cannot. We then present examples to demonstrate the computing power of matrix grammars, involving DNA codons and the Fibonacci Sequence.

Kristian Hayward (Undergraduate Student) – Florida Atlantic University

An Elementary Approach to Tensors with Applications

Not many people know about tensors, and there is a wide variety of confusing definitions. Attempts to simplify explanations have shown inconsistency, occasionally increasing confusion. Despite the complexity, tensors find application across disciplines, spanning Computer Science to Physics, particularly in junior and senior undergraduate courses. Developing an intuitive grasp of tensors becomes crucial for undergraduates, enabling them to forge connections within their respective fields. This presentation aims to explain tensors through a simple yet abstract approach, leveraging foundational concepts like functions/mappings and Cartesian products. Deriving tensors and tensor products from these concepts offers a more accessible introduction for undergraduates. In addition, some applications will be shown to further emphasize the importance of gaining a clear understanding of tensors and tensor products. By fostering clarity before delving into advanced coursework, undergraduates can appreciate the wide variety of tensor applications and the intrinsic nature of tensors.

Jessica Marconi and Dylan Strickley (Graduate Students) – University of North Florida

The St. Petersburg Problem

The St. Petersburg Problem, a classic mathematical puzzle, challenges the concept of expected value and has intrigued mathematicians for centuries. With this poster, we delve into the intricacies of the problem and explore its implications. We discuss the limitations of expected

value as a decision-making tool in this context and examine proposed solutions including finite funds, utility theory, and a variable entry fee.

Plenary Sessions

C. Allen Butler, MAA Treasurer, Board of Directors – Daniel H. Wagner Associates, Inc.

Bio: Dr. Butler holds a B.A. in Mathematics from Texas Tech University and a PhD in Mathematics from the University of Illinois, Urbana – Champaign (1987). He has been employed at Daniel H. Wagner Associates, Inc. (www.wagner.com) since 1987, serving as President and CEO from 2008 to 2021. Throughout his career, Dr. Butler served as the principal investigator for Department of Defense R&D projects involving a variety of mathematical disciplines as applied to areas such as target tracking, multi-sensor data fusion, and search optimization. He has been involved in the development and implementation of optimal search techniques for several projects, including a research effort whose goal was the interdiction of narcotics smugglers in the Caribbean. Dr. Butler is a member of AMS, MAA, SIAM, IEEE, and INFORMS.

Dr. Butler is an INFORMS Fellow, the President of the Practice Section of INFORMS, and serves on the INFORMS Prize Committee for the “Daniel H. Wagner Prize for Excellence in Operations Research Practice.” He also serves on the Board of Trustees of the Institute for Mathematical and Statistical Innovation and is a visiting lecturer for SIAM. And most importantly, he is the treasurer of the MAA.

Bayes’ Theorem – Making Rational Decisions in the Face of Uncertainty

A statement of Bayes’ Theorem (aka Bayes’ Rule) can be written very succinctly, but this belies its far-reaching consequences. In this talk, I will provide a little of the history behind Bayes’ Theorem, a derivation of the mathematical basis in probabilistic terms, and a description of the less formal basis where it is viewed as a form of evidential or inferential reasoning. I will illustrate the utility of Bayes’ Theorem by describing applications from the work of my company, Daniel H. Wagner Associates, Inc. One of these resulted in the location and recovery of the “Ship of Gold,” the SS Central America, a side-wheel steamer carrying nearly six hundred passengers returning from the California Gold Rush, which sank in a hurricane two hundred miles off the Carolina coast in September 1857.

Emilie Purvine, MAA AWM Speaker – Pacific Northwest National Laboratory

Bio: Dr. Emilie Purvine is a mathematician and data scientist at Pacific Northwest National Laboratory. She joined PNNL in 2011 after receiving her PhD in mathematics from Rutgers University with a focus on enumerative combinatorics and nonlinear recurrence relations. While at PNNL Emilie has had the opportunity to contribute to a variety of projects tackling hard problems in applications including computational biology and chemistry, power grid modeling, cyber network analysis, and knowledge models. Her current mathematical research focus is on topological data analysis applied to discrete structures like graphs and hypergraphs. Much of her

work involves finding mathematical nuggets in applied domains and working on theoretical advances to enable operational progress.

Emilie also greatly values the ability to make mentoring a focus of her work. She loves to give presentations to students at all levels to provide an example of what a mathematician can do outside of academia. Interns and postgraduates (2-3 year temporary employees including post bachelors, post masters, and postdoc) are always included into her projects to promote on the job learning.

Outside of her core work activities Emilie has also been the chair of the MAA's Membership Committee and an associate editor of the AMS Notices. In her free time Emilie spends time with her friends and family, enjoys a good book, loves the outdoors and traveling to new destinations.

Graphs and Hypergraphs and Topology, Oh My!

Mathematical structures and concepts can be great models of real-world data. For example, differential equations have a long history of success in applied mathematics to model dynamics found in rivers and oceans, the atmosphere, and molecular systems (just to name a few!). Network science is an area of applied math that uses graph structures to model relational systems like social, collaboration, and transportation networks. Graphs, however, are limited to modeling pairwise relationships among entities. Hypergraphs and topological spaces provide alternate models of relational systems that allow for arbitrary sized and structured relationships. In this talk I will introduce the mathematical concepts of graphs, hypergraphs, and topology and show how they are used to model real-world data from a variety of applications including biological systems, chemistry measurements, and cyber networks. We'll also talk about what measurements and properties of these structures can tell us about the systems they model.

Derek Buzasi, FL State Speaker – Florida Gulf Coast University

Bio: Derek received his undergraduate degree in physics from the University of Chicago, and his PhD in astronomy from Penn State University. He has worked at a variety of institutions, including the National Center for Atmospheric Research, Johns Hopkins University, the California Institute of Technology, and the University of California at Berkeley.

Most recently, he served for ten years as Professor of Physics at the US Air Force Academy. Derek has published more than 120 papers and has also worked on a variety of major instrument teams, including Detector Scientist for the Cosmic Origins Spectrograph, part of the Hubble Space Telescope's most recent upgrade, and Principal Investigator for the Wide-Field Infrared Explorer satellite. He currently serves on the Science Team for NASA's planet-finding Kepler mission. Derek's research interests include almost anything having to do with stars. He began by studying various aspects of stellar (and solar) activity, such as spots, flares, and winds, and has done both observations and theoretical work, including radiative transfer modeling and magnetohydrodynamic models of stellar flux tubes. More recently, he has moved from studying stellar atmospheres and environments to studying stellar interiors and convection through the use of asteroseismology. Derek also works on computer modeling, particularly of nonlinear

systems, and is co-author of the chapter on Computational Astrophysics in the CRC Computer Science Handbook.

Derek is also a reserve Navy Engineering Duty Officer with the rank of Commander; his current assignment is with Pearl Harbor Naval Shipyard in Hawaii. In his free time, he enjoys sailing, swimming, and reading, along with just hanging out with his wife Heather and son Grant. He is excited about becoming part of FGCU and advancing the teaching and learning missions of the institution.

The Mathematics and Music of the Stars

About 60 years ago, solar physicists discovered that the Sun vibrates like a musical instrument, and they began to explore using the frequencies of those vibrations as a tool to better understand the Sun. Since then, we've come to understand that all stars oscillate. Space-based observatories have given us the tools to detect these oscillations, and mathematical analysis of this music of the stars has revolutionized stellar astrophysics. In this talk, I'll give a short history of the study of stellar oscillations, describe the tools we use to translate the measurements we make into physics, and the impact this has all had -- and continues to have -- on astronomy.

SPECIAL THANKS TO

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