

The Department of Mathematics at Francis Marion University

welcomes you to the

2019 Francis Marion Undergraduate Mathematics Conference

Friday, March 29, 2019

— Schedule —

12:30 *p.m.* **Registration begins**, Lobby, Lee Nursing Building.

Mingle and Post! Lobby. Grab a snack, network with students and faculty and take pictures with our math photo booth props. Post pictures with #FMUMC2019

12:55 *p.m.* **Welcome and Announcements**, Auditorium.

1:00 *p.m.* **Math Jeopardy!** Auditorium.

2:00 *p.m.* **Student Presentations Begin**, Classrooms 137 and 145.

Schedule of talks and abstracts are included in packet.

4:30 *p.m.* **Keynote Address**, Auditorium.

Dr. Brian Beasley, Professor, Presbyterian College,

The Abundancy Index: Seeking Friends and Outlaws ... and Perfection.

Calling all mathophiles: How far can we take a simple mathematical idea and stretch it to produce an impressive array of research results and questions? Let's find out. Given a natural number, we define its abundancy index to be the sum of its positive factors divided by the number itself. Using this one function, we determine which positive integers have friends; we hunt for outlaws among the rational numbers; and we examine the elusive open question of whether odd perfect numbers exist. Together we will explore the many properties of this remarkable function, applying techniques accessible to all math students and encountering questions for the next generation of researchers to tackle.

5:30 *p.m.* **Student Presenter Recognition and Closing Remarks**

— Website—

<http://www.fmarion.edu/mathematics/activitiesandevents/#FMUMC>

— Social Media #FMUMC2019 —

Facebook: @FMUmath

Twitter: @fmumath

Student Talk Schedule

	LNB Room 137	LNB Room 145
2:00-2:15	<i>Estimating Tool Life Using Mathematical Models</i> Taylor Watson Francis Marion University	<i>The Art Galley Theorem</i> Jessica Beck Francis Marion University
2:20-2:35	<i>Interaction Strengths and Ecological Stability</i> Chace Covington Francis Marion University	<i>Random Fibonacci Sequences</i> Alex Foster Coastal Carolina University
2:40-2:55	<i>Modeling HIV/AIDS in South Carolina Using SIR Method</i> Brooke Haywood Francis Marion University	<i>The Big M Method</i> Caleb McDowell Francis Marion University
3:00-3:15	<i>Factors Influencing Retention Rates Across 142 Postsecondary Institutions</i> Zachary Middleton Francis Marion University	<i>Path Domination in Graphs</i> Rebecca Jackson Charleston Southern University
3:20-3:35	<i>Decision Making with Logistic Regression</i> Edward Hubbard Francis Marion University	<i>Fourier Series and the Basel Problem</i> Adrian Avalos Coastal Carolina University
3:40-3:55	<i>Chipkill: The Power of Finite Fields</i> Cannon MacIntosh Coastal Carolina University	<i>Cryptosystems: Introduction to Elgamal Encryption</i> Terrik Boatwright Francis Marion University
4:00-4:15		<i>Analysis of Simplicial Complexes Using Persistent Homology and Linear Algebra</i> Jonathan Britt Francis Marion University

Student Talk Abstracts

Jessica Beck, Francis Marion University
The Art Galley Theorem

I will be discussing the “Art Gallery” theorem and the history behind it. This theorem has floor functions, geometry, and even some coloring! This question was asked by Victor Klee, a professor at the University of Washington.

Jonathan Britt, Francis Marion University
Analysis of Simplicial Complexes Using Persistent Homology and Linear Algebra

The topological structure of simplicial complexes made from a data set can be studied using several different methods. Linear algebra and persistent homology are two interesting methods that can be used to calculate homologies of a simplicial complex.

Terrik Boatwright, Francis Marion University
Cryptosystems: Introduction to Elgamal Encryption

I will explain what cryptography is and the different methods used to secure data and information. I will give an explanation on the historical use of encryption through different types of ciphers. I will talk about public and private key encryption and give examples. Then I will explain the modern usage of these encryption methods through algorithms such as Elgamal encryption.

Chace Covington, Francis Marion University
Interaction Strengths and Ecological Stability

Ecological stability describes how species populations in an ecosystem behave after a disturbance. Within an ecosystem, species populations interact with one another with various interaction strengths. This study uses a first-order multivariate autoregressive model framework to explore the possible relationships between different interaction strengths and measures of ecological stability.

Alex Foster, Coastal Carolina University
Random Fibonacci Sequences

Ever since the Four Color Theorem was proved in 1976, proofs using computers have become increasingly influential and controversial. In 1999, Viswanath determined a convergent n th root for random Fibonacci sequences (1.13198824...). Here we present a generalization of these sequences and an interesting observation for the apparent convergence of the n th root for these generalizations.

Student Talk Abstracts

Brooke Haywood, Francis Marion University
Modeling HIV/AIDS in South Carolina Using SIR Method

Since its initial outbreak in the U.S. in 1981, HIV and its resulting disorder, AIDS, have been included in dialogues surrounding public health. As the search for a definitive cure for HIV/AIDS is ongoing, prevention of its spread is vital to ensure minimization of its affects. Using the SIR model for epidemiology and data published by S.C. DHEC, this project models the spread of HIV in S.C.

Edward Hubbard, Francis Marion University
Decision Making with Logistic Regression

I will present a brief overview of the algorithm and applications of logistic regression in AI, data science, and statistics.

Rebecca Jackson, Charleston Southern University
Path Domination in Graphs

A dominating set of a graph is a set of vertices where for every vertex either the vertex is in the set or adjacent to a vertex in the set. We define a n -path dominating set to be a set of n -paths such that the vertex set is a dominating set. The n -path domination number to be the minimum cardinality of such a set. We explore the existence of such sets and bounds for the n -path domination number.

Cannon MacIntosh, Coastal Carolina University
Chipkill: The Power of Finite Fields

In coding theory, SECDED codes are commonly used to send information. These codes are single error correcting and double error detecting. In this exploration we will utilize finite fields to display the superior error correction capability of Chipkill.

Caleb McDowell, Francis Marion University
The Big M Method

Throughout the presentation, I will show how the big M method works, why it works, and how to successfully use it on a problem. I will also cover the broader implications of linear programming as well as the simplex method. This will include the application of these methods to problem solving in industry as well as routing methods.

Student Talk Abstracts

Zachary Middleton, Francis Marion University

Factors Influencing Retention Rates Across 142 Postsecondary Institutions

On average, retention rate is 70.49% with a standard deviation of 10.9 across 142 postsecondary institutions in the Southeastern United States. The purpose of this study was to discover if there exist significant factors that influence retention rate. Using step-wise linear regression, the study showed that several factors influenced retention rates.

Taylor Watson, Francis Marion University

Estimating Tool Life Using Mathematical Models

Reliability has become widely invested in to maximize output in assets by reducing downtime due to various reasons. Improvements may be implemented by studying the characteristics of machinery and calculating/studying manufacturing metrics. One of the areas focused on is estimating tool life. Mathematical modeling using a Weibull analysis may be utilized to produce accurate tool life estimates.

Adrian Avalos, Coastal Carolina University

Fourier Series and the Basel Problem

We explore Fourier Series and consider expansions for some elementary functions. These computations yield conclusions about infinite series. In particular, Euler's famous result, known as the Basel Problem, will be an immediate consequence.