ISMAA 2019

Abstracts

1	Olcay Akman. *If you or a loved one is a math major, please pay attention to the following announcement.*
	You may be entitled to a quality education. All math or stats majors, faculty members, and advisors are invited to learn about an exciting one year graduate certificate program designed for students wanting to strengthen their background before applying to a graduate program in data science, statistics, or mathematical biology. This program is also designed for future professionals in mind, offering the flexibility of online and/or traditional graduate coursework in preparation for joining a data-focused workforce. BUT WAIT! That's not all! This is only one of the many exciting opportunities ...
2	Simon Walthers. *An Investigation into Combinations: Arranging People into Rooms*
	This study examines the properties and patterns associated with the combinations of room selections involving a number of people distributed evenly into a certain amount of rooms. The combinations involving small amounts of people and people per room are examined first to identify regular patterns that could be useful in identifying possible equations to represent any case with different amounts of people and people per room. This presentation will cover an exploration whose goal was to find explicit formulas to express the number of possible ways to arrange n people into p rooms evenly.
3	Kalpa Thuewaththage and Jerzy Kocik. *Octonions and Rotations*
	There are four division algebras over R, namely real numbers, complex numbers, quaternions and octonions. They can be used to represent a number of orthogonal groups. In particular, the groups SO(3) and SO(4) of rotations of 3- and 4-dimensional spaces, respectively, can be described in terms of quaternions. We start with reviewing these cases and next turn to the groups of rotations of 7- and 8- dimensional spaces and describe them interms of octonions. Since octonions form a non-associative division algebra, we use Moufang Identities to overcome the difficulty of some calculations and ...
4	Hadi Safari Katesari, Yaser Samadi and Samira Zaroudi. *Modeling Count Data via Copulas: Comparison of Kendall's tau and Spearman's rho*
	Copula models have been widely used to model the dependence between continuous random variables, but modelling count data via copulas has recently become popular in the statistics literature. Spearman's rho is an appropriate and effective tool to measure the degree of dependence between two random variables. In this paper, we derived the population version of Spearman's rho correlation via copulas when both random

	variables are discrete. The closedform expressions of the Spearman correlation are obtained for some copulas of simple structure such as Archimedean copulas with different ...
5	Carley Maupin and Marco Pettinato. *Predictive Modeling and Analysis of Softball Using Linear Algebra-based Ranking Systems*
	The use of predictive modeling in the analysis of sports data is an exciting, but challenging task. There are many mathematically inspired sports ranking systems, but the Colley and Massey Methods are among the most elegant and simple. Both involve setting up and solving a system of equations. One way to improve these methods for ranking and predicting future outcomes is by introducing weights to these systems. In this talk, we will share the results of a summer research project in which we created and tested the predictive power of weighted Colley and Massey Methods using data from softball ...
6	Jon Johnson, Merrilee Guenther and Tom Sawyer. *The Elmhurst College KEYSTONE Program*
	The Elmhurst College KEYSTONE Program, funded by the National Science Foundation (DUE-1160956), is designed to increase the number of STEM graduates at Elmhurst College by concentrating on entering students' first-year experience. This program includes special First Year Seminar classes, the use of peer mentors, an "introduction to research" January term course, a career speaker series, and summer research.
7	Jim Olsen. *Look For and Make Use of Structure, Symmetry, and Similarity*
	We'll look at some wonderful geometry problems which can help our students* develop a connected understanding of mathematics and higher order thinking, see the beauty of mathematics, and experience the joy of mathematical reasoning, as a human experience. *I believe these problems are appropriate for high school students as well as college math majors.
8	Seyed Yaser Samadi and Mahappy Kankanamge Tharindu Priyan De Alwis. *Fourier Methods for Estimating the Central Mean Subspace in Time Series*
	Prior to conducting any kind of data analysis, it is important to reduce the dimension of variables, while preserving or extracting the key information or other properties of interest. In time series analysis, dimensionality reduction techniques are often used to estimate the conditional mean and variance functions. The central and central mean subspace can be used to project the high-dimensional feature space to a lower-dimensional space to estimate the conditional mean and variance functions in which preserve sufficient information and other features of

	interest contained in the data. ...
9	Angela Antonou and Rita Patel. *Math Teachers' Circle: A Comparison Between One and Three Day Workshops*
	In this presentation, we discuss the impact on teacher participants of two professional development workshops (one which lasted three days and one which lasted one day) administered as Math Teachers' Circles. We will compare and contrast the outcomes regarding teacher disposition regarding teaching and inquiry based learning.
10	Roshini Gallage. *Approximation Of Continuously Distributed Delay Differential Equations*
	We present a theorem on the approximation of the solutions of delay differential equations with continuously distributed delay with solutions of delay differential equations with discrete delays. We present numerical simulations of the trajectories of discrete delay differential equations and the dependence of their behavior for various delay amounts. We further simulate continuously distributed delays by considering discrete approximation of the continuous distribution.
11	Brendan Miller. *Categorification of Matrices Over the Natural Numbers*
	This paper expands on a well known result in category theory. Namely, the natural numbers have a simple categorification: the category of finite dimensional vector spaces over a given field. Since other algebraic structures can be constructed from the natural numbers, it stands to reason that these constructions have canonical categorifications. In [2] the author demonstrated that the semiring of nonnegative rational numbers can be categorified. In this paper, we demonstrate that the semiring of matrices over the natural numbers has a canonical categorification.
12	William Stowe. *The Last Digits of Infinity (On Tetrations Over Modular Rings)*
	A tetration is defined as repeated exponentiation. As an example, 2 tetrated 4 times is 2^(2^(2^2)) = 2^16. Tetrated numbers grow rapidly; however, we will see that when tetrating where computations are performed mod n for some positive integer n, there is convergent behavior. We will show that, in general, this convergent behavior will always show up.
13	Abigail Bailey. *The Art of Finding the Perfect Example*

	Some view math as a science with practical applications, while others prefer to look at math as an art with freedom of expression. Regardless of one's perception, mathematicians and those working as math practitioners are perpetually hunting for the perfect example to guide their work. The examples chosen and studied impact the ideas and conjectures that emerge through observing the consistencies or deviations among them. So how do we find, categorize, and exhibit examples to have the most meaningful impression and foster the maximal possible learning? Let's look at a few examples!
14	Lingguo Bu. *Spin the Cube*
	What happens when a cube spins around one of its major diagonals? Using physical, dynamic, and 3D-printed models, we look into the visual art and rich mathematics within a spinning cube.
15	Eric Redmon. *Modeling Crossed-Prism Graphs in Self-Assembling DNA Using Graph Theory and Linear Algebra*
	Motivated by the recent advancements in nanotechnology and the discovery of new laboratory techniques using the Watson-Crick complementary properties of DNA strands, formal graph theory has recently become useful in the study of self-assembling DNA complexes. Construction methods based on graph theory have resulted in significantly increased efficiency. In this paper, we present the results of applying graph theoretical and linear algebra techniques for constructing crossed-prism graphs. In particular, we explore various design strategies given two laboratory constraints.
16	April Tran and Jonathan Reaban. *Isomorphism between Rubik's Puzzles*
	We consider several Rubik's type puzzles with different shapes, asking if the actions on these puzzles are isomorphic. That is, when will the algorithm for solving one also apply to the other.
17	Timothy Comar. *Undergraduate Research in Mathematical Biology: Impulsive Differntial Equatios and Agent-Based Models*
	In this talk we will discuss several research projects conducted with undergraduate students. The projects we highlight are models for integrated pest management and pulse vaccination strategies. These models are developed using impulsive differential equations or agent-based models. We then discuss some further avenues for further research.
18	Jerzy Kocik. *Triangle simplified*
	Triangle is not a simple creature: it has a plethora of "centers" and other associated geometric objects. Among them are Euler's line and the nine-point circle, which are often omitted in rushed teaching. We shall present a modified view on triangle that will make these concepts simple and natural. New objects will also emerge.
19	Gregory Galperin. *An Intriguing 4-dimensional Polytope*

	My talk is devoted to a description of a very intriguing and exotic convex 4-dimensional polyhedron (polytope) Q with an arbitrary number n > 4 of vertices which has no diagonals inside it. It means that any segment that connects two arbitrary vertices of this polytope is its edge, and thus the total number of Q's edges equals the total number of handshakes in a company with n people. This phenomenon cannot occur in the plane or in 3-dimensional space: the only convex polygon with no diagonals is a triangle and the only one 3D polyhedron which does not have diagonals is a simplex with 4 ...
20	Aaron Zerhusen. *Polling, voting, and gerrymandering. Teaching the mathematics of democracy in a liberal arts math class.*
	In the fall of 2018 I taught a themed math for liberal arts majors class centered around mathematics related to elections and redistricting. Topics included voting theory, statistics and polling, and redistricting and gerrymandering. I'll discuss how the class went, and some data on the effect it had on the students' attitudes toward mathematics.
21	Jackson Hansen. *Design Strategies for Modeling Mongolian Tent Graphs using DNA Self-Assembly*
	Motivated by the recent advancements in nanotechnology and the discovery of new laboratory techniques using the Watson-Crick complementary properties of DNA strands, formal graph theory has recently become useful in the study of self-assembling DNA complexes. In this talk, we present our results applying graph theoretical and linear algebra techniques for Mongolian tent graphs. We explore designs strategies in which graphs smaller than or equal to the target graphs are acceptable.