KME

North Central Regional Convention

April 19 - 20, 2024

Missouri State University

Host Chapter: Missouri Alpha

All Events in Hill Hall 001 (see map below) unless otherwise indicated

Friday, April 19

7:00 P.M. Mixer
Math trivia contest, with a mix of mathematics history, mathematics, terminology and esoterica. Pizza and soda will be served.

Saturday, April 20

8:00 Registration

8:30 Welcome
Dr. Tamera Jahnke, Dean of the College of Natural and Applied Sciences

8:45 *Orthogonal Latin Squares and Their Quantum Counterparts*
Yashasvi Moon, Missouri State University

9:10 *An Introduction to the Method of Determined Coefficients*
Micah Herron, Evangel University

9:35 *The Product of the Chromatic Number and Independence Number of a Graph*
Rachel Lee, Missouri State University

10:00 BREAK

10:20 *Genus One Subgroup Lattices*
Peter Russell, Missouri State University

10:45 *Pizza Equality*
Tori Risner, Evangel University

11:10 Faculty Workshop: *Can You Do Math Like an Egyptian?*
Dr. Cynthia Huffman, Pittsburg State University

11:50 Group Picture

12:00 Lunch

1:00 Faculty Presentation: *An Introduction to JASP*
Dr. Ananda Jayawardhana, Pittsburg State University
Held in Cheek 173

1:30 Faculty Workshop: *Images, Functions and Reflections*
Dr. John snow, University of Mary Hardin – Baylor
Held in Cheek 173

2:10 Keynote Address: *Ramsey's Theorem*
Dr. Les Reid, Missouri State University

2:40 Awards, Closing Remarks

Participating Chapters

Kansas Alpha, Pittsburg State University
Kansas Beta, Emporia State University
Kansas Delta, Washburn University
Missouri Alpha, Missouri State University
Missouri Eta, Truman State University
Missouri Theta, Evangel University
Missouri Xi, William Woods University
Texas Kappa, University of Mary Hardin–Baylor

Local Organizer: Dr. Les Reid, Missouri State University

Abstracts

"Orthogonal Latin Squares and Their Quantum Counterparts"
Yashasvi Moon, Missouri State University
Faculty Advisor: Dr. Les Reid, Missouri State University

A Latin square of order n is an n × n array consisting of n symbols such that every row and every column contains every symbol exactly once. Two Latin squares are said to be orthogonal if when superimposed, each ordered pair appears exactly once. In 1782, Euler conjectured that if $n \equiv 2 \pmod 4$, then a pair of orthogonal Latin squares of order n cannot exist. We will examine the history of this conjecture. We will also discuss recent developments in which the classical objects in Euler's conjecture are replaced with quantum mechanical ones (qubits).[1]

References

1. https://www.quantamagazine.org/eulers-243-year-old-impossible-puzzle-gets-a-quantum-solution-20220110/

"An Introduction to the Method of Determined Coefficients"
Micah Herron, Evangel University
Faculty Advisor: Dr. Jeremy Osborne, Evangel University

This presentation discusses an alternative to differential equation's method of undetermined coefficients. We will explain research presented by David Bradley[1]. In contrast to the method of undetermined coefficients, we provide two formulas for particular solutions of the differential equation $\phi(D)y = f$. Bradley's formulas are obtained by applying the technique of differentiation with respect to a parameter to the exponential shift theorem for linear differential operators.

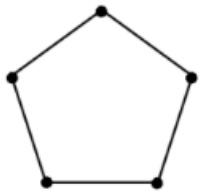
References

1. https://www.jstor.org/stable/48661778

"The Product of the Chromatic Number and Independence Number of a Graph"

Rachel Lee, Missouri State University
Faculty Mentor: Dr. Les Reid, Missouri State University

Given a graph G, its chromatic number $\chi(G)$ is the smallest number of colors needed to color its vertices so that no vertices connected by an edge have the same color. Its independence number $\alpha(G)$ is the largest number of vertices such that no two vertices are connected by an edge. For example, the graph shown below has $\chi(G)=3$ and $\alpha(G)=2$.



It is well known that $\chi(G)\alpha(G)\geq n$, where n is the number of vertices of G. Recently, Hefty and Johnson established an upper bound $f(n)$ for $\chi(G)\alpha(G)$.[1,2] In this talk, we will discuss this upper bound and determine which values in the range $[n, f(n)]$ can occur.

References

1. Z. Hefty and P. Johnson, Problem #2165 (proposal), *Mathematics Magazine*, 2023 (1), p.90.
2. E. Schmeichel, Problem #2165 (solution), *Mathematics Magazine*, 2024 (1), p.89.

"Genus One Subgroup Lattices"

Peter Russell, Missouri State University
Faculty Advisor: Dr. Les Reid, Missouri State University

The subgroup lattice of a group is the graph whose vertices are the subgroups of the group, and two subgroups are connected by an edge if one is a subgroup of the other and no proper subgroup lies between them. Bohanon and Reid completely characterized those finite groups whose subgroup lattice can be embedded in the plane with no edges crossing.1 We wish to investigate those groups whose subgroup lattice is not planar but can be drawn on the surface of a torus with no edges crossing. In this talk, we will restrict our attention to cyclic groups, where the subgroup lattice of $\mathbb{Z}n$ is the same as the divisor lattice of n

References

1 J.P. Bohanon and L. Reid, Finite groups with planar subgroup lattices, Journal of Algebraic Combinatorics, 23 (2006), 207-223.

"Pizza Equality"
Tori Risner, Evangel University
Faculty Advisor: Dr. Jeremy Osborne, Evangel University

This presentation discusses one of mathematics most important subjects: Pizza equality. We will explain research done by Greg Frederickson[1]. Under the right conditions it is possible to cut 1 pizza in such a way that 2 people get equal amounts of pizza regardless of where the center of all the cuts lies on the pizza. We will use symmetry, circumcircles, and angles of intercepted chords in order to prove this claim.

References

1. https://www.jstor.org/stable/10.4169/math.mag.85.1.26

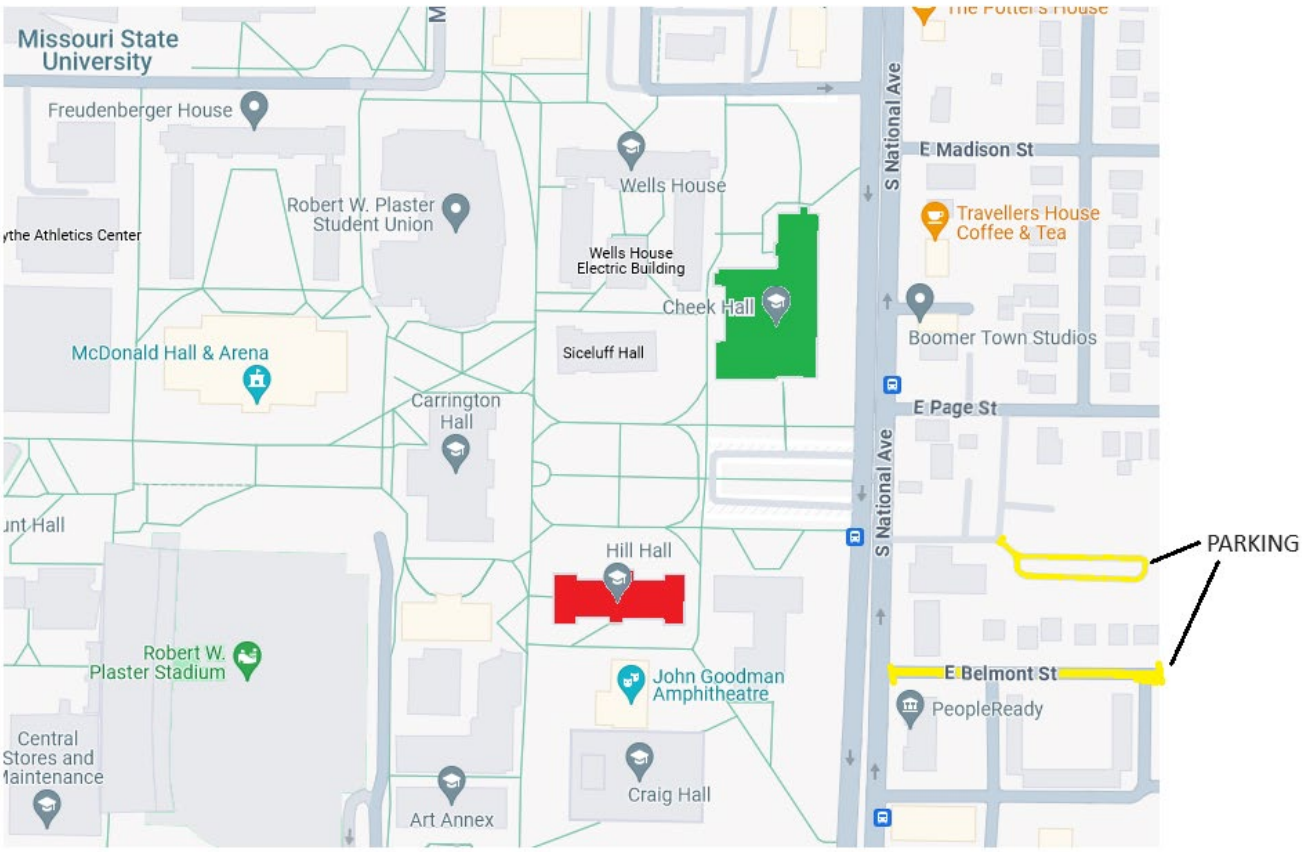
Faculty Workshop: "Can You Do Math Like an Egyptian?"
Dr. Cynthia Huffman, Pittsburg State University
We'll go back in time several millennia and experience a scribal school, learning about ancient Egyptian numerals and arithmetic.

Faculty Presentation: "An Introduction to JASP"
Dr. Ananda Jayawardhana, Pittsburg State University
We will introduce JASP, a free statistical package with a spreadsheet layout and an easy to use graphical interface. JASP includes descriptive statistics, confidence intervals, regression, and more.

Faculty Workshop: "Images, Functions, and Reflections"
Dr. John W. Snow, University of Mary Hardin-Baylor
We will briefly survey an algorithm for generating random functions on the square with vertices (-1, -1) and (1, 1) as compositions of certain basis functions and demonstrate how to use such functions to create "artistic images" based on a seed image. Participants will then have the opportunity to use the algorithm to generate their own images.

Keynote Address: "Ramsey's Theorem"
Dr. Les Reid, Missouri State University

In a party with six or more people there must be a group of three people who all know one another or a group of three people who do not know one another. This statement is one of the simplest consequences of Ramsey's theorem. In this talk, we will state the finite version of Ramsey's theorem, prove it in a special case, define Ramsey numbers and investigate them, introduce Graham's number (one of the largest numbers to appear in a mathematical proof), and discuss generalizations of Ramsey numbers.



From Les Reid:

The northern lot is owned by the Baptist Student Union, but they have been allowing anyone to park there for several years. People should NOT park north of the BSU sign (that is the Lutheran lot and they do enforce parking restrictions).

If anyone is uncomfortable with this, they can park on Belmont Street, which is the only street parking available.