

**Kansas Section of the MAA
2017 Annual Meeting
University of Kansas, April 28–29, 2017**

Abstracts of Talks

Keynote Speaker

Francis Su

Benediktsson-Karwa Professor of Mathematics, Harvey Mudd College
President of the Mathematical Association of America

Combinatorial Fixed Point Theorems

Friday, 7:30pm–8:30pm, 120 Snow Hall

The Brouwer fixed point theorem and the Borsuk-Ulam theorem are beautiful and well-known theorems of topology that admit combinatorial analogues: Sperner’s lemma and Tucker’s lemma. In this talk, I will trace recent connections and generalizations of these combinatorial theorems, including applications to the social sciences. Some of this work includes research with undergraduates.

My Favorite Math Fun Facts

Saturday, 11:00am–12:00pm, 120 Snow Hall

For several years, I have been collecting “Math Fun Facts”, which are juicy math tidbits that I have been using to start off my calculus classes, as a warm-up activity. Math Fun Facts are can be from any area of mathematics (not just calculus), can be presented in less than 5 minutes, and are meant to arouse my students’ curiosity and fascination with the subject and to give them a glimpse that mathematics is full of interesting ideas, patterns, and new modes of thinking. In this talk, I will present my favorite Math Fun Facts. They’re definitely fun, but will they be YOUR favorites? You decide.

Contributed Presentations

Saturday, 8:30–8:55am

Qiang Shi and Ryan Frier (Emporia State University)

The First Year of Inspired By Math Program

Saturday, 8:30–8:55am, 301 Snow Hall

Inspired By Math is a new math enrichment program in Emporia, Kansas. The program attracts motivated and talented middle school students in Emporia area. We currently have 21 students for the first year. The year-long program began with a four-day summer camp, in which students worked on the AMC 8 problems and attended math expository talks. The fall and spring program is further enhancing and enriching these topics covered in the summer camp. This presentation will give an overview of the program objectives and structure, introduce the math activities we have been doing, and discuss the early impact and assessment of the program. The Inspired By Math program is funded by Dolciani Mathematics Enrichment Grant, Novice Math Circle Grant, Emporia State University, and Emporia Middle School.

Tim Frye (Tabor College)

Recursive Relationships in the Classes of Odd Graphs and Middle Levels Graphs

Saturday, 8:30–8:55am, 302 Snow Hall

The classes of odd graphs O_n and middle levels graphs B_n form one-parameter subclasses of the Kneser graphs and bipartite Kneser graphs respectively. In particular both classes are vertex-transitive while resisting definitive conclusions about their Hamiltonicity, and have thus come under scrutiny with regards to the Lovasz conjecture. We will establish that middle levels graphs may always be embedded in odd graphs and middle levels graphs of higher degree, and furthermore, that this embedding allows us to define a recursion relationship in both classes which can be used to lift paths in O_{n-1} (respectively B_{n-1}) to paths in O_n (respectively B_n). Moreover, there is a natural incidence between disjoint copies of these embedded middle levels graphs, and the graph formed by this incidence is again an odd or middle levels graph. We will also list some connections between odd and middle levels graphs and Catalan numbers.

Katherine Brumley (Pittsburg State University)

Algebra Drawn Out

Saturday, 8:30–8:55am, 321 Snow Hall

In *Algebra Drawn Out*, we will look at a brief history of quadratic equations. Through the Babylonians' guessing method and the use of drawings to Carlyle's solutions that allowed for negative roots, we will see how constructions were used to solve different cases of quadratic equations.

Saturday, 9:00–9:25am

Ananda Jayawardhana (Pittsburg State University)

Use of Doceri in Virtual and Online Classes

Saturday, 9:00–9:25am, 301 Snow Hall

Doceri is an interactive whiteboard for the iPad. In a virtual classroom, the instructor sits in front of a computer and has two-way audio communications with students. The instructor can open electronic presentations, files, tables, etc., and share the screens with the students. Doceri provides a way to use the iPad as a whiteboard and work problems and share the screen with students in real time. These sessions can also be recorded and shared with students later. In addition, instructors can create videos using Doceri and share with students. In this presentation, I will share how I use Doceri in my classes.

Josh Bolick (University of Kansas Libraries)

Open Educational Resources and Math

Saturday, 9:00–9:25am, 321 Snow Hall

Higher education costs have skyrocketed in the last 2 decades. While not the largest contributor to overall costs, textbooks have risen at a rate exceeding 4x inflation and are increasingly impacting student success and retention. Open educational resources are one tool in a complex mix of strategies to affordability. There are particularly strong opportunities in Math, where a great number of materials currently exist. In this talk, I will briefly outline the affordability crisis and the opportunity of open education to address student needs, with an emphasis in math materials.

Saturday, 9:30–9:55am

Heidi Hulsizer (Benedictine College)

Round Robin Proofs

Saturday, 9:30–9:55am, 301 Snow Hall

Learning how to create proofs can be a difficult process for many undergraduate students. This session illustrates a method in which students sit in a circle and take turns adding to various proofs. This forces students to think about several different proofs in one setting and also forces them to consider alternative methods of proof provided by classmates. This method was used in an Honors Set Theory class but could easily be extended to a Discrete Math or Proofs class. The benefits and disadvantages of this method will be discussed.

Leah Childers (Pittsburg State University)

Mapping class groups: a pictorial introduction

Saturday, 9:30–9:55am, 302 Snow Hall

A key example in geometric group theory is the mapping class group of a surface, a group that arises from the geometry and topology of surfaces. In this talk we give an elementary, pictorial introduction to the mapping class group of a surface. We will explore standard examples and discuss basic tools for studying the group. Our focus will be on the interplay between the geometry of the surface and the algebraic properties of this group.

Cynthia Huffman (Pittsburg State University)

Rare Mathematics Books at the Linda Hall Library

Saturday, 9:30–9:55am, 321 Snow Hall

The speaker was recently a Research Fellow in the History of Science Department at the Linda Hall Library (LHL) of Engineering, Science and Technology. We will take a look at some of the highlights in the world-renowned LHL rare book collection and share how one can experience these mathematical treasures oneself, either in person or virtually.

Saturday, 1:20–1:45pm

Peyton Burlingame (Pittsburg State University)

Cross Ratio

Saturday, 1:20–1:45pm, 301 Snow Hall

A question posed in the MAA Monthly is the following: “Given four points A , B , C , and D in order on a line in Euclidean space, under what conditions will there be a point P off the line such that the angles $\angle APB$, $\angle BPC$, and $\angle CPD$ have equal measure?” We will present a partial solution of this question using the cross ratio. The cross ratio plays a central role in projective geometry however can be proved using the Law of Sines. The elements of the proofs are comprised of calculus, algebra, and geometry.

Devin Mattoon and Dannie Urban (Missouri Western State University)

Tilings and Pi

Saturday, 1:20–1:45pm, 302 Snow Hall

This talk will explore a combinatorial approach to rational approximations of π .

Mary Kate Levitt (Benedictine College)
Explaining the Rubik's Cube
Saturday, 1:20–1:45pm, 321 Snow Hall

This presentation covers the origins of the Rubik's Cube, the mathematical content behind the cube, and the math used to solve the cube. We will also see how many possibilities in which the cube can be positioned. Overall the cube shows an application of group theory. We will also see the algorithms used to solve the cube and how algorithms are created. If you want to learn how to solve the Rubik's Cube, come and learn one way to do it!

Saturday, 1:50–2:15pm

Scott Van Thuong, Landis Duff, and Jacob Rowley (Pittsburg State University)
Coloring \mathbb{R}^n
Saturday, 1:50–2:15pm, 301 Snow Hall

Consider the following: we are given three colors to assign to every point of three-dimensional Euclidean space, \mathbb{R}^3 . If we assign these colors arbitrarily, will one color attain every distance? That is, can we find one color such that, given any positive real distance, there exist points of this color separated by that distance? We answer this affirmatively and show that it generalizes to higher dimensions. We use induction, the initial cases being that of \mathbb{R}^2 and \mathbb{R}^3 . In the inductive step, we present an algebraic proof that the non-empty intersection of two non-equal $(n - 1)$ -spheres in \mathbb{R}^n is either an $(n - 2)$ -sphere or a single point. Further, what is the minimum number of colors we need to exhibit a coloring of \mathbb{R}^n in which for every color, there exists an unattainable distance. We exhibit such a 2-coloring of \mathbb{R}^n , thus showing the minimum is 2 colors when $n = 1$. In addition, we exhibit colorings of \mathbb{R}^2 and \mathbb{R}^3 that provide tentative upper bounds for the minimum number of colors.

Hong Biao Zeng (Fort Hays State University)
What if a programmer competes in the Kansas Collegiate Mathematics Competition?
Saturday, 1:50–2:15pm, 302 Snow Hall

Revisited the problems in past Kansas Collegiate Mathematics Competition. Provided delegate programming solutions to some of the interested problems.

Jeff Poet (Missouri Western State University)
Strings, Partitions, and the Cube of Rubik
Saturday, 1:50–2:15pm, 321 Snow Hall

A graph is a non-empty collection of points together with edges that connect some pairs of points. Some graphs have Hamiltonian paths (a path that visits each point once); others do not. If the graph cannot be "realized" with one string (path), how many does it take? We consider some interesting examples and provide basic ideas of how to prove something is minimal in this new and unfamiliar context. Accessible to all undergraduate students.

Saturday, 2:20–2:45pm

Sam Platt (Pittsburg State University)

Properties of Ulam Spirals and Other Prime Spirals

Saturday, 2:20–2:45pm, 301 Snow Hall

Prime numbers are known to be both unpredictably distributed and highly structured. This structure can be found in many visual representations of the integers; one such way is through prime spirals. Starting with Ulam, these spirals help to visually understand some characteristics of prime numbers and how they are structured.

Ali Mohammed Hakami (Pittsburg State University)

Al-Maghribi's Mecca Problem Meets Sudoku, solving the problem by the matrix 9×9 in the sixteenth century

Saturday, 2:20–2:45pm, 302 Snow Hall

There was a real problem. A man has 9 children and a farm which has 81 trees, and he gets per year: 1 unit of fruits from the first tree, 2 units from the second tree... , and 81 units from the 81st tree, but he does not know how to divide the trees equally among his kids with the same amount of units of fruits. That is, how can everyone get the same numbers of trees and the same amount of units equally?

Caitlin White (Pittsburg State University)

Thinking like Cardano

Saturday, 2:20–2:45pm, 321 Snow Hall

This presentation, based upon an article by Dr. William B. Branson, follows along Cardano's thought processes through solving one type of cubic equation, allowing a deeper understanding and appreciation of the work presented in *Ars Magna*. We explore the expression of Cardano's solution, which relies upon geometry and abacco mathematics, using diagrams presented in *Ars Magna*, as well as modern-day physical models.