MAA
MATHEMATICAL ASSOCIATION OF AMERICA

**81st Annual Meeting
of the
Oklahoma – Arkansas Section**

**Northeastern State University
28-30 March 2019**

**MAA Core Interests:
Education
Research
Professional Development
Public Policy
Public Appreciation**

OK-AR Section Website
http://sections.maa.org/okar

Abbreviations for OK – AR Institutions Represented in this Program Book

ATU	Arkansas Tech University
CU	Cameron University
ECU	East Central University
HSU	Henderson State University
HU	Harding University
IU	Indiana University
JBU	John Brown University
LU	Langston University
NSU	Northeastern State University
OBU	Oklahoma Baptist University
OSU	Oklahoma State University
OU	University of Oklahoma
SNU	Southern Nazarene University
SWOSU	Southwestern Oklahoma State University
TU	University of Tulsa
UAF	University of Arkansas
UALR	University of Arkansas, Little Rock
UAM	University of Arkansas at Monticello
UAPB	University of Arkansas at Pine Bluff
UCA	University of Central Arkansas
UCO	University of Central Oklahoma
UWT	University of Washington Tacoma

Meeting Overview

Thursday, March 28

4:00 – 8:00 pm	Registration and Check-in, Science Building 264
4:30 pm	Section NExT, Science Building 173
6:00 – 8:30 pm	Team Jeopardy Competition, Science Building 260, 160, and LL60
8:30 pm	Integration Bee, Science Building LL60

Friday, March 29

8:00 am – 3:00 pm	Registration and Check-in, Science Building 264
9:00 – 11:30 am	Section NExT, Science Building 173
9:00 – 11:30 am	Student Workshop, Science Building 260, *Shapes and Smiles!*
	John Diamantopoulos
9:00 – 11:30 am	Faculty Workshop, Science Building 263, *Developing a Culture of Mathematical Growth Mindset to Increase Students' Engagement, Perseverance, and Success*.
	Martha Parrott
11:45 am – 1:00 pm	Section NExT Lunch, University Center 221
	Faculty Sponsors Lunch, University Center 226
	Department Chairs Lunch, University Center 225
1:00 – 2:35 pm	Presented Papers, Undergraduate Students, Sessions 1 through 5, Science Building Rooms 261, 262, 263, 246, and 257
2:20 – 3:15 pm	Presented Papers, Sessions 6 through 10, Science Building Rooms 261, 262, 263, 246, and 257
3:15 – 3:40 pm	Refreshments, Science Building 264
3:45 – 4:45 pm	Section Visitor Lecture, Science Building LL60
	Epic Math Battles: Counting vs. Matching.
	Jennifer Quinn, University of Washington – Tacoma
4:50 – 5:50 pm	Executive Committee Meeting, Science Building 173
6:00 – 7:45 pm	Banquet, University Center Ballroom
8:00 – 9:00 pm	R. B. Deal Lecture, Webb Auditorium
	How the World Fits Together.
	Chaim Goodman-Strauss, University of Arkansas

Saturday, March 30

8:00 – 10:00 am	Registration and Check-in, Science Building 264
8:00 – 8:30 am	Refreshments, Science Building 264
8:30 – 9:05 am	Presented Papers, Sessions 11 through 15, Science Building Rooms 261, 262, 263, 246, and 257
9:15 – 10:25 am	Section Business Meeting, Science Building Lecture Hall LL60
10:30 – 11:25 am	Presented Papers, Sessions 16 through 20, Science Building Rooms 261, 262, 263, 246, and 257

Thursday Evening, March 28, 2019

4:00 – 8:00 pm	**Registration and Check-in**, Science Building 264
4:30 pm	**Section NExT**, Science Building 173
	Coordinator: Kristi Karber
6:00 pm	**Competitions for Undergraduates**
	Presiding: Scott McClendon and John Diamantopoulos
6:00 – 8:30 pm	**Team Jeopardy Competition**, Science Building 260, 160, and LL60
8:30 – 12:00 pm	**Integration Bee**, Science Building Lecture Hall LL60

Friday Morning, March 29, 2019

8:00 am – 3:00 pm   **Registration and Check-in**, Science Building 264

9:00 – 11:30 am   **Section NExT**, Science Building 173

9:00 – 11:30 am   **Student Workshop**, Science Building 260
Shapes and Smiles!
    John Diamantopoulos
Description: Participants will be provided 12 square pieces of paper, given oral directions to fold each of the squares uniformly, and then directed to assemble the 12 folded pieces into a stellated octahedron. The result will be a colorful, symmetric "conversation piece" of art constructed without the use of any adhesives. There will also be designed humorous mathematical interludes within the folding process to make the fun simply unbearable!

9:00 – 11:30 am   **Faculty Workshop**, Science Building 263
Developing a Culture of Mathematical Growth Mindset to Increase Students'
Engagement, Perseverance, and Success.
    Martha Parrott, Assistant Dean, College of Science and Health Professions, NSU
Description: Math mindsets matter. The presence or absence of mathematical growth mindset either transforms learning or creates barriers to student success. This session will engage faculty in dialogue that focuses on how to transform learning in higher education classrooms by exploring implications of student and instructor mindset. The research of Dweck (2016) and Boaler (2016) helps us more deeply understand the impact of mindset on student learning.   As faculty, we want to encourage students to reach their highest academic potential and close achievement gaps rather than hide them. Understanding the continuum of fixed and growth mindset is the first step in creating a productive culture of mathematical mindset in our classrooms whether online, blended, or face-to-face. When we support students' self-beliefs, we position them on a journey toward a more productive mindset that can overcome even their most difficult past struggles.   Equally important is recognizing and overcoming false growth mindset (Dweck, 2016, January 13). Because it takes more than instructor or student talk to grow and develop this disposition, attendees will take away action steps which will include specific tools related to handling mistakes students make, task selection, and classroom conversations, which together have the potential to transform learning in higher education mathematics classrooms.

Friday Lunch, March 29, 2019

11:45 am – 1:00 pm Section NExT Lunch, University Center 21

Faculty Sponsors of MAA Student Chapters Lunch, University Center 226

Department Chairs Lunch, University Center 225

Friday Afternoon, March 29, 2019

Session 1: Undergraduate Presentations, *Science Building 261*
Presiding: Britney Hopkins

1:00 - 1:15 pm **A Timeline of the History of Mathematics**, Hunter Marquez de la Plata and Shaylie Sanders (UAFS)
Mentor: Jack L. Jackson II
Abstract: This project is a timeline of mathematics poster which spans 1100-2018 including major mathematicians, birth and death dates, countries, and specialties. It also includes dates when certain mathematical notations, terms, and ideas were introduced, along with selected other events. The timeline also includes callouts detailing the contributions of particularly important mathematicians and mathematical ideas.

1:20 - 1:35 pm **Decoding Diffie-Hellman and Three-Pass**, Ginger Johnson (ECU)
Mentor: Andrew Wells
Abstract: Key exchange is used in Cryptography to exchange keys between two parties, allowing them to code messages with a cryptographic algorithm. This paper looks at two key exchanges, Diffie-Hellman and Three Pass, to explain how they work. Diffie-Hellman involves the parties deciding on a key together. Three-Pass allows them to have private keys. Both involve Number Theory and Abstract Algebra.

1:40 - 1:55 pm **Links in Higher Dimensional Spheres**, Kelsi Guleserian (OBU)
Mentor: Cherith Tucker
Abstract: The classification of non-splittable links in higher dimensional spheres has long been a difficult task. In this talk, we seek to explore a relatively simple way to identify when two spheres form a non-splittable link when embedded in a higher dimensional sphere. We will review the tools needed to understand and prove this interesting result and examine related corollaries regarding great circles.

2:00 - 2:15 pm **A brief discussion of finite rings**, Kailey Earlywolf (NSU)
Mentor: Richard Hasenauer
Abstract: We will see that there are eleven rings with four elements.   We will generalize these rings with a small number of elements and discuss some unsolved problems.

Session 2: Undergraduate Presentations, *Science Building 262*
Presiding: Ron Smith

1:00 - 1:15 pm   **Quasi-Newtonian Iterative Processes**, Samundra Regmi (CU)
Mentor: Ioannis K. Argyros
Abstract: We present a finer local as well as a semi-local convergence for Quasi-Newtonian
Iterative Processes than in earlier works. Numerical examples
show that the new results can be used to solve equations that the older
results could not.

1:20 - 1:35 pm   **Measuring Symmetry in Sine Waves Produced by Music**, Jimmy Atkins (UAM)
Mentor: Farrokh Abedi
Abstract: This research shows how to write equations for consecutive notes and chords played
by musical instruments. After writing the equations and graphing the sine waves produced by
the music, I will be able to compare the sine waves for symmetry. Sounds that produce a
symmetric sound wave are generally considered to sound more consonant that those that are
not symmetric.

1:40 - 1:55 pm   **An Investigation of the Gamma Function**, Caleb Frazier and Joshua Layton (UCO)
Mentor: Michael C. Fulkerson
Abstract: In this talk, we define the gamma function as a generalization of the familiar
factorial function, and we investigate some of its properties.

2:00 - 2:15 pm   **"When Will I Ever Use This?" The Purposes and Standards for Mathematics Education
in Oklahoma Schools**, Hannah Durkee (OBU)
Mentor: Sarah Marsh
Abstract: Historically, math education developed from societal necessity into a way to build
critical thinking skills. Modern secondary math education strives to find a balance of logical
problem-solving with real-world applications. I will discuss the results of a survey of
Oklahoma secondary math teachers, who were asked about the importance of teaching real-
world math and critical thinking in their classrooms, as well as their perspectives on current
standards.

Session 3: Undergraduate Presentations, *Science Building 263*
Presiding: Myron Rigsby

1:00 - 1:15 pm **Application of Ergodic Theorem to Determine the Probability of Leading Digits of Positive Powers**, Armand Ghosh (OU)
Mentor: Pengfei Zhang
Abstract: Benford's Law states that the probability of leading digits LD appearing in a randomly-selected natural number is $\log_{10}(1+1/LD)$. We can show by applying the Ergodic Theorem that the distribution of leading digits of positive powers follows Benford's Law, provided that the base is not a power of 10.

1:20 - 1:35 pm **Combinatorial Proofs of Families of Fibonacci Identities**, Joshua Crouch (SNU)
Mentor: James Sellers
Abstract: In a recent work, Baxter and Pudwell mentioned the following identity for the Fibonacci numbers F(n) and noted that it can be proven via induction:
For all $n > 0$, $F(2n) = 1 \cdot F(2n-2) + 2 \cdot F(2n-4) + ...(n-1) \cdot F(2) + n$

A tiling proof of this identity and two companion identities leads to three infinite families of Fibonacci identities, and a generalization produces three more families of identities.

1:40 - 1:55 pm **Dark Matter in Spiral Galaxies: a Discrete Approach**, Christopher Forth and Paul Biswas (OBU)
Mentor: Albert Chen
Abstract: This talk intends to focus on the discrete mathematical modeling and computational realization of generic spiral galaxies to ascertain the rotational velocity of bodies as a relation of radial distance.

2:00 - 2:15 pm **Iterated Line Graphs of Graphs With Regular And Bi-Regular Partitions**, Zachary King (UCO)
Mentors: Liz Lane-Harvard and Thomas Milligan
Abstract: Graph theory has many important applications in discrete mathematics and mathematical modeling. One tool that has been used to understand the underlying structure of graphs is the line graph. In 1965, van Rooij and Wilf first characterized iterated line graphs by the growth of their vertex count. In 2017, Balch, Milligan, and Lane-Harvard detailed the properties of the iterated line graphs of regular graphs, bi-regular graphs, and stars. This presentation and paper will detail new research being done to extend those results to larger classes of graphs, particularly graphs composed of regular and bi-regular subgraphs.

Session 4: Undergraduate Presentations, *Science Building 246*
Presiding: Sarah Marsh

1:00 - 1:15 pm **Peer-Led Team Learning Leadership Experience**, Antonia Bannister and Tamia Parker (UAPB)
Mentors: Anna Harris and Mike Seger
Abstract: This presentation will cover our journey as a Peer-Led Team Learning leader (PLTL). We are PLTL leaders at the University of Arkansas at Pine Bluff. We will be explaining the challenges as well the success stories that we have faced while being PLTL leaders. From the very first day that we learned that we had been accepted to become PLTL leaders, we were very excited, not knowing that this was not just the basic tutoring job. It took courage and strength to be able to tutor our peers and serve as mentors to them as well. Although this job is a lot of hard work, we have taken it seriously from the very beginning. We have constantly put our best foot forward to not only tutor our students in math but also foster meaningful relationships with them that will lead to success stories outside of getting a good grade in math.

1:20 - 1:35 pm **Peer-Led Team Learning (PLTL) Leader Experience and Julia Coding**, Simon Lewis and Bradford House (UAPB)
Mentor: Anna Harris
Abstract: We are participants in the NSF HBCU-UP TIP Grant at the University of Arkansas at Pine Bluff. Our presentation is created to show some of our experiences of being a Peer-Led Team Learning leader and writing functions using the Julia programming Language. As participants, our job is to write the code of functions for College Algebra, Pre-Calculus, and Calculus courses. The purpose of these functions is to assist students to be able to test their answers to the solutions of the code. The main aim of this program is to work as an advanced calculator but more user-friendly. Coding is not our only job; we are also responsible for assisting the students to learn how to use Julia in their respective classrooms.

1:40 - 1:55 pm **Peer-Led Team Learning (PLTL) Experiences**, Sha'nee Hulsey and Wade Garner (UAPB)
Mentors: Anna Harris and Rashunda Johnson
Abstract: We are participants at the NSF HBCU-UP TIP Grant at the University of Arkansas at Pine Bluff. This presentation will discuss the following topics: a) how the project was designed to help students understand and achieve more in college algebra; b) how the project has benefited students who attend the weekly sessions; and c) how being a Peer-Led Team Learning (PLTL) mentor has benefited us as math/math education majors. Weekly workshops were more than tutoring, but also about discussing challenges as college students. These challenges will be discussed during this presentation as well.

2:00 - 2:15 pm **Peer-Led-Team-Learning Leadership Experience**, Tashombia Lindsey (UAPB)
Mentors: Anna Harris and Samuel Chaney
Abstract: I am a NSF HBCU-UP TIP Grant participant on the University of Arkansas at Pine Bluff's campus. In this presentation, I will cover the experiences I had being a Peer-Led Team Learning (PLTL) leader, starting groups, Julia Box, and my weekly PLTL meeting. I took initiative from the very beginning when the PLTL leader position was introduced to me. I wanted to ensure that my students got the best out of the experience. PLTL is not only about tutoring, but also about forming meaningful relationships that will lead to mentorships and friendships.

Session 5: Undergraduate Presentations, *Science Building 257*
Presiding: Cherith Tucker

1:00 - 1:15 pm   **Inverse Problems Involving Partial Differential Equations (PDEs)**, Nadab Juarez-Flores and Mike Demmin (CU)
Mentors: Narayan Thapa and Gregory Herring.
Abstract: Inverse Problems is a rapidly growing branch in mathematics which can be used to solve numerous real-life scenarios which cannot be solved by a direct approach. Many phenomena in science can be modeled as problems involving partial differential equations (PDEs). Several PDEs can be solved using inverse problem methods. In this presentation, we consider an Initial Boundary Value Problem (IBVP) with a time-dependent parameter and a source function. We use an overspecified condition and a pair of transformations to transform the given IBVP free from parameter. We then use a numerical method to find an approximate solution to our IBVP using MATLAB and, given an exact known solution to the IBVP, error analysis will be performed.

1:20 - 1:35 pm   **Modeling Measles Vaccination and Outbreak**, Amber Young (UCO)
Mentor: Brittany Bannish
Abstract: We build a differential equations model of measles transmission in a population. We include susceptible, vaccinated, infectious, and recovered people in our model. We study how rate of vaccination and rate of infection affect the total number of people with measles. A novel modification of our model is looking at the two-stage vaccination process and its effect on the number of people with measles.

1:40 - 1:55 pm   **Application of Mathematical Statistics to Portfolio Optimization**, Muhammad Khalil (LU)
Mentors: Abebaw Tadesse and Andrew Bucki
Abstract: In this talk, we explore the applications of mathematical statistics and R tools (DataCamp) to compute and analyze global minimum variance portfolio on four Northwest Stocks, using the monthly closing price data, based on the Markowitz's algorithm.

2:00 - 2:15 pm   **Fingerprint Analysis of Fatty Acids Found in Algae**, Hayden Jumper (UAM)
Mentor: Victoria L. Fox
Abstract: Certain strains of Eustigmatophyceae are analyzed for statistical markers that indicate if the sample strains contain enough diversity to create specific fingerprint profiles of the fatty acids present in the algae.

2:20 - 2:35 pm   **Pricing European and American Options Using Numerical Methods**, Upama Neupane, Sharan Khanal, and Joseph Morgan (CU)
Mentor: Narayan Thapa
Abstract: This article introduces numerical methods for pricing both European and American options governed by the Black-Scholes equation. After a careful treatment on boundary conditions, we use explicit, implicit, and Crank-Nicolson schemes for numerical solutions to the resulting problem. We present a computational algorithm and display numerical results. We estimate relative error in L1 norm to test the accuracy of the schemes.

Session 6: Mathematics Education and Classroom Notes, *Science Building 261*
Presiding: Anna Harris

2:20 - 2:35 pm   **Pilot Faculty Experience: Evidence-Based Learning Utilizing Peer-Led Team Learning (PTLT) and Julia coding**, Rashunda Johnson (UAPB)
Abstract: Last semester, the University of Arkansas at Pine Bluff (UAPB) was awarded the Targeted Infusion Grant (TIP) from the National Science Foundation HBCU-UP. This presentation will discuss why the project was needed at UAPB, the structure of the project, and the use of peer leaders as supplemental instructors. The incorporation of learning management systems, JULIA programming language, preliminary successes and challenges, and further project plans will also be discussed.

2:40 - 2:55 pm   **Targeted Infusion Project: Infusion of Cyber, Research, and Peer-Led Team Learning to Enhance Minority STEM Majors' Mathematics Performance**, Anna Harris (UAPB)
Abstract: Mathematics is an important foundation of every science. Strong mathematical skills are the gateway to productive interdisciplinary exchanges in undergraduate science, technology, engineering, and mathematics (STEM) disciplines. The goal of this project is to infuse cyber/web-based, research/project-based, and peer-led-team-learning to enhance minority STEM majors' Mathematics performance.

3:00 - 3:15 pm   **Rethinking Math Content Courses for Preservice Elementary Teachers**, Cynthia Francisco (OSU)
Abstract: We are currently revamping our math content courses for preservice elementary teachers at OSU. In this talk, we will discuss the goals, challenges, and progress so far in this process. In particular, we will discuss how working with elementary school students in local schools has influenced our work with preservice teachers.

Session 7: Mathematics Education and Classroom Notes, *Science Building 262*
Presiding: Shanda Hood

2:20 - 2:35 pm **The Impact of Frequent Student-Faculty Interactions on Repeater Students**, Shanda Hood and Josh Girshner (UAF)

Abstract: Data show that half of all students who have dropped/failed Survey of Calculus or Finite Math at the University of Arkansas will do so again. To make connections and create a comfortable environment for discussing issues, repeater students were asked to meet with the instructor to complete an academic improvement plan which establishes regular contact with the instructor. Frequent interactions with these at-risk students have resulted in increased academic success.

2:40 - 2:55 pm **Simultaneous Success: Tales from a Composite Course**, Mary Harper and Nancy McClain (ECU)

Abstract: Focused on the incorporation of co-requisite courses into the general education pathway for mathematics. Discussion will surround success, limitations, delivery, and unforeseen impacts.

3:00 - 3:15 pm **Some initial thoughts on co-requisite classes**, Ron Koehn (SWOSU)

Abstract: Southwestern Oklahoma State University has just recently started offering co-requisite classes in its Mathematics department. This talk will discuss some initial thoughts on these classes. The co-requisite classes being offered will be described by relating the way these classes came to be, the structure and size of these classes, and how students enroll in them. The results for a survey given to these students will be presented. And, the results of this class in terms of grades and pass rates in College Algebra will be given; these will be compared with a previous semester using traditional remediation.

Session 8: Applied Mathematics, *Science Building 263*
Presiding: Michael Lloyd

2:20 - 2:35 pm **2D Ideal MHD and the Transformation to a 1D System**, Nicki Boardman (OSU)

Abstract: The magnetohydrodynamic (MHD) equations are the center piece of the study of magnetohydrodynamics. The MHD equations consist of a coupled system of the Navier-Stokes equations of fluid dynamics and Maxwell's equations of electromagnetism. This particular talk will discuss the transformation of the 2D ideal MHD equations to a 1D system. Results including local existence and uniqueness of solutions to the 1D system with symmetric initial conditions will be covered.

2:40 - 2:55 pm **Identifying Beat Subsets and Features in the ECG**, Emily Hendryx (UCO)

Abstract: This work presents a framework for identifying beat features in the electrocardiogram (ECG). Since each feature corresponds to a part of the cardiac cycle, tracking changes in features over time can provide insight regarding a patient's clinical status. Using tools from numerical linear algebra to first identify a representative subset of beats from a larger data set, we can then use clinical expertise and data science methods to identify individual beat features.

3:00 - 3:15 pm **Three-Parameter Bayesian Estimation Problem**, Michael Lloyd (HSU)

Abstract: A Bayesian estimate of three parameters will be derived using PERT, triangular distributions, and R. An analyst at a large corporation introduced me to this problem.

Session 9: Educational Technology, *Science Building 246*
Presiding: Noel Sagullo

2:20 - 2:35 pm   **3D Modeling Solids of Revolution**, Jeff Beyerl (UCA)
Abstract: Students have trouble visualizing solids of revolution; I have used 3D modeling to help them understand. This is a talk about my experience teaching solids of revolution and development of tools to aid in doing so. Both software and 3D printed models will be demonstrated during the talk.

2:40 - 2:55 pm   **Multivariable Calculus and GeoGebra**, Tom McNamara (SWOSU)
Abstract: GeoGebra provides an accessible way to view and manipulate graphs of two-variables functions. We have used this platform in a course on multivariable calculus. Applications include graphing surfaces, using level curves to visualize surfaces, understanding directional derivatives, and motivating Lagrange Multipliers.

3:00 - 3:15 pm   **Using Jupyter Notebook**, Noel Sagullo (UAFS)
Abstract: The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. In this talk, I will share my experience with using Jupyter in introductory classes in Linear Algebra and Discrete Mathematics.

Session 10: Research in Mathematics Education, *Science Building 257*
Presiding: Amy Schachle

2:40 - 2:55 pm   **Active Learning with Programming Approach (ALPA) in Mathematics for STEM Education, Part I**, Andrew Bucki, Abebaw Tadesse (LU), and Tracey Warren (IU)
Abstract: A metaanalysis study made by S. Freeman et al. PNAS, 2014, provided evidence that an Active Learning (AL) made average examination scores improved by about 6% as compared to the Traditional Learning (TL). In this talk, we present our proposed new educational program, the Active Learning with Programming Approach (ALPA). Our preliminary data indicate significant improvement over AL.

3:00 - 3:15   **Active Learning with Programming Approach (ALPA) in Mathematics for STEM Education, Part II**, Abebaw Tadesse, Andrew Bucki (LU), and Tracey Warren (IU)
Abstract: This is a continuation of the first part of the presentation on Active Learning with Programming Approach (ALPA) in Mathematics for STEM Education, Part I. We present examples from elementary and advanced mathematics illustrating our proposed pedagogy in ALPA

3:15 – 3:40 pm   **Refreshments**, Science Building 264

3:45 – 4:45 pm   **Section Visitor Lecture**, *Science Building Lecture Hall LL 60*
        Presiding: Jeanine Myers, Section Chair

        Epic Math Battles: Counting vs. Matching
        Jennifer Quinn, University of Washington Tacoma

        Abstract: Positive sums count. Alternating sums match. So which is "easier" to consider mathematically? This talk is one part *performance art* and three parts combinatorics. The audience will judge a combinatorial competition between the competing techniques. Be prepared to explore a variety of positive and alternating sums involving binomial coefficients, Fibonacci numbers, and other beautiful combinatorial quantities. How are the terms in each sum concretely interpreted? What is being counted? What is being matched? Do alternating sums always give simpler results? You decide.

        About the Speaker: Jennifer Quinn is a professor of mathematics at the University of Washington Tacoma. She earned her BA, MS, and PhD from Williams College, the University of Illinois at Chicago, and the University of Wisconsin, respectively. She taught in and chaired the mathematics department at Occidental College before moving to UW Tacoma where she helped develop the mathematics curriculum and served in several administrative capacities. She has held many positions of national leadership in mathematics including Executive Director of the Association for Women in Mathematics, co-editor of *Math Horizons*, Second Vice President of the Mathematical Association of America (MAA), Chair of the Council on Publications, and Officer-at-Large to the MAA Board of Directors. She received one of MAA's 2007 Haimo Awards for Distinguished College or University Teaching, the MAA's 2006 Beckenbach Book award for *Proofs That Really Count: The Art of Combinatorial Proof*, co-authored with Arthur Benjamin. As a combinatorial scholar, Jenny thinks that beautiful proofs are as much art as science. Simplicity, elegance, transparency, and *fun* should be the driving principles. Jenny is currently a candidate for MAA President, and she would appreciate your vote.

4:50 – 5:50 pm   **Executive Committee Meeting,** *Science Building Room 173*

Friday Evening, March 29, 2019

6:00 – 7:45 pm   **Banquet**, University Center Ballroom
        Presiding: John Diamantopoulos, Section 1st Vice Chair

        Menu:
        House Salad with Ranch or Italian Dressing
        Main Course: Chicken Marsala, Flank Steak
        Side Items: Oven Herb Roasted Potatoes, Wild Rice, Vegetable Medley
        Dessert: Chef's Choice of Desserts

8:00 – 9:00 pm   **R. B. Deal Lecture**, Webb Auditorium
Presiding: Nicholas Zoller, Chair, Named Lecture Committee

How the World Fits Together
Chaim Goodman-Strauss, University of Arkansas

Abstract: All around us, we are surrounded by
fantastic complexity, in any number of settings,
arising from the simple interactions of simple gadgets,
and there are many examples even in recreational
mathematics. For a sample, try to decide whether or
not you use copies of this tile to cover the entire
plane!

About the Speaker: Chaim Goodman-Strauss is a professor of mathematics at the University
of Arkansas. He received both his B.S. (1988) and Ph.D. (1994) in mathematics from the
University of Texas at Austin. His doctoral advisor was John Edwin Luecke. He joined the
faculty at the University of Arkansas in 1994 and served as departmental chair from 2008 to
2015. He held visiting positions at the National Autonomous University of Mexico and
Princeton University and did research at The Geometry Center, where he investigated
aperiodic tilings of the plane.

In 2008 Goodman-Strauss teamed up with J. H. Conway and Heidi Burgiel to write *The
Symmetries of Things*, an exhaustive and reader accessible overview of the mathematical
theory of patterns. He produced hundreds of full-color images for this book using software
that he developed for the purpose. The Mathematical Association of America said, "The first
thing one notices when one picks up a copy … is that it is a beautiful book … filled with
gorgeous color pictures … many of which were generated by Goodman-Strauss. Unlike some
books which add in illustrations to keep the reader's attention, the pictures are genuinely
essential to the topic of this book."

Goodman-Strauss has been fascinated by patterns and mathematical paradoxes for as long as
he can remember. He attended a lecture about the mathematician Georg Cantor when he was
17 and said, "I was already doomed to be a mathematician, but that lecture sealed my fate."
He became a mathematics writer and popularizer. From 2004 to 2012, in conjunction with
KUAF 91.3 FM, the University of Arkansas NPR affiliate, he presented "The Math Factor," a
podcast website dealing with recreational mathematics. He is an admirer of Martin Gardner
and is on the Math & Science Advisory Council of Gathering 4 Gardner, an organization that
celebrates the legacy of the famed mathematics popularizer and Scientific American
columnist, and is particularly active in the associated Celebration of Mind events.
He also creates large-scale sculptures inspired by mathematics, and some of these have been
featured at Gathering 4 Gardner conferences.

Saturday Morning, March 30, 2019

8:00 – 10:00 am   **Registration and Check-in**, Science Building 264
8:00 – 8:30 am   **Refreshments**, Science Building 264

Session 11: Classroom Notes, Statistics, *Science Building 261*
Presiding: Jason Holland
8:30 - 8:45 am   **Expectation and the Riemann Zeta Function**, Jason Holland (HU)
    Abstract: When trying to supply the student with examples of calculating expectation for a random variable, it is important to point out that E[X] may not exist. Preparing such an example last semester for a probability course led to an interesting connection with the Riemann Zeta function. In this presentation, we will share that observation.

8:50 - 9:05 am   **Alternating Advantages in Two Player Games**, Andrew Wells (ECU)
    Abstract: Many games have a kind of advantage built into them for one of the players. Examples might include going first or second, playing at home or away, or being allowed to make some choice affecting the game. Some games have mechanisms for determining which player gets this advantage others do not. In this presentation, we will discuss a few mechanisms for changing advantages between two players and what impact that has on outcomes.

Session 12: Experiences in Applied Mathematics, *Science Building 262*
Presiding: Matthew Donahue
8:30 - 8:45 am   **Developing Research Collaborations (How I Became a Biostatistician)**, Jack Jackson (UAFS)
    Abstract: A presentation of some experiences in developing research collaborations with colleagues in other disciplines

8:50 - 9:05 am   **Tulsa's Next Top Model**, Matthew Donahue (TU)
    Abstract: SIMIODE (Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations) is a community of practice dedicated to using modeling to teach differential equations. This fall the University of Tulsa will host SCUDEM (SIMIODE Challenge Using Differential Equations Modeling): a mathematical modeling competition for teams of undergraduates and advanced high school students. In this presentation, event information will be discussed including past challenge problems, roles of faculty advisors, and how students and schools can become involved.

Session 13: Research in Mathematics Education, *Science Building 263*
Presiding: Gregory Varner
8:30 - 8:45 am **Does Flipping a College Algebra Course Work**? Gregory Varner (JBU)
Abstract: The flipped or hybrid classroom has been a topic of much interest in Mathematics education during the last several years. Unfortunately, despite this interest, data on its success has been mixed. Here results will be presented on the success of using a flipped style of teaching in a small classroom setting, which was done during the past few (be specific) years at John Brown University, including results on student performance and student perception of the course.

8:50 - 9:05 am **Documenting Student Engagement in Calculus Instruction Videos**, Jason Martin (UCA) and Michael Tallman (OSU)
Abstract: How do students watch mathematics videos and how might their watching experience impact their learning? We will present some findings from the NSF funded Calculus Videos Project (calcvids.org) where we are investigating student learning and sense-making from instructional calculus videos. Data includes student responses to pre/post video questions, play/pause records, and eye-tracking.

Session 14: Classroom Notes, Calculus, *Science Building 246*
Presiding: Thomas McNamara
8:30 - 8:45 am **Filling Prerequisite Knowledge Gaps in Calculus I**, Myron Rigsby (UAFS)
Abstract: For three semesters, I have been teaching an extended class time section of Calculus I targeted to students with borderline prerequisite scores. I will discuss some results, lessons learned, and next steps, Hopefully, others trying similar experiments will bring suggestions.

8:50 - 9:05 am **Developing a Conceptual Model of the Cross Product of a Vector**, Deborah Moore-Russo (OU)
Abstract: Students struggle with computing the cross product in relation to the two vectors that form it, but very little research has involved a non-contextual geometric cross product activity, especially in an online context. This study uses grounded theory to analyze student work completed for an online visualization activity. The research aims to develop categories that could outline a conceptual model of student understanding of the cross product.

Session 15: Classroom Notes, Mathematics for General Education, *Science Building 257*
Presiding: Nicholas Zoller
8:30 - 8:45 am **Newspapers and Quantitative Literacy: A Natural Pairing**, Fred Worth (HSU)
Abstract: In this presentation, we will look at a long-time project I have been using in our quantitative literacy course. It tests the students' understanding of the topics while helping to demonstrate to them the relevance and applicability of the concepts in the course.

8:50 - 9:05 am **Notes on Teaching Survey of Math**, Michelle Lastrina (ECU)
Abstract: Report on teaching general education mathematics course for non-STEM majors during Fall 2019 semester. This course was taught without a required textbook. Additionally, students choose some of the material covered during the semester. This talk will discuss the experience, semester goals, some of the instructional materials created, and reflections from the class.

9:15 – 10:25 am **Section Business Meeting**, Science Building Lecture Hall LL 60
Presiding: Jeanine Myers, OK-AR Section Chair

Session 16: Mathematics and History, *Science Building 261*
Presiding: Nikola Petrov

10:30 - 10:45 am **Teaching Mathematics with Primary Historical Sources**, Nicholas Zoller (SNU)

Abstract: From Fall 2017 to Spring 2019, I volunteered to be a site tester for a National Science Foundation project that encourages faculty to use primary historical sources in undergraduate mathematics courses. I will share my experiences as a site tester, show examples of available projects, and provide details about how faculty can participate.

10:50 - 11:05 am **Some of the worst hitters in baseball history - part 2**, Fred Worth (HSU)

Abstract: In this continuation of my presentation from last year, I will look at some of the worst hitting performances in baseball history.

11:10 - 11:25 am **Johann and Jacob Bernoulli, Leibniz, Newton, and the curious history of the brachistochrone**, Nikola Petrov (OU)

Abstract: The initial development of the calculus of variations was fueled by passions between its creators. In this talk, we will discuss the famous problem of the brachistochrone, posed by Johann Bernoulli to all mathematicians in 1696, and the solutions by some of the greatest mathematicians of the day. The talk does not require any previous knowledge.

Session 17: Applied Mathematics, *Science Building 262*
Presiding: Nicholas Jacob

10:30 - 10:45 am **Chebyshev Polynomial Formulas for Coefficients of the Solutions to Initial Value Problems**, David Stapleton (UCO)

Abstract: A class of linear differential equations with constant coefficients and initial values is discussed in which the solution coefficients can be expressed in terms of Chebyshev polynomials involving the differential equation coefficients. This allows an immediate prescription of the solution to these initial value problems. The Laplace transform method provides a derivation of the formulas.

10:50 - 11:05 am **Symplectic techniques in solving Hamilton-Jacobi equation with applications to short wavelength optics**, Mahesh Sunkula (OU)

Abstract: Hamilton-Jacobi equation plays an important role in theoretical and mathematical physics.
Moreover, it builds a bridge between classical mechanics and other branches of physics - optics and quantum mechanics. We will discuss some techniques from symplectic geometry and give a geometric interpretation for the solutions of the Hamilton-Jacobi equation.
We will illustrate the method discussed on a particular example from short-wavelength optics.

11:10 - 11:25 am **Binning: Dividing Your Histogram**, Nicholas Jacob (ECU)

Abstract: Visualizing large amounts of data is more important than ever. With terabytes of data at everyone's fingertips, effective strategies for organizing and synthesizing data need to be reexamined. This presentation will examine different strategies for appropriately choosing how many bins a histogram might require. We will explore different techniques with distribution fitting in mind and examine some visualization tricks that can be used to manipulate the data displays. Special emphasis will be given to Excel and the python package mathplotlib for how to make a histogram that tells the story of your data.

Session 18: Algebra, *Science Building 263*
Presiding: Kayla Murray

10:30 - 10:45 am **Digital Roots: What are they?**, Kayla Murray (UAFS)
Abstract: In this talk, we will discuss the process of finding the digital root of any positive integer. Digital roots have a strong connection with numerical congruence. We will discuss this connection and the applications of digital roots.

10:50 - 11:05 am **Groups with Perfect Order Subsets**, Sariah Johnson and Michael Fulkerson (UCO)
Abstract: A group is said to have perfect order subsets if the number of elements of any given order divides the order of the group. In this talk, we investigate these groups, and we present some new results.

11:10 - 11:25 am **An Exploration of Lie Algebras and Representation Theory**, Kayla Murray (UAFS)
Abstract: What is a Lie algebra? A Lie algebra is a vector space equipped with an additional operation called the bracket with some special properties. In this talk, we explore the topic of Lie Algebras through examples. In addition, we will briefly discuss representation theory in connection to Lie algebras.

Session 19: Analysis, Topology, Algebra, *Science Building 246*
Presiding: Matthew Lynam

10:30 - 10:45 am **Prime Numbers and the Riemann Zeta Function**, Michael Fulkerson (UCO)
Abstract: In this talk, we define the Riemann zeta function and show its relationship to prime numbers via the Euler product formula. We also discuss one of the most important unsolved problems in mathematics, the Riemann Hypothesis.

10:50 - 11:05 am **Approximate Inverse Limits and (m,n)-dimensions**, Matthew Lynam (ECU)
Abstract: In 2012, Vitaly V. Fedorchuk introduced the notion of the (m,n)-dimension. These are defined using m-coverings and generalizes the covering dimension. Here we are going to look at this notion in the setting of approximate inverse systems of compact metric spaces. We give a characterization of (m,n)-\dim X, where X is the limit of an approximate inverse system.

11:10 - 11:25 am **An Algorithm to Reverse the Generalized Factorials Process**, Nitesh Mathur (TU)
Mentor: Kevin O'Neal
Abstract: We investigate the Generalized Factorials function, which generates factorials for any infinite subset of the integers. We wrote Mathematica code to experiment with various examples and propose an algorithm to reverse the process, that is, given a sequence of Generalized Factorials, generate the subset it came from originally.

Session 20: Education Technology, Python, *Science Building 257*
Presiding: Ernst Bekkering
10:30 - 10:45 am **Math and Python for Undergraduates**, Ernst Bekkering and Elliot Reif (NSU)
Abstract: Python is a powerful programming language with simple syntax. Different libraries provide math and stats functions. SymPy can use symbolic computation, where expressions are represented exactly, and unevaluated variables left in symbolic form. The online shell shows math symbols, but input is not user-friendly, and execution is slow. We discuss how a local application might be more suited for use by undergraduate students.

10:50 - 11:05 am **Python for Mathematics**, Naixue Xiong and Steven Rice (NSU)
Abstract: Python is a powerful scripting language with great opportunities for use in the sciences, including mathematics. We show how free versions of Python can be installed and how libraries can be imported. We conclude with a demonstration of the terminal interface, and two popular graphical user interfaces.

11:10 - 11:25 am **The Ten Best Python Libraries for Math**, Naixue Xiong and Ernst Bekkering (NSU)
Abstract: Basic installations of Python include some functions that can be used for mathematical operations. This functionality can be extended by importing additional libraries. We discuss the ten best Math libraries for Python.

Thank you for coming, and thank you to our hosts,
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Future Section Meeting Hosts

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Fayetteville, Arkansas

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