



**MAA**

**MATHEMATICAL ASSOCIATION OF AMERICA**

**80<sup>th</sup> Annual Meeting  
of the  
Oklahoma – Arkansas Section**

**Arkansas Tech University  
12-14 April 2018**

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

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

**Executive Committee  
2017 – 2018**

Ramesh Garimella, Past Chair  
Amy Schachle, Chair  
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Kristi Karber, Treasurer  
Michael Lloyd, Communications Director  
Ron Smith, Section Representative

**Abbreviations for OK – AR Institutions Represented in this Program Book**

AHS	Arkadelphia High School
ATU	Arkansas Tech University
ECU	East Central University
HC	Hendrix College
HSU	Henderson State University
HU	Harding University
NSU	Northeastern State University
OCU	Oklahoma Christian University
OSU	Oklahoma State University
OU	University of Oklahoma
SNU	Southern Nazarene University
SWOSU	Southwestern Oklahoma State University
TCC	Tulsa Community College
TU	University of Tulsa
UAF	University of Arkansas
UAFS	University of Arkansas - Fort Smith
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

## Meeting Overview

### Thursday, April 12

- 4:00 – 11:00 pm Registration and Check-in, Brown Hall Lobby  
MAA Book Sales, Brown Hall 147
- 4:00 – 7:00 pm Section NExT, Brown Hall 436
- 6:00 – 8:30 pm Team Jeopardy Competition, Rothwell 138 and 321
- 8:30 – 12:00 pm Integration Bee, Rothwell 138

### Friday, April 13

- 8:00 am – 8:00 pm Registration and Check-in, Brown Hall Lobby, Brown Hall 2<sup>nd</sup> Floor Lobby  
MAA Book Sales, Brown Hall 147
- 8:30 – 11:00 am Section NExT, Brown Hall 436
- 8:30 – 11:00 am Student Workshop, Doc Bryan Lecture Hall, *The Mathematics of Gerrymandering*  
Ruth Enoch
- 8:30 – 11:00 am Faculty Workshop, Doc Bryan Lecture Hall, *The Mathematics of Gerrymandering*  
John Watson
- 11:30 am – 1:00 pm Section NExT Lunch, Doc Bryan 242  
Faculty Sponsors of MAA Student Chapters Lunch, Doc Bryan 242  
Department Chairs Lunch, Doc Bryan 242
- 1:30 – 4:30 pm Refreshments, Brown Hall 2<sup>nd</sup> Floor Lobby
- 1:00 – 2:35 pm Presented Papers, Undergraduate Students, Sessions 1 through 6, Brown Hall Rooms 134, 148, 254, 356, 435, and 436
- 2:40 – 3:35 pm Presented Papers, Sessions 7 through 12, Brown Hall Rooms 134, 148, 254, 356, 435, and 436
- 4:00 – 5:00 pm Polya Lecture, Doc Bryan Lecture Hall  
*The Birth and Rise of Mathematical Epidemiology*  
Carlos Castillo-Chavez, Arizona State University
- 6:00 – 7:30 pm Banquet, Young Ballroom
- 8:00 – 9:00 pm N.A. Court Lecture, Doc Bryan Lecture Hall  
*Numerical Ranges over Finite Fields: A Discrete Analogue of a Complex Problem*  
Patrick X. Rault, University of Arizona

### Saturday, April 14

- 8:00 – 10:00 am Registration and Check-in, Brown Hall Lobby  
MAA Book Sales, Brown Hall 147
- 8:00 – 11:00 am Refreshments, Brown 2<sup>nd</sup> Floor Lobby
- 8:00 – 9:15 am Presented Papers, Sessions 13 through 17, Brown Hall Rooms 134, 148, 254, 356, and 435
- 9:30 – 10:30 am Section Business Meeting, Doc Bryan Lecture Hall
- 10:45 am – Noon Section Visitor Lecture, Doc Bryan Lecture Hall  
*Solving Problems: MAA American Mathematics Competitions and Evolving Views of Mathematics Education*  
Michael Pearson, MAA Executive Director

## Thursday Evening, April 12, 2018

- 4:00 – 11:00 pm**      **Registration and Check-in**, Brown Hall Lobby  
MAA Book Sales, Brown Hall 147
- 4:00 – 7:00 pm**      **Section NExT**, Brown Hall 436
- Competitions for Undergraduates**  
                                 Presiding: Scott McClendon
- 6:00 – 8:30 pm**      **Team Jeopardy Competition**, Rothwell 138 and 321
- 8:30 – 12:00 pm**      **Integration Bee**, Rothwell 138

## Friday Morning, April 13, 2018

- 8:00 am – 5:00 pm**      **Registration and Check-in**, Brown Hall Lobby, Brown Hall 2<sup>nd</sup> Floor Lobby  
MAA Book Sales, Brown Hall 147
- 8:30 – 11:00 am**      **Section NExT**, Brown Hall 436
- 8:30 – 11:00 am**      **Student Workshop**, Doc Bryan Lecture Hall  
*The Mathematics of Gerrymandering*  
                                 Ruth Enoch  
**Description:** Using materials obtained by Dr. John Watson at a workshop held at Duke University last November by the Metric Geometry and Gerrymandering Group (MGGG) at Tufts University, Ruth Enoch will lead a discussion of some of the mathematics involved in helping courts determine whether legislative districts have been gerrymandered. We will join the faculty workshop to watch video clips of Moon Duchin, Tufts University, and Jonathan Mattingly, Duke University. We will then separate from them to discuss various geometric measures of gerrymandering.
- 8:30 – 11:00 am**      **Faculty Workshop**, Doc Bryan Lecture Hall  
*The Mathematics of Gerrymandering*  
                                 John Watson  
**Description:** Using materials obtained at a workshop held at Duke University last November by the Metric Geometry and Gerrymandering Group (MGGG) at Tufts University, John Watson will lead a discussion of some of the mathematics involved in helping courts determine whether legislative districts have been gerrymandered. The workshop will include video clips of Moon Duchin, Tufts University, and Jonathan Mattingly, Duke University. Various geometric measures of gerrymandering will be discussed and problems presented which can be used in a wide variety of classes at both the undergraduate and graduate level.
- 11:30am – 1:00pm**      **Section NExT Lunch**, Doc Bryan 242
- 11:30am – 1:00pm**      **Department Chairs Lunch**, Doc Bryan 242
- 11:30am – 1:00pm**      **Faculty Sponsors Lunch**, Doc Bryan 242

## Friday Afternoon, April 13, 2018

### Session 1: Undergraduate Talks I, *Brown Hall Room 134*

Presiding: Britney Hopkins

- 1:00 - 1:15 pm**    **Examples of Image Processing Utilizing Mathematica**, Davell Lloyd (UAPB)  
**Mentor:** Anna Harris  
**Abstract:** Every time a photo or video is recorded and viewed, image processing has taken place. My goal is to better understand image processing with simplified examples utilizing Mathematica.
- 1:20 - 1:35 pm**    **Optical Phenomena**, Javaughn Love (UAPB)  
**Mentor:** Ana Harris  
**Abstract:** In this research presentation I will be discussing the basis of reflection and refraction.
- 1:40 - 1:55 pm**    **Classification of Noise Color on Distorted Audio Signals via an Adaptive Neuro-Fuzzy Inference System**, Allie Wynn (UAM)  
**Mentor:** V. Lynn Fox  
**Abstract:** A computational, cost-efficient method for identifying the color of the distorting noise on compounded audio signals has been developed. This method employs an infinite-valued logic system trained via neuro network learning.
- 2:00 - 2:15 pm**    **Validation of a Liquid Chromatography Mass Spectrometry Method with Spiked Synthetic Urine**, Brittany Fox (UAFS)  
**Mentor:** Jack L. Jackson II  
**Abstract:** This method tests for forty-one common drugs of abuse and was validated with six different studies to show it passes laboratory regulations.

### Session 2: Undergraduate Talks II, *Brown Hall Room 148*

Presiding: Cherith Tucker

- 1:00 - 1:15 pm**    **Partisanship's Effect on the Electoral System**, Josh Lessner (SNU)  
**Mentor:** Dr. Nathan Drake  
**Abstract:** This presentation provides further mathematical insight into the complexities of voting power, and the relationship between the Electoral college and partisanship.
- 1:20 - 1:35 pm**    **Von Neumann's Pseudorandom Numbers**, Hailey Lawrenson (HU)  
**Mentor:** Jason Holland  
**Abstract:** This discussion surveys the mathematical idea of randomness through an analysis of John von Neumann's Middle Square method of generating pseudorandom values. Considered by the mathematics and computing communities to be an ineffective method for pseudorandom number generation, this analysis lends a hand to the discussion of what it means for a generating algorithm to be "random enough."
- 1:40 - 1:55 pm**    **Business Analytics: Credit Card Users**, Kyron Lawson (UAPB)  
**Abstract:** I created a business model to decrease the percentage of credit card default users using binary classification and excel.
- 2:00 - 2:15 pm**    **Using Microsoft Visual Basic to Calculate the Sum and Average**, Camille Gardner (UAPB)  
**Mentor:** Anna Harris  
**Abstract:** The goal of this research is to create a form that calculates the sum and average amount of something using Microsoft Visual Basic. Microsoft Visual Basic is a programming environment from Microsoft in which a programmer uses a graphical user interface (GUI) to choose and modify preselected sections of code written in the basic programming language.
- 2:20 - 2:35 pm**    **Big Data Modeling and Management: Online Game Design**, Chayla Graham (UAPB)  
**Mentor:** Anna Harris  
**Abstract:** My presentation displays how to create the design required for an online game using knowledge and skills in big data modeling and management.

**Session 3: Undergraduate Talks III, Brown Hall Room 356**

Presiding: Nick Jacob

- 1:00 - 1:15 pm**    **Its a One Way Trip: A Topological Examination of a Chess Board**, Brooke Barton and Madison DeArmond (NSU)  
**Mentor:** Richard Hasenauer  
**Abstract:** We investigate the knight's traditional moves on various sized chess boards. The research begins by choosing a unique starting point on each board and then determining whether there is a path the Knight can take with the Knight passing over each square exactly once. Our results are both interesting and unexpected.
- 1:20 - 1:35 pm**    **Two Methods for Triangulating Hyperbolic Punctured Spheres**, Tucker Feix (OSU)  
**Mentor:** Neil Hoffman  
**Abstract:** A demonstration of quick computations on convex polyhedra used to expose differences in two methods for triangulating punctured spheres.
- 1:40 - 1:55 pm**    **Chordial Inverses**, Lawrence Dongilli (UCO)  
**Mentor:** Scott McClendon  
**Abstract:** For every point P on a planar function  $y = f(x)$  exterior to the unit circle there are two points A and B on the unit circle such that the line AP and the line BP are tangent to the unit circle. The points A and B define a chord. As P moves along  $y = f(x)$ , these chords change. If the lines containing these chords are taken as tangent lines, then the function to which they are tangent is called the chordial inverse of  $y = f(x)$ . We examine the chordial inverses of various functions, as well as some of their properties.
- 2:00 - 2:15 pm**    **The Pythagorean Theorem: Geometry's Most Elegant Theorem**, Timyah Wellmaker (UAPB)  
**Mentor:** Anna Harris  
**Abstract:** We will discuss the history of the mathematician Pythagoras. We will also prove that his theorem remains true. Lastly, we will show that this theorem is still used today.

**Session 4: Undergraduate Talks IV, Brown Hall Room 435**

Presiding: Ron Smith

- 1:00 - 1:15 pm**    **The Effect of an Inquiry-Based Learning Pedagogy on Student Attitudes and Beliefs about Mathematics in a Precalculus Course**, Seth Howard and Rachel Creech (OCU)  
**Mentor:** Paul Howard  
**Abstract:** We will discuss how Likert survey results and student metaphors were used to examine effects of an Inquiry-Based Learning Pedagogy on college Precalculus students' beliefs about the teaching and learning of mathematics.
- 1:20 - 1:35 pm**    **A Preservice Elementary Teacher's Journey into Mathematics and Drama: The Genius and Tragedy of Evariste Galois**, Cora Russell (OCU)  
**Mentor:** Paul Howard  
**Abstract:** A preservice elementary teacher discusses how mathematics and drama were brought together as an intriguing play was written about the tragic life of Evariste Galois. Also discussed is the positive impact this project had on a preservice elementary teacher's views of mathematics as personal and holistic.
- 1:40 - 1:55 pm**    **Introducing the Magic Square in Primary Education**, Nicholas Javaughn Williams Love (UAPB)  
**Mentor:** Ana Harris  
**Abstract:** To introduce the magic square in primary education to help improve student basic algebra skills in addition, multiplication, division, and subtraction.
- 2:00 - 2:15 pm**    **Influence of Prerequisite Skills on Calculus I**, Dusty Leming (UAFS)  
**Mentor:** Myron Rigsby  
**Abstract:** Quantitative analysis of tests to identify the extent to which prerequisite errors affect student test scores, combined with qualitative research with four selected students to identify deeper issues.

**Session 5: Undergraduate Talks V, Brown Hall Room 436**

Presiding: Kristi Karber

- 1:00 - 1:15 pm**    **The Correlation between Mathematics and Music**, Jimmy Atkins (UAM)  
**Mentor:** Farrokh Abedi  
**Abstract:** This is an introduction to mathematics in music. It will cover how to graph music using sine functions and how to measure dissonance in the sound notes make when played together.
- 1:20 - 1:35 pm**    **Ahme's Rind Papyrus**, Diamond Compton (UAPB)  
**Abstract:** I will be presenting the history of the Ahme's Rhind Papyrus. I will solve two problems from the papyrus and compare how to solve the problems in ancient Egyptian math to modern day math.
- 1:40 - 1:55 pm**    **Women in STEM**, Emily Torrealba (ATU)  
**Mentor:** John Watson  
**Abstract:** A summary of my time as a STEM student and my efforts to start ATU Women in STEM. Topics include the need for diversity in STEM fields and the challenges minority students encounter in these fields.
- 2:00 - 2:15 pm**    **An additive approach to squaring**, Caleb Cornelius (AHS)  
**Mentor:** Fred Worth  
**Abstract:** We will consider an algorithm that will produce the square of any positive integer primarily using addition.
- 2:20 - 2:35 pm**    **Modeling Music With Geometric Figures**, Christopher Smith (UAFS)  
**Mentor:** Jack L. Jackson II  
**Abstract:** Using Geometer's Sketchpad to model music with geometric figures and investigate different tuning systems.

**Session 6: Undergraduate Talks VI, Brown Hall Room 254**

Presiding: Jack L. Jackson II

- 1:00 - 1:15 pm**    **Counter-intuitive Examples In Analysis**, Valdimar Sigurdsson (UAF)  
**Abstract:** We present examples of counter-intuitive phenomena arising in real and Fourier analysis.
- 1:20 - 1:35 pm**    **Simulations of Non-Linear Cross Diffusion in Epidemics**, Azaryah Wilson (UCA)  
**Mentor:** Long Le  
**Abstract:** Cross-Diffusion is the spread of a substance away from another substance. In an epidemiological view, it is the movement of a healthy population away from an infected population in order to avoid infection. The purpose of this research is to use numerical schemes to simulate a disease outbreak occurring within a cross-diffusing population, both in 1D and 2D. From this, we can compare and contrast diffusion methods with what we would expect in nature.
- 1:40 - 1:55 pm**    **Exploring Finite-Time Blow-Up of Separable Nonautonomous Differential Equations**, Jacob Hines (HC)  
**Mentor:** Duff Campbell  
**Abstract:** As has been previously proven (Jared Williams, Hendrix '03), one can determine whether an autonomous differential equation will blow up in finite time (i.e., have a vertical asymptote) without actually solving the equation. However, the autonomous case is extremely narrow and only covers relatively few cases. I have extended Williams' result into the separable nonautonomous case, which requires an additional criterion in some cases.
- 2:00 - 2:15 pm**    **Modeling the Treatment of HIV in Children**, Kelley France (UCO)  
**Mentor:** Brittany Bannish  
**Abstract:** We build a differential equations model to study how the length of HIV treatment in young children affects the treatment success. We present our model and the results, identifying conditions under which the child would enter remission. We conclude by discussing how this information can be used to minimize the risks to other children/patients.

**Session 7: Mathematics Education and Classroom Notes** *Brown Hall Room 356* Presiding: John Watson

**2:40 - 2:55 pm** **Using Open Resources in a Freshman General Education Course: A progress report**, John Watson (ATU)

**Abstract:** For the past several years I have been using open resources in a freshman general education mathematics course for non-STEM majors. This is a progress report on that endeavor which has resulted in the compilation of those open resources into an iBook.

**3:00 - 3:15 pm** **Engaging Students with Meaningful Mathematics**, James Fetterly (UCA)

**Abstract:** Mathematics is a participation sport. However, most students are unaware of that, and they are passive when it comes to content contribution. This session will examine methods and ideas to motivate and involve students in rich mathematical content. Using these six strategies may enhance student engagement with the content of mathematics.

**3:20 - 3:35 pm** **An Interesting Problem from Euclidean Geometry**, Jack Jackson (UAFS)

**Abstract:** We will investigate under what conditions two triangles may have two pair of congruent angles and a pair of (not necessarily corresponding) congruent sides in Euclidean Geometry.

**Session 8: Research in Mathematics Education** *Brown Hall Room 254* Presiding: Lisa Mantini

**2:40 - 2:55 pm** **Transitional Conceptions of the Orientation of the Cross Product in CalcPlot3D**, Deborah Moore-Russo (OU)

**Abstract:** Students struggle with computing the direction of 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 a dynamic, online visualization activity. This preliminary research aims to develop categories that could outline a conceptual model of student understanding of the cross product.

**3:00 - 3:15 pm** **Comparison of student work in online vs. in-person instruction**, Lisa Mantini (OSU)

**Abstract:** In this paper we will summarize observed similarities and differences in the student work submitted on final exams in two versions of the Introduction to Analysis course: one taught in person during summer 2016, and one taught online in summer 2017.

**3:20 - 3:35 pm** **Schema Development in an Introductory Topology Proof**, Ashley Berger (OU)

**Mentor:** Sepideh Stewart

**Abstract:** We discuss an exploratory study into schema development of introductory topology students. We employed the idea of schema to analyze students' responses to a final exam problem about a basis for the product topology on a product space.



**Session 9: Mathematics Education and Classroom Notes** *Brown Hall Room 134* Presiding: Charles L Cooper

**2:40 - 2:55 pm** **Notational and Procedural Impediments to Learning Mathematics**, Charles L. Cooper (UCO)  
**Abstract:** In this talk we will discuss some of the implications of mathematical notation and the learning of procedures with respect to the learning of mathematics. Examples will be entertained from College Algebra through the Calculus.

**3:00 - 3:15 pm** **Could Algebra be the Root of Problems in Calculus Courses?**, Sepideh Stewart (OU)  
**Abstract:** The aim of this paper is to investigate in what ways the difficulties with algebra impact students' success in calculus.

**3:20 - 3:35 pm** **Teaching Statistics in a Quantitative Literacy Class**, Chizuko Iwaki (UAFS)  
**Abstract:** We will discuss outcomes of teaching the concept of statistics in Quantitative Literacy class

**Session 10: Mathematics Education and Classroom Notes** *Brown Hall Room 148* Presiding: Duff Campbell

**2:40 - 2:55 pm** **Approximating Logarithms**, Duff Campbell (HC)  
**Abstract:** Using known values for  $\log(2)$  and  $\log(3)$ , it is easy to find  $\log(4)$ ,  $\log(6)$ ,  $\log(24)$ , etc. For fun, I will see if we can also find decent approximations of  $\log(n)$  for other integers  $n$ .

**3:00 - 3:15 pm** **Factors that Impact Student Perceptions and Attendance in a Math Tutoring Center**, Christine Tinsley (OU)  
**Abstract:** Math tutoring centers are becoming more common, but we know little of their effectiveness. In this talk, I report on a survey completed by 1,088 students to shed light on key factors that impact students' math center experiences and their attendance.

**3:20 - 3:35 pm** **Comparison of Formats of Teaching Entry Level Probability and Statistics**, Garin Bean (UAF)  
**Mentor:** Jack L. Jackson II  
**Abstract:** In this study the author examined the attitudes and performance of college-level students in three introductory-level probability and statistics courses taught using three different pedagogical formats: traditional lecture-based, flipped, and full-online.

**Session 11: General** *Brown Hall Room 435*

Presiding: Fred Worth

**2:40 - 2:55 pm** **One of baseball's most dominant pitchers**, Fred Worth (HSU)  
**Abstract:** Dazzy Vance accumulated an impressive set of statistics that brought him induction into the baseball hall of fame. But a look at some of his numbers in the context of his era presents an even more impressive picture.

**3:00 - 3:15 pm** **Some of the worst hitters in baseball history**, Fred Worth (HSU)  
**Abstract:** A few years ago we looked at the worst hitter in baseball history. This time we're going to expand on that topic.

**3:20 - 3:35 pm** **Curves generated from regular polygons**, Andrew Wells (ECU)  
**Abstract:** A diagram of inscribed regular polygons has many patterns to be explored. One interesting question is defining polar curves that pass through selected vertices. This talk demonstrates some of these paths and generalizes as much as possible. It should be accessible to anyone who has seen polar coordinates.

**Session 12: Special Session on Mathematics Pathways** *Brown Hall Room 436* Presiding: Deborah Korth  
2:40 - 3:35 pm **Forging Relevant Mathematics Pathways in Arkansas**, Deborah Korth (UAF) and Linus Yu (UAFS)

**Abstract:** In this presentation we will share the results of a survey asking leadership in all departments that do not require calculus what mathematics competencies are necessary for their students to master. All 2-year and 4-year public institution in Arkansas participated. Although College Algebra has been traditionally required in many of these degree programs, most of the responses indicated that concepts introduced in Quantitative Literacy or Introduction to Statistics courses would be more appropriate for these students. This project was part of the Math Pathways Task Force whose goal is to ensure that all college students in Arkansas are taking mathematics courses relevant to their degree programs, future careers, and civic responsibilities.

3:45 – 5:00 pm **Polya Lecture, Doc Bryan Lecture Hall**  
Presiding: Amy Schachle, Section Chair

**The Birth and Rise of Mathematical Epidemiology**  
Carlos Castillo-Chavez, Arizona State University

**Abstract:** In this lecture, I will revise some of the origins of mathematical epidemiology and their impact on recent applications including Ebola, influenza, and vector born diseases.

**About the Speaker:** Carlos Castillo-Chavez is a mathematical epidemiologist and a Regents Professor of Mathematical Biology at Arizona State University. He has won awards by the American Association for the Advancement of Science (AAAS) Mentor Award and Fellow (2007), the Stanislaw M. Ulam Distinguished Scholar by the Center for Nonlinear Studies at Los Alamos National Laboratory (2003), the Society for Advancement of Chicanos and Native Americans in Science (SACNAS) Distinguished Scientist Award (2001), the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (1997), and the Presidential Faculty Fellowship Award from the National Science Foundation and the Office of the President of the United States (1992-1997). Carlos served from 2010-2015 on President Barak Obama's national medal of science committee and is a fellow of SIAM, AMS, and AAAS. Carlos is the executive director of the Mathematical and Theoretical Biology Institute and the Institute for Strengthening the Understanding of Mathematics and Science as well as the founding director of the Mathematical, Computational and Modeling Sciences Center at ASU. He previously taught at Cornell for 18 years.

5:00 – 6:00 pm **Executive Committee Meeting, Brown Hall Room 253**

## Friday Evening, April 13, 2018

6:00 – 7:30 pm

**Banquet – Buffet Style**, Young Ballroom  
Presiding: Jeanine Myers, Section 1<sup>st</sup> Vice Chair

*Menu:*

Pork Tenderloin Medallions	Salad
Chicken Breast	Roll
Mashed Potatoes and Gravy	Assorted Desserts
Green Beans	Tea, Water, Coffee

8:00 – 9:00 pm

**N.A. Court Lecture**, Doc Bryan Lecture Hall  
Presiding: Thomas McNamara, Chair, Court Lecture Committee

**Numerical Ranges over Finite Fields: A Discrete Analogue of a Complex Problem**  
Patrick X. Rault, University of Arizona

**Abstract:** Mathematics includes the diverse areas of algebra, analysis, and geometry. Studying the interplay between these areas can lead to striking breakthroughs in our understanding of the deep structure of mathematics. Given a square matrix, we can calculate its determinant, trace, eigenvalues, and eigenvectors to deduce its core structural properties. A lesser-known core invariant of the matrix is a set of complex numbers known as its numerical range. If  $A$  has complex entries, then the numerical range of  $A$  is a convex set of complex numbers which contains the eigenvalues of  $A$ . While these complex numerical ranges have been completely classified for  $n$ -by- $n$  matrices with  $n < 5$ , little is known in higher dimensions. When we consider these matrices over finite fields, new simplifications and complications arise. History tells us that the study of these analogous problems can provide new insight on the original problem. Here we will discuss some pioneering work on these finite field numerical ranges with undergraduates at SUNY Geneseo, together with some generalizations using the machinery of number theory. It is foreseeable that a complete classification of finite field numerical ranges could be accomplished in the coming decade, which could, in turn, shed light on what a classification for complex matrices would look like.

**About the Speaker:** Patrick X. Rault has been a member of the University of Arizona faculty since August 2016, where he is Associate Professor of Mathematics and Director of the Mathematics Program for UA-South. Before joining the University of Arizona, Dr. Rault earned tenure and promotion to Associate Professor at the State University of New York at Geneseo. He earned his Ph.D. from the University of Wisconsin in 2008. He is the recipient of the 2015 MAA Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member, the 2014 Hurrell/McNaron Award for scholarly presentation from SUNY College at Geneseo, a 2013 Council on Undergraduate Research (CUR) Mathematics and Computer Sciences Division Faculty Mentoring (National) Award for Outstanding Mentoring of Undergraduate Students in Research, and he is a National NExT fellow. Dr. Rault serves on the CUR Governing Council, currently as the Chair of the Math-Computer Science division.

## Saturday Morning, April 13, 2018

**8:00 – 10:00 am**    **Registration and Check-in**, Brown Hall Lobby  
MAA Book Sales, Brown Hall 147

### **Session 13: Analysis and Topology** *Brown Hall Room 134*

Presiding: Aaron Yeager

**8:00 - 8:15 am**    **Newton's Extension of Pascal's Triangle**, Tom McNamara (SWOSU)  
**Abstract:** We discuss how the coefficients in the expansion of certain infinite series can be obtained by a "backward extension" of Pascal's Triangle.

**8:20 - 8:35 am**    **Zeros of Random Orthogonal Polynomials with Complex Gaussian Coefficients**, Aaron Yeager (OSU)  
**Abstract:** We present asymptotics for the expected number zeros of random linear combinations of complex valued i.i.d. standard Gaussian random variables with orthogonal polynomials from the Nevai class.

**8:40 - 8:55 am**    **Relationships Among Notions of Largeness**, Lakeshia Jones (UALR)  
**Abstract:** We deal with 26 notions of largeness in a semigroup. We establish exactly the patterns of implications that must hold among 24 of these. We also note which of them are partition regular in the sense that whenever the union of two sets is large, one of them must be large.

### **Session 14: Applied Mathematics** *Brown Hall Room 148*

Presiding: Mehmet Aktas

**8:00 - 8:15 am**    **Assessing Models for a Stress Hormone in Human Saliva**, Michael Lloyd (HSU)  
**Abstract:** Various models were assessed for predicting cortisol concentration in psychology students' saliva based on light absorbance values.

**8:20 - 8:35 am**    **Tasting Wine with K-nearest Neighbors Classifier**, Nicholas Jacob (ECU)  
**Abstract:** During the summer of 2017, I participated in a data analytics training with PIC Math utilizing the Python programming language. Our group examined wine attributes and how they affected the tasting results. This talk will present the work including some discussions on Principle Component Analysis, K-nearest Neighbors classifier, cross validation, feature engineering, and bias-variance trade-off.

**8:40 - 8:55 am**    **Fingerprint Identification Using Topological Data Analysis**, Mehmet Aktas (UCO)  
**Abstract:** Fingerprints have been used extensively for proof of identity for years since they are completely unique to each individual. Current automated fingerprint identification methods basically use three different levels of features: Level 1 features (pattern), Level 2 features (minutiae points) and Level 3 features (pores and ridge shape). Although these features are effective in recognition, there are some situations where they are inadequate. In this paper, we report an on-going work concerning a new method of identification which uses topological data analysis, an emergent field of mathematics that studies the shape of the data, to take all the three level features and also other unlabeled, uncategorized topological features into consideration.

**Session 15: Discrete Mathematics** *Brown Hall Room 254*

Presiding: Jeffrey Beyerl

- 8:00 - 8:15 am**    **Graph pebbling and the pebbling number of selected graphs**, Michelle Lastrina (ECU)  
**Abstract:** Graph pebbling is a mathematical game that can be played on a graph. In the game, pebbles are placed on the vertices of the graph prior to pebbling moves. In this talk, we will describe and demonstrate graph pebbling. We will also explore a corresponding parameter known as the pebbling number for some families of graphs. Time permitting, we will compare those values to other graph parameters.
- 8:20 - 8:35 am**    **Classifying Improper Interval Graphs**, Jeffrey Beyerl (UCA)  
**Abstract:** In the field of graph theory, an interval graph is a graph that can be represented as the intersection graph of closed intervals on the real line. Such a graph is said to be  $\mathbb{R}$ -improper if no interval contains more than  $\mathbb{R}$  others. In this talk we will informally construct examples of improper interval graphs and look at recent results on classifying these graphs.
- 8:40 - 8:55 am**    **Iterated Line Graphs on Trees**, Thomas Milligan (UCO)  
**Abstract:** In 1965, van Rooij and Wilf considered sequences of line graphs, in which they grouped sequences of line graphs into four categories. We'll add to their research by presenting results on sequences of line graphs for star graphs. We will then investigate slight variations of star graphs.

**Session 16: Educational Technology** *Brown Hall Room 356*

Presiding: John Diamantopoulos

- 8:00 - 8:15 am**    **Visual Proofs by Animated GIFs**, John Diamantopoulos (NSU)  
**Abstract:** Some proofs are quite naturally done as “proofs without words”. Creating animated GIFs to represent such proofs can really make them “come to life” for the students. Come and see some examples that I’ve created recently and I’ll discuss exactly how they were created.
- 8:20 - 8:35 am**    **Incorporating an iPad into Mathematics Courses to Promote Student Engagement**, Britney Hopkins and Kristi Karber (UCO)  
**Abstract:** We will discuss apps that can be used to enhance student engagement and understanding both in and out of the mathematics classroom. Specific examples of how these apps were utilized in various courses will also be given.
- 8:40 - 8:55 am**    **Developing Students' Reasoning about the Derivative of Complex-Valued Functions with the Aid of Geometer's Sketchpad**, Jonathan Troup (OU)  
**Mentor:** Sepideh Stewart  
**Abstract:** In this presentation, I share results of a case study describing the development of two undergraduate students’ geometric reasoning about the derivative of a complex-valued function with the aid of Geometer’s Sketchpad (GSP). Participants’ use of GSP, speech, and gesture assisted with discovering function behavior, generalizing how the derivative describes the rotation and dilation of an image with respect to its pre-image for non-linear complex-valued functions, and recognizing that the derivative is a local property.
- 9:00 - 9:15 am**    **Desmos Knows**, Mary Harper and Matt Lynam (ECU)  
**Abstract:** Focused on the incorporation of free Desmos technology as a way of furthering students’ understanding of key conceptual ideas in College Algebra, Trigonometry, Calculus, and Complex Variables.

**Session 17: Mathematics Education and Classroom Notes** *Brown Hall Room 435* Presiding: Sepidah Stewart

**8:00 - 8:15 am**      **NextGen Accuplacer Implementation and Findings**, Jeanine Myers and Kristi Brown (ATU)  
**Abstract:** Accurate mathematics placement is an important part of student success in mathematics courses. The NextGen Accuplacer Test was put on the market starting Fall 2017 without a concordance for results of test scores. Arkansas Tech University implemented the test last fall, determined bounds, and collected data. In this talk we present our findings based on our collected data.

**8:20 - 8:35 am**      **My Experience with Oral Exams**, Victoria Ryburn (UAF)  
**Abstract:** This discussion will be a detailed account of my experience with oral exams in an online course. I will share the instructions to the students, how the students submitted the exam, the rubric used for grading, a few small clips of student submissions and student opinions of the experience.

**8:40 - 8:55 am**      **Implementing Active Learning: Challenges and Rewards**, Candace Andrews (OU)  
**Abstract:** OU implemented active learning in its Precalculus classes in fall 2016. This talk will report on lessons learned including reasons for adopting this approach, how this was accomplished, challenges faced, and benefits of this pedagogical methodology.

**9:00 - 9:15 am**      **Standards-Based Grading: A Mastery-Based Assessment Approach**, Sasha Townsend (Faculty member, TCC and graduate student, TU)  
**Mentor:** Kevin O'Neil  
**Abstract:** For five semesters, I have used a nontraditional, mastery-based assessment approach called standards-based grading (SBG) to encourage learning, assess my students understanding, and enhance student motivation and accountability. My presentation will discuss SBG, the benefits and challenges of the grading system, and my experiences in implementing the method with different populations of students (STEM vs. non-STEM majors, TCC students vs. TU students). While there are both logistical and buy-in challenges to implementing this system, student outcomes and understanding have made me a firm believer in the efficacy and fairness of this approach.

**9:30 – 10:30 am**      **Section Business Meeting**, Doc Bryan Lecture Hall  
Presiding: Amy Schachle, OK-AR Section Chair

10:45 am – Noon

**MAA Section Visitor Lecture**, Doc Bryan Lecture Hall

Presiding: Amy Schachle, OK-AR Section Chair

**Solving Problems: MAA American Mathematics Competitions and Evolving Views of Mathematics Education**

Michael Pearson, MAA Executive Director

**Abstract:** Through its years as the American High School Mathematics Examination and now as the AMC, MAA competitions programs illustrate the evolving views of what constitutes effective mathematical problem solving, as well as identifying and cultivating mathematical talent. We will take a leisurely tour through more than a half-century of the Association's efforts to advance mathematics through competitions.

**About the Speaker:** Michael Pearson received a bachelor's degree from the University of Mississippi in 1980, a master's degree from Mississippi State University in 1982 and a Ph.D. (Harmonic Analysis) from The University of Texas at Austin in 1989. Prior to joining the MAA (in 2002), he served on the faculty at Florida International University (1989–1992) and Mississippi State University (1992–2002). As Executive Director, Michael provides leadership to further the mission of the MAA. As a long-time member of the MAA, he is delighted to have the opportunity to work closely with colleagues who share the sense of community and common purpose that he sees as the fundamental strength of the Association.

Thank you for coming, and thank you to our host,  
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