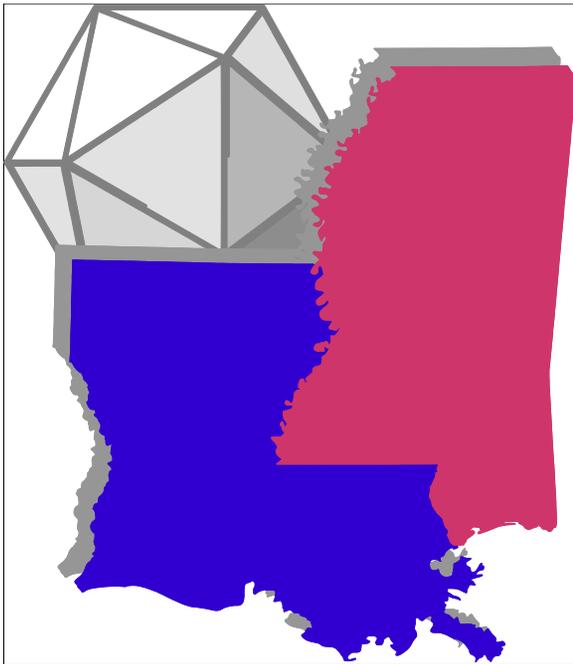


The Mathematical Association
of America

Louisiana/Mississippi Section



94th

Annual Meeting
hosted by Millsaps College
Jackson, Mississippi
February 16 – 18, 2017

Plenary Address

Intrinsic Properties of Graphs Embedded in \mathbb{R}^3

Erica Flapan, Pomona College

Friday, February 17th, 1:30 p.m. – 2:30 p.m.

Ford Academic Complex Recital Hall

Knot theory is the study of embeddings of simple closed curves in \mathbb{R}^3 . A natural extension of knot theory is the study of embeddings of graphs in \mathbb{R}^3 . However, in contrast with knots, the structure of a graph can be complex, and this can affect all of its embeddings. If every embedding of a graph has a particular property, then we say that property is intrinsic to the graph. For example, a graph is said to be intrinsically knotted if every embedding of the graph in \mathbb{R}^3 contains a knot. In this talk I will introduce intrinsic knotting and other intrinsic properties of graphs, and present some open problems in the area.

NOTES:

7th Annual R.D. Anderson Lecture

Effective Thinking and Creative Puzzle Solving

Edward B. Burger, Southwestern University

Friday, February 17th, 5:30 p.m. – 6:30 p.m.

Ford Academic Complex Recital Hall

Here's a Puzzle: How can we joyfully and impactfully engage our students to thrive in their math courses? How can we inspire our students to see the beauty and power of mathematical thinking? Here we will offer some practical strategies of thinking that will allow our students to not only make greater meaning of mathematics, but use those mindful practices beyond their math classes and for the rest of their lives. We will illustrate these strategies of effective thinking through some illustrative puzzles.

NOTES:

Outstanding Teacher Address

Surprising Sums

Tommy Leavelle, Mississippi College
Saturday, February 18th, 10:30 a.m. – 11:30 a.m.
Ford Academic Complex Lecture Hall (AC 215)

In the calculus sequence, several weeks are dedicated to the concept of convergent infinite series. A number of tests such as the Integral Test, the Limit Comparison Test and the Ratio Test are explored as means of determining whether or not a given series converges. Much less emphasis is given to determining the exact value of the sum. In this talk, we will look at some of the surprising sums that can be obtained.

NOTES:

Student Luncheon and Presentation

Invariants Under Group Actions to Amaze Your Friends!

Doug Ensley, Deputy Director of the MAA
Friday, February 17th, 11:15 a.m. – 12:45 p.m.
Campbell Conference Center

By understanding invariant properties of a group action (a.k.a., shuffling) on a deck of cards, a magician can find order where the spectator believes he or she has created disorder, often resulting in a surprising, perhaps even magical effect. This presentation will highlight some specific card tricks that illustrate the mathematical ideas of permutations and invariance.

NOTES:

Section NExT Workshop

NOTES:

Friday, February 17th, 8:30 a.m. – 11:30 a.m.
Sullivan Harrell Hall Room 368

8:30 a.m. Welcome & Introductions

Jana Talley, Jackson State University,
Section NExT Coordinator
Christine Gordon, McNeese State University,
Section NExT Committee
Carmen Wright, Jackson State University,
Section NExT Committee

8:50 a.m. Getting Connected with the MAA

Michael Pearson, MAA
Doug Ensley, MAA

9:20 a.m. Just Say Yes...No...Maybe?

Jana Talley, Jackson State University

9:50 a.m. Break

10:00 a.m. Integrating Technology

Into Undergraduate Instruction

Carmen Wright, Jackson State University
Christine Gordon, McNeese State University
Lenny Ornas, McNeese State University

10:30 a.m. Growth Mindset

Judith Covington, Louisiana State University,
Shreveport

11:15 a.m. Closing Remarks

Student Papers

Friday, February 17th, 3:00 p.m. – 5:30 p.m.
Sullivan Harrell Hall Room 369

3:00 p.m.

Zeckendorf's Theorem and Fibonacci Coding

William Hawkins

Undergraduate, Mississippi College

The Fibonacci sequence, first introduced in the 1200's, is famous for appearing in seemingly random places in mathematics. The sequence has found an additional application in coding theory, the mathematical study of the best way to transmit data by preserving the integrity of the data against possible losses in transmission. Many schemes and representations have been developed for encoding data, and Fibonacci Coding employs an interesting property of the Fibonacci sequence to produce a robust, error correcting code. Here, we trace the development of the properties of the Fibonacci numbers that allow this code to be useful.

3:15 p.m.

The Distance Between a Point and a Line

Deep Karki,

Undergraduate, Southeastern Louisiana University

We determine the minimum distance between a given point and a given line in two dimensional and in three dimensional spaces, using 1-norm, that is we find the minimum values of the function $Y(t) = |x_1 - x_2t| + |x_3 - x_4t|$ and $Z(t) = |x_1 - x_2t| + |x_3 - x_4t| + |x_5 - x_6t|$, where x_1, x_2, \dots, x_6 are real numbers.

3:30

Solving Recurrence Relations Using Linear Algebra

Cameron Dean

Undergraduate, Southeastern Louisiana University

We use linear algebra techniques to study the general recurrence relation $a_{n+2} = \alpha a_{n+1} + \beta a_n$. We also develop relationships between the entries of the sequence $\{a_n\}$. In particular, we look at the Fibonacci Sequence $a_{n+2} = a_{n+1} + a_n$.

3:45 p.m.

Characterizing Behavior

of the Difference Equation $x_{n+1} = (ax_n + b) \pmod{1}$.

Joseph D Fontenot

Undergraduate, University of Louisiana at Lafayette

The difference equation $x_{n+1} = (ax_n + b) \pmod{1}$ is well understood for $a \in \mathbb{Z}$ and $b \in [0,1)$. We extend these results to characterize the behavior on $a \in (-1, 1), a \neq 0$. We describe the kind of possible cycles and demonstrate that we can find bounds to determine exactly when they occur.

NOTES:

4:00 p.m.

**An Investigation of Existence and Enumeration
of Certain Arrangements of $\{1,1,2,2,3,3,4,4,\dots,n,n\}$**

Damodar Dahal

Undergraduate, Southeastern Louisiana University

We investigate the existence and enumeration of certain arrangements of numbers $\{1,1,2,2,3,3,4,4,\dots,n,n\}$. This specific arrangement requires that same numbers be separated by a gap equal to the number itself. For example, the two 1's should be separated by a gap of 1, the two 2's by a gap of 2, and so on. This specific arrangement seems to exist if and only if $n = 4k$ or $n = 4k + 3$. Necessity is proven. Further more, computer algorithms verify the converse up to $n=44$ and provide a count for how many arrangements exist for $n = 3, 4, 7, 8, 11, 12, 15, 16$.

4:15 p.m.

Picard's Iterative Method for Caputo Fractional ODEs

Rainey J Lyons,

Graduate, University of Louisiana at Lafayette

With fractional DEs rising in popularity and methods for solving them still being developed, approximations to solutions of fractional IVPs have great applications in related fields. This paper proves a generalized Picard's Iterative Existence and Uniqueness Theorem for Caputo Fractional ODEs and shows how the iterations can be used to approximate the solution.

4:30

Elliptic Curve Cryptography Comparison

Sadie Newell

Graduate, McNeese State University

Cryptography has become essential in passing secret information from one party to another in today's world. In cryptography, there are currently two main methods for public-key cryptography, those being elliptic curve cryptography and RSA. This paper will focus on elliptic curve cryptography, starting with what an elliptic curve is in general as well as some of the math involved with elliptic curves. Furthermore, two algorithms will be looked at in depth, individually; the Elliptic Curve Diffie-Hellman Algorithm and the Elliptic Curve Digital Signature Algorithm.

4:45 p.m.

**Isomorphisms Between 2-near-transitive Tournaments
and 1-near-transitive Tournaments**

Nick Collins,

Graduate, Louisiana Tech University

A tournament is a directed graph in which each pair of vertices is connected by a single arc. A transitive tournament is a tournament with the following property: if node P dominates node Q, and node Q dominates node R, then P dominates R. An α -near-transitive tournament (α -NT) is defined as a transitive tournament in which directions of α distinct arcs have been reversed. On any fixed number of vertices, all 2-NT tournaments isomorphic to a 1-NT tournament are determined. Disregarding trivial examples, there are surprisingly only three classes of 2-NT tournaments isomorphic to a 1-NT tournament.

5:00 p.m.

Topics from the Theory of Random Walks

Samantha Courville,
Graduate, McNeese State University

A random walk is a mathematical formalization of some path that entails random steps successively. We will come across theoretical conclusions that are not expected and may come as a shock to most people's intuition. We will reveal that commonly accepted acts dealing with chance fluctuations have no foundation. The classic Gambler's Ruin problem and the expected time of completion for the game will be the first branch of one dimensional random walks that will be discussed. The next topic will be the probability that one, two, and three dimensional random walks will return back to the origin. The Ballot Theorem and the Reection Principle will be the last focuses for this project.

5:15 p.m.

The Stability of Larry Niven's Ring World

Steven Dabelow,
Graduate, McNeese State University

In Science Fiction, we often have to deal with problems such as those associated with that of megastructures. In this paper, we will introduce the idea of Larry Niven's Ring World and discuss its stability problem by usage of Celestial Mechanics and concepts from Control Theory.

NOTES:

Contributed Papers A

Friday, February 17, 3:15 p.m. – 5:15 p.m.
Sullivan Harrell Hall Room 368

3:15 p.m.

On the square roots of Möbius transformations

Edgar Reyes

Southeastern Louisiana University

Let $n \geq 2$, and let $B = \{x \in \mathbb{R}^n : \|x\| < 1\}$ be the open unit ball. The group $GM(B)$ of Möbius transformations that leave B invariant is a well studied subject. Let $f \in GM(B)$ denote a reflection about a given hyperplane. For $\psi \in GM(B)$, we set $\psi * = f\psi^{-1}f$. We analyze certain square roots of $\psi\psi^*$

3:40 p.m.

A Matrix Decomposition RBF Differential Quadrature Algorithm for Solving Elliptic Boundary Value Problems

Daniel Watson

Mississippi College

This talk discusses a differential quadrature (DQ)-radial basis function (RBF) method for the numerical solution of elliptic boundary value problems in circular domains. With an appropriate selection of collocation points the matrices appearing in this discretization possess block circulant structures. These linear systems can thus be solved efficiently using a matrix decomposition algorithm (MDA). Problems governed by the Poisson equation, the biharmonic equation and the Cauchy-Navier equation are considered.

4:05 p.m.

Delivering Analog Mathematics in a Digital World

Dr. Ben Rushing

Northwestern State University of Louisiana

This presentation shares ideas for communicating symbolic mathematics to students living in a digital world. Included will be information about convenient ways to respond to mathematics questions over email, use of online documents and videos, and other means of transmitting mathematical content.

4:30 p.m.

Enumerating nets of prism-like polyhedra

Zsolt Lengvarszky

Louisiana State University Shreveport

We describe an enumeration method for distinct nets (unfoldings) of prism-like polyhedra such as prisms, antiprisms, pyramids, and cupolas.

NOTES:

Contributed Papers B

Saturday, February 18, 9:00 a.m. – 10:30 p.m.
Sullivan Harrell Hall Room 369

9:00 a.m.

Increasing Teachers' Content Understanding through Professional Development

Dr. Lecretia A. Buckley
Dr. Jana Talley
Jackson State University

The Mathematics Advancement in Teaching through Professional Development (MAT-PD) program for elementary and middle school teachers aims to enhance content-knowledge, increase teacher self-efficacy and improve teacher practices. Participants demonstrated an increase in content knowledge and self-efficacy as well as reported implementation of research-based teaching strategies.

9:25 a.m.

A free, open source, online textbook for Calculus-based Probability and Statistics using Mathbook XML.

John Travis,
Mississippi College

In this presentation, I will demonstrate a new OER textbook for an introductory calculus-based probability and statistics course. This online textbook utilizes Mathbook XML and allows for multiple output formats including an online option that incorporates active Sage and WeBWorK elements. Results from piloting the text in a course during Fall 2016 will be presented.

9:50 a.m.

Using GeoGebra as a Statistics Test Generator

David Gurney
Southeastern Louisiana University

This talk will show how GeoGebra can be used to generate statistics tests and their answer keys on paper. These tests can include anything appearing on typical statistics tests, and by moving a slider, a different version of the test is created along with an updated answer key.

NOTES:

Biographies

Dr. Erica Flapan, Pomona College, is the author of "When Topology Meets Chemistry: A Topological Approach to Chemistry" (2000), which was the one of the first books to discuss these exciting applications of mathematics to molecular structures. She is also the co-author of "Number Theory: A Lively Introduction with Proofs, Applications and Stories" (2011) which makes number theory accessible and applicable. Her research includes a variety of topics that have direct applications to the topology and symmetry of molecules, including DNA and proteins. . She is also interested in questions related to the application of knot theory to graphs in 3-space. She is an AMS fellow, and currently has an NSF research grant. Known for her ability to give excellent talks at a variety of levels, she received the MAA Haimo Teaching Award in 2011 and she is currently an MAA Polya lecturer. Her most recent book is "Knots, Molecules, and the Universe: An Introduction to Topology" which uses a visual approach to introduce first year college students to topology and its applications.

Dr. Edward Burger is President of Southwestern University as well as an educational and business consultant on thinking, innovation, and creativity. He has delivered over 700 addresses worldwide at venues including The Smithsonian Institution, Microsoft Corporation, The World Bank, The International Monetary Fund, the U.S. Department of the Interior, The New York Public Library, and the National Academy of Sciences. He is the author of

over 70 research articles, books, and video series (starring in over 4,000 on-line videos). Burger was awarded the 2001 MAA *Deborah and Franklin Tepper Haimo National Award for Distinguished Teaching of Mathematics*. The MAA also named him their 2001-2003 Polya Lecturer. In 2004 he was awarded the MAA *Chauvenet Prize*, and in 2006 he was a recipient of the MAA *Lester R. Ford Prize*. In 2006, Reader's Digest listed Burger in their annual "100 Best of America" as *America's Best Math Teacher*. In 2010 he was named the winner of the *Robert Foster Cherry Award for Great Teaching*—the largest prize in higher education teaching across all disciplines in the English speaking world. Also in 2010, he starred in a mathematics segment for NBC-TV on the *Today Show*; that appearance earned him a 2010 *Telly Award*. The Huffington Post named him one of their 2010 *Game Changers*: "HuffPost's *Game Changers* salutes 100 innovators, visionaries, mavericks, and leaders who are reshaping their fields and changing the world." In 2012, Microsoft Worldwide Education selected him as one of their "Global Heroes in Education." In 2013, Burger was inducted as an inaugural *Fellow of the American Mathematical Society*. In 2014, Burger was elected to *The Philosophical Society of Texas*. Today he has a weekly, lively program on higher education and thinking produced by NPR's Austin affiliate KUT. The series is aptly called Higher ED, and the episodes are available at kut.org/topic/higher-ed/ or on iTunes.

Doug Ensley has been Deputy Executive Director of the MAA since 2016. In this position Doug oversees MAA communities such as Sections and SIGMAAs as well as all of MAA's sponsored programs and alphabet soup, including PIC Math, CoMInDS, StatPREP, Progress through Calculus, NREUP, and the forthcoming Instructional Practices Guide. In addition, he has served as Interim Director of Competitions and Outreach for the 2016-17 academic year, while a search has been underway for a permanent director.

Before coming to the MAA Doug was on the mathematics faculty at Shippensburg University since 1993. He taught for many summers at the Pennsylvania Governor's School for the Sciences and he served as Visiting Mathematician at the MAA headquarters in 2000. His primary academic interests are in discrete mathematical topics and the use of technology in teaching mathematics. In his faculty life, Doug was PI on an NSF grant to develop technology-based learning material for the student-centered teaching of mathematical proof, which is incorporated in his textbook, *Discrete Mathematics: Mathematical Reasoning and Proof with Puzzles, Patterns and Games*, co-authored with Dr. Winston Crawley of Shippensburg. He also co-founded (with Dr. Barbara Kaskosz of the University of Rhode Island) the website, www.flashandmath.com, which received the 2009 ICTCM Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics.

Doug is a proud member of the inaugural 1994-95 class of Project NExT and a chronic organizer of paper sessions, minicourses, and summer workshops. Within the Eastern Pennsylvania-Delaware section, Doug has worn many hats including Section NExT coordinator, Secretary, Vice Chair, Chair, and Governor.

Schedule of Events

Thursday, February 16th

- 5:00 -7:00 p.m. **Registration**
Olin Hall of Science Lobby
- 6:00 - 9:30 p.m. **Integration Bee**
Olin Hall of Science Room 100
- 7:30 – 8:00 p.m. **Video and Pizza**
Olin Hall of Science Room 100

Friday, February 17th

- 8 a.m. – 4 p.m. **Registration**
Sullivan Harrell Hall 307
- 8 a.m. – 5 p.m. **Exhibits**
Sullivan Harrell Hall 307
- 8:00 – 10:30 a.m. **Team Competition**
Campbell Conference Center
- 8:30 – 11:30 a.m. **Section NExT**
Sullivan Harrell Hall 368
- 11:15–12:45 p.m. **Student Luncheon**
Campbell Conference Center
- 1:30 – 2:30 p.m. **Plenary Address**
Ford Academic Complex Recital Hall
- 3:00 – 5:30 p.m. **Student Papers**
Sullivan Harrell Hall 369
- 3:15 – 5:00 p.m. **Contributed Papers A**
Sullivan Harrell Hall 368

- 5:30 – 6:30 p.m. **R.D. Anderson Lecture**
Ford Academic Complex Recital Hall
- 6:30 – 8:30 p.m. **Anderson Banquet**
Campbell Conference Center

Saturday, February 18th

- 8 a.m. – 10 a.m. **Registration**
Sullivan Harrell Hall 307
- 8 a.m. – 10 a.m. **Exhibits**
Sullivan Harrell Hall 307
- 8 a.m. – 9 am **MAA Liaison Breakfast**
Cabot Lodge
- 9 a.m.–10:15 a.m. **Contributed Papers B**
Sullivan Harrell Hall 369
- 10:30 a.m. – 11:30 a.m.
Outstanding Teacher Address
Ford Academic Complex Lecture Hall
(AC215)
- 11:45 a.m. – 12:45 p.m.
Business Meeting
Ford Academic Complex Lecture Hall
- 1:00 p.m. – 2:00 p.m.
Executive Committee
Sullivan Harrell Hall 368



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