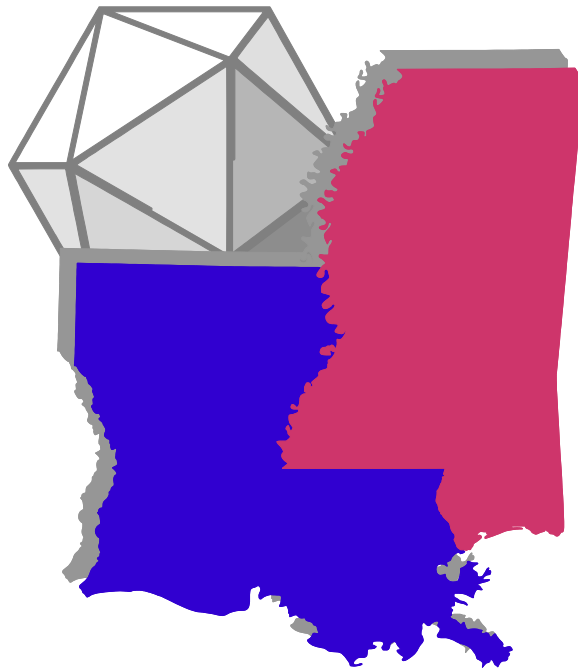


The Mathematical Association
of America

Louisiana/Mississippi Section



97th Annual Meeting
hosted by Loyola University New Orleans
New Orleans, Louisiana
February 27-29, 2020



Parking will be on the top 3 floors (5,6,7) of the West Road Garage. This is the road that divides Loyola and Tulane. See the campus map

<http://sections.maa.org/lams/meeting/campus-map.pdf> .

If driving in the city is not possible/desirable, one may take the Saint Charles Avenue streetcar directly to our campus. From downtown, the starting point is at the intersection of Canal Street and Carondelet. The rest of the route can be seen here: <https://www.norta.com/Maps-Schedules/System-Map/Line.aspx?ID=12>. It costs \$1.25 each way.

Institutional Partners

Institutional Partners' Membership Fees help fund student activities.
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The University of Louisiana at Lafayette
The University of Southern Mississippi
The University of Mississippi
Xavier University New Orleans
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Schedule of Events

Thursday, February 27

All activities in Monroe Hall

Registration	5 p.m. – 7 p.m.	Monroe Hall First Floor
Integration Bee	6:30 p.m. – 9 p.m.	Monroe Hall 610
Pizza	7:30 p.m. – 8 p.m.	Monroe Hall near 610

Friday, February 28

All activities in the Danna Student Center

Registration	8 a.m. – 4 p.m.	Danna Center Entrance
Team Competition	8:30 a.m. – 11 a.m.	St. Charles Room
Section NExT	9:00 a.m. – 11:30 a.m.	Octavia Room
Exhibits	9 a.m. – 5 p.m.	Claiborne/Riverbend Rooms
Student Luncheon	11:15 a.m. – 12:45 p.m.	St. Charles Room
Plenary Address	1:00 p.m. – 2:00 p.m.	Audubon Room
Student Papers	2:10 p.m. – 5:10 p.m.	Audubon Room
Contributed Papers A	2:30 p.m. – 4:30 p.m.	Octavia Room
R.D. Anderson Lecture	5:30 p.m. – 6:30 p.m.	Audubon Room
Anderson Banquet	6:30 p.m. – 8:30 p.m.	St. Charles Room

Saturday, February 29

All activities in the Danna Student Center

Registration	8 a.m. – 10 a.m.	Danna Center Entrance
Exhibits	9 a.m. – 11 a.m.	Claiborne Room

Contributed Papers B	9 a.m. – 10:00 a.m.	Audubon Room
Discussion Sessions	9 a.m. – 10:00 a.m.	Freret Room
Outstanding Teacher Address	10:30 a.m. – 11:30 a.m.	Audubon Room
Business Meeting	11:45 a.m. – 12:45 p.m.	Audubon Room
Executive Committee	1 p.m. – 2 p.m.	Audubon Room

Plenary Address
Digraphs and Determinants
Jennifer Quinn, University of Washington Tacoma
Friday, February 28th, 1:00 p.m. – 2:00 p.m.
Audubon Room in the Danna Center

“There is no problem in all mathematics that cannot be solved by direct counting” (Ernst Mach)

In linear algebra, you learned how to compute and interpret determinants. Along the way, you likely encountered some interesting matrix identities involving beautiful patterns. Are these determinantal identities coincidental or is there something deeper involved?

In this talk, I will show you that determinants can be understood combinatorially by counting paths in well-chosen directed graphs. We will work to connect digraphs and determinants using two approaches:

- Given a “pretty” matrix, can we design a (possibly weighted) digraph that clearly visualizes its determinant?
- Given a “nice” directed graph, can we find an associated matrix and its determinant?

Previous knowledge of determinants is an advantage but not a necessity.

9th Annual R.D. Anderson Lecture
Cracking the Cubic: Cardano, Controversy, and Creasing
Alissa Crans, Loyola Marymount University
Friday, February 28th, 5:30 p.m. – 6:30 p.m.
Audubon Room in the Danna Center

We're all familiar with the solution to a general quadratic equation--some of us even learn songs or mnemonics in school to help us remember the famous formula. But have you heard about analogous formulas for the cubic, quartic, or quintic equations? It turns out that the solution of the cubic didn't reveal itself to mathematicians quite so easily. There's a real story here, filled with challenges, drama, and controversy! Surprisingly, we can trade in our formulas for folding. Our exploration will take a turn toward the concrete as we follow the footsteps of Margherita Beloch and solve the cubic using only origami.

Outstanding Teacher Address
The Joy of Mathematics
Clifton Wingard, Mississippi University for Women
Saturday, February 29th, 10:30 a.m. – 11:30 a.m.
Audubon Room in the Danna Center

The pleasure of working with mathematics has many facets. In this presentation, I want to share some of my journey as a student and teacher.

Student Luncheon Address
Why is the 4-Color Theorem such a Big Deal in Physics?

Scott Baldrige, Louisiana State University
Friday, February 28th, 11:30 a.m. – 12:30 p.m.
Saint Charles Room

The 4-Color Theorem is simple to state but hard to prove: Can a map of states of any country be painted with only four colors so that no two neighboring states are painted the same color? In this talk, we explore the unusual and unexpected connections between the 4-Color Theorem and physics throughout history, and suggest that it still has an important role to play in string theory. This theory replaces point particles with strings and is a leading "theory of everything" in physics. It is a modern day attempt to realize Einstein's dream of merging quantum theory with general relativity.

Section NExT Workshop
Friday, February 28th, 9:00 a.m. – 11:30 a.m.
Octavia Room in the Danna Center

9:00

Welcome & Introductions

Carmen Wright, Jackson State University, Coordinator
Christine Gorton, McNeese State University, Committee

9:20

Opportunities in the MAA

Michael Pearson, MAA Executive Director

9:35

Active Learning

Jennifer Quinn, University of Washington

10:20

Break

10:35

MAA IP Guide on Classroom Practices

Jennifer Quinn, Carmen Wright, Christine Gorton

11:20

Closing Remarks

Student Presentations

Friday, February 28th, 2:10 p.m. – 5:10 p.m.

Audubon Room in the Danna Center

2:10

Exploring the Math in Music

Madison Batarseh Annison, Undergraduate, Mississippi College

This presentation describes and analyzes some of the major connections between math and music. Beginning with the historical significance and connections, it goes on to point out how these two still affect math and music today. Highlighting these connections in an educational setting can prove to be beneficial to students. Thus, there are several professors who have taught math and music to undergraduate students who are discussed here. Finally, the discussion concludes by analyzing elements of group theory concerning several binary operations in music.

2:30

The dynamics of a discrete-time, stage-structured, amphibian population model

Maxwell Reigner Kane, Undergraduate, University of Louisiana at Lafayette

The study of amphibian populations, particularly in response to various environmental and epidemiological stressors, is an area of active research in biomathematical modeling. In particular, there is great interest in analyzing the dynamics of populations impacted by the bacteria *Batrachochytrium dendrobatidis* (Bd), a deadly infection which has destroyed amphibian populations in recent years. This paper analyzes the dynamics of a discrete-time, stage-structured model of the species *Rana muscosa*, which has been extensively impacted by Bd. The analysis includes calculation of the inherent net reproductive number, the existence and stability of equilibria, and sufficient conditions for the uniform persistence and permanence of the population.

2:50

The Long Time Behavior of the Predator-Prey Model with Holling Type III

Regen McGee, Undergraduate, The University of Southern Mississippi

In this paper, the classical Lotka-Volterra model is expanded based on functional response of type III to analyze a dynamical predator-prey relationship with hunting cooperation (α) and the Allee effect among predators. The stability was first analyzed by deriving a Jacobian matrix from partial derivatives of our model. Newly derived eigenvalues are then used to determine the stability. The viability of the model is then demonstrated by using MATLAB. The numerical results show a clear Allee effect and a variety of possible phenomena related to stability when carrying capacity (κ) is varied. Two different types of bifurcation are then shown from our results.

3:10

Dynamics of frog populations under the influence of two diseases

Nicholas Henderson, Undergraduate, University of Louisiana at Lafayette

The use of mathematical models to represent populations is a common tool for biomathematicians to analyze population dynamics. The models are often restricted to what can be reasonably studied, but the use of numerical methods can greatly expand the possibilities of the model. This paper studies the effects of *Batrachochytrium dendrobatidis* (Bd), a devastating fungal disease among amphibians, and *Janthinobacterium lividum* (Jl), a bacterial species which can prevent fungal infection, through numerical methods.

3:30

Automatic Numerical Methods for Enhancement of Blurred Text-Images via Optimization and Nonlinear Diffusion

Aaditya Kharel, Undergraduate, The University of Southern Mississippi

The Perona-Malik diffusion equation (PME) accounts for both forward and backward diffusion regime so as to perform simultaneous denoising and deblurring depending on the value of the gradient. One of the limitations of this equation is that a large value of the gradient for backward diffusion can lead to singularity formation or staircasing. Guidotti, Kim and Lambers (GKL) came up with a bound for backward diffusion (sharpening) to prevent staircasing, where the backward diffusion is only limited to a specific range beyond which backward diffusion is stopped and forward diffusion begins. In our research, we propose a nonlinear partial differential equation (PDE) model that combines the PME model and GKL model for automatic sharpening of blurred text-images using Nelder-Mead optimization. We solve our model by using by discretizing the PDE in space using finite-difference discretization. Then, we enhance the image in each iteration using Backward Euler and Minimum Residual Method (MINRES) in MATLAB. Our result shows that our proposed model is accurately in enhancing text images.

3:50

Cognitive hierarchy theory and the infinite centipede game.

Christopher Bayard, Undergraduate, University of Louisiana at Lafayette

A famous example of backward induction producing counter-intuitive results is in the Centipede Game, a game in which two players work together to double their payoffs until one betrays the other by taking the larger payoff, ending the game. The standard equilibrium result, obtained through backwards induction, is that either player should immediately take the larger pot and end the game as soon as they have the chance. However, studies show that real players tend not to follow the equilibrium solution, instead letting the game continue for a few rounds. This paper uses Cognitive Hierarchy Theory as an alternative method to evaluate the Infinite Centipede Game in a way that may be more consistent with experimental results. We include different assumptions for level 0 players, as well as an analysis of the actions of higher level players.

4:10

Twisted central configurations for the planer 8-body problem

Gokul Bhusal, Undergraduate, The University of Southern Mississippi

A Central Configuration (CC) is a special arrangement of masses in the N-body problem where the gravitational force on each body points proportionally toward the center of mass. In this paper, we study the case where four bodies with masses m_1, m_2, m_3, m_4 form a square CC, and the other four with masses m_5, m_6, m_7, m_8 forms another square CC. Both square CCs share one axis of symmetry. We show the existence and non-existence of this kind of central configurations for the planar 8-body problem.

4:30

A Class of Bicyclic Antiautomorphisms of Mendelsohn Triple Systems

Haile Gilroy, Graduate, McNeese State University

A cyclic triple, (a, b, c) , is defined to be the set $\{(a, b), (b, c), (c, a)\}$ of ordered pairs. A Mendelsohn triple system of order v , $MTS(v)$, is a pair (M, β) , where M is a set of v points and β is a collection of cyclic triples of pairwise distinct points of M such that any ordered pair of distinct points of M is contained in precisely one cyclic triple of β . An antiautomorphism of a Mendelsohn triple system, (M, β) , is a permutation of M which maps β to β^{-1} , where $\beta^{-1} = \{(c, b, a) \mid (a, b, c) \in \beta\}$. Necessary conditions for the existence of a Mendelsohn triple system of order v admitting an antiautomorphism consisting of two cycles of lengths M and N , where $N > 2M$ have been shown, and in some cases, sufficiency has been shown. We show sufficiency for the case $M \equiv 1 \pmod{24}$ with $N = 6M$.

4:50

Sets in R^3 Determining One Taxicab Distance

Bineyam Tsegaye, Undergraduate Student, Millsaps College

In 1946, Erdős asked the question “what is the minimum number of distinct distances determined by n points?” In our research, we investigated the maximum number of points possible for n taxicab distances. In this presentation, we will sketch a proof of the optimal number of points in three dimensions in the case when $n=1$.

Faculty Presentations: Session A

Friday, February 28th, 2:30 p.m. – 4:30 p.m.

Octavia Room in the Danna Center

2:30

Obtaining an upper density bound for two-radius packings of disks in the plane

Ali Mohajer, Loyola University New Orleans

Since 1960, an upper bound, due to August Florian, on the density of packings of unequal disks in the plane has been in hand which depends only on the homogeneity (the infimum of the ratio of the radii) of the packing, and is computed using a particular configuration of one large and two small disks. Though it is almost always not sharp, this density bound has so far only been improved upon when the homogeneity of the packing is sufficiently close to 1, or in certain highly regular configurations. In this talk we discuss methods and tools for improving this upper bound in binary packings at a ratio of radii which does not admit such regularity. We also present a recent result which sharpens this bound in binary packings of homogeneity 0.7.

2:50

Sets with slow-decaying density and unbounded missing distances

Alex Rice, Millsaps University

A famous result established independently by Furstenberg-Katznelson-Weiss, Bourgain, and Falconer-Marstrand states that if a set contains a positive proportion of the plane, in the sense of positive upper density, then it determines all sufficiently large distances. Here we demonstrate the sharpness of this result by constructing sets with arbitrarily slowly decaying density that avoid an unbounded collection of distances.

3:10

Combinatorics of Some Origami Models

Zsolt Lengvarszky, LSU Shreveport

The assembly of some compound origami models may be difficult due to the large number of possibilities. We examine the combinatorics of these models.

3:30

ACT scores, metacognition, or something else: What is needed to support success for students in general education mathematics courses?

Iris Johnson, LSU Shreveport

Our Louisiana Board of Regents has required additional academic support for college students with ACT scores lower than 19. Comparing ACT scores and additional information about those students with students who have higher ACT scores leads to more questions than answers. Current findings and questions will be shared.

3:50

A comparative study of physics-informed deep learning models for discovering partial differential equations

Duong Nguyen, UL Lafayette

In this work, we study physics-informed deep learning models to identify the general time-dependent nonlinear partial differential equations governing noisy data. We compare the performance of different regression techniques (LASSO, Ridge, TrainSTridge, and elastic net). We propose a different approach by employing pre-train neural networks to reduce the computation time.

4:10

L-Iwasawa decomposition of the Lie algebra of the Lorentz group

Edgar Reyes, Southeastern Louisiana State University

I investigate a non-Cartan type involution of the Lie algebra \mathfrak{g} of the Lorentz group, and discuss a corresponding Iwasawa-like decomposition of \mathfrak{g} .

Faculty Presentations: Session B

Saturday, February, 29th

9:00 a.m. – 10:00 a.m.

Octavia Room in the Danna Center

9:00

Using quaternions in spherical geometry

Marshall Whittlesey, California State University, San Marcos

We show how to use quaternions to prove significant theorems in spherical geometry. These methods are featured in the speaker's new book with CRC Press, [Spherical Geometry and its Applications](#), which the author hopes will be attractive for use in topics courses in geometry.

9:20

Analysis and applications of cognitive hierarchy theory for examples of two-player-two-action games

Grace Sternaman and Madeleine Angerdina, UL Lafayette

Cognitive hierarchy theory offers a model for understanding individuals' strategies and interactions in a game theoretic context. In this presentation, we adopt the framework while relaxing some assumptions generally made within cognitive hierarchy theory to analyze a collection of two-player-two-action games. We also include applications and areas for future research.

9:40

Using a 3D Printer for Class: Design. Print. Teach.
Nicholas Richardson, Northwestern State University

The price of 3D printers has dropped to where they are affordable by anyone. Customized prints can be designed, printed, and brought into a classroom relatively quickly. This is how I have made some prints for students to get a better understanding of abstract concepts by having a physical object.

Discussion Sessions
Saturday, February, 29th
9:00 a.m. – 10:00 a.m.
Freret Room

9:00

Judith Covington, Northwestern State University

The MAA has recently launched their new communications platform for members, called MAA Connect. In this session we will first talk about how to create an account on MAA connect. After that, we will discuss ways that our section can make use of this new platform. If possible, bring your MAA login and a device that you can use to access the internet.

9:30

Christy Sue Langley

I want to host a discussion where we can gather information from each other about what is and is not working in your online/hybrid/flipped classes. We will collect this information and make it available after the meeting to all parties interested.

Possible questions of interest: What courses are you doing online? Who is your audience and how successful are they? How does your online calendar match to the spring/fall/summer semester calendar? Are your courses more asynchronous or synchronous in style of material presentation? How do you handle office hours? What platforms (LMS or publisher online system) do you use: positives and negatives? Is the content being created by instructor or publisher? Do you use videos, created by whom? How many resources are too many and how many is too few? What styles of exams do you give and are they proctored?

Biographies

Scott Baldridge is the Loretta Cox Stuckey and Dr. James G. Traynham Distinguished Professor at Louisiana State University and co-director of the Gordon A. Cain Center for STEM Literacy. He was also the lead curriculum writer and mathematician of Eureka Math/EngageNY Curriculum. Scott's mathematical research is related to current models used in physics that attempt to realize Einstein's goal of unifying general relativity and quantum mechanics—equations that describe all wave-particle (including gravity) interactions in the universe. He earned his PhD. in mathematics from Michigan State University and previously held a faculty position at Indiana University before accepting a professorship in mathematics at Louisiana State University. He has given over 150 collegiate lectures, appeared on national television and radio programs for his expertise in mathematics and mathematics education, and has a popular YouTube channel for math related videos. You can follow him on twitter at @ScottBaldridge and visit his website at www.scottbaldridge.net.

Alissa S. Crans has been recognized nationally for her enthusiastic ability to share and communicate mathematics, having been honored by the MAA with the Hasse Prize, as well as with a 2011 Henry L. Alder Award. She is a professor of mathematics at Loyola Marymount University, where her research interests lie in the field of higher-dimensional algebra and are supported by the Simons Foundation. Alissa is known for her active mentoring and supporting of women, underrepresented students, and junior faculty and her dedication to helping students, and the general public, increase their appreciation and enthusiasm for her discipline. In her downtime, you can find her rehearsing with the Santa Monica College Wind Ensemble, running or biking along the Venice boardwalk, or on her quest to find the spiciest salsa on the westside of LA.

Jennifer Quinn is a professor of mathematics at the University of Washington Tacoma and President-Elect of the MAA. She earned her BA, MS, and PhD from Williams College, the University of Illinois at Chicago, and the University of Wisconsin, respectively. She has received a Haimo Award for Distinguished College or University Teaching and a Beckenbach Book award for *Proofs That Really Count: The Art of Combinatorial Proof*, co-authored with Arthur Benjamin. Jenny was the Anderson Distinguished Lecturer to the LA/MS Section in 2015 and is pleased to return to renew friendships and make more mathematical connections.

Clifton Wingard received his BS degree from Belhaven University in Jackson, Mississippi, and his MS and PhD degrees from the University of Mississippi. His doctoral advisors at Ole Miss were Dr. Bill Staton and Dr. Glenn Hopkins, and his research explored the enumeration of independent sets in graphs. Clifton began his teaching career as a secondary teacher at Calhoun City High School in Mississippi, and he has taught at Oklahoma Baptist University, Delta State University, The Mississippi School for Mathematics and Science, and Mississippi University for Women. In addition to enjoying the mathematics, Clifton enjoys working with pre-service and in-service teachers.

The following businesses have supported our meeting:

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A donation from Dr. Michael Kelly also supported our
meeting