The 75th Meeting of the Alabama Association of College Teachers of Mathematics

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Alabama Journal of Mathematics

Managing Editor:
Dr. Hoa Dinh, Troy University

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The Alabama Journal of Mathematics (AJM) is published under the auspices of the Alabama Council of Teachers of Mathematics (ACTM) and the Alabama Association of College Teachers of Mathematics (AACTM). The AJM is designed to meet a number of needs of the mathematics community in the state of Alabama. Specifically, the intent of the journal is to knit together the various components of this mathematical community. As such, the journal includes research articles in mathematics and mathematics education appropriate for a general audience and activities and problems for K-16 mathematics teachers. The journal is peer-reviewed and indexed in MathSciNet, and as such it is appropriate for tenure and promotion considerations.

Acknowledgements

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AACTM Officers

Schedule

08:30AM–08:50AM	**Check-In & On-Site Registration**
08:50AM–09:00AM	*Welcome!* **Jamie Adams**
09:00AM–09:15AM	*Forbidding the Subdivided Claw as a Subgraph Or Minor* **Sarah Allred**
09:20AM–09:35AM	*Visualization of Nurse Stress at University Hospital* **Bridgette Wilson**
09:40AM–09:55AM	*Convergence in the Hausdorff Metric for Filled Julia Sets* **Joanna Furno**
10:00AM–10:15AM	**Break**
10:15AM–11:10AM	**Lewis-Parker Lecture:** *Categorification without Categories - On the book that I will probably never finish...* **Arik Wilbert**
11:15AM–12:25PM	**Lunch & Group Photo**
12:30PM–12:45PM	*Small Steps, Big Results: The Art and Science of Mentoring Future Scholars* **Kwadwo Antwi-Fordjour**
12:50PM–01:05PM	*Longest Narrow Path Polyominoes* **Daniel Hodgins**
01:10PM–01:25PM	*Dynamics of the La Crosse Virus* **George Lytle**

01:30PM–01:45PM *Using ChatGPT in teaching mathematics*
Hoa Dinh

01:50PM–01:55PM **Break**

02:00PM–02:15PM *Using the Pi-Base for Undergraduate Research*
Daniel Leary

02:20PM–02:35PM *Deploying a 24/7 AI-Powered Math Tutor for Math 359: Mathematical Theory of Data Science*
Jia Zhao

02:40PM–02:55PM *Non-Compliant Graphs and Intrinsic Knotting*
Andrei Pavelescu

03:00PM–03:15PM *Navigating the New Title II Digital Accessibility Requirements*
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03:20PM–03:50PM **AACTM Business Meeting**

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Abstracts

(in alphabetical order by speaker's name)

Forbidding the Subdivided Claw as a Subgraph Or Minor

Sarah Allred ⟨sarahallred@southalabama.edu⟩
University of South Alabama

There are several results on the structure of graphs that exclude a tree or forest as a minor. However, there is little data on what graphs excluding specific small trees look like. Information of this kind can help to generate new general questions. In *Graph Minors I*, Robertson and Seymour proved that every graph that does not have a forest as a minor has bounded path-width. In 2023, Dujmović et al. strengthened the bound.

In this talk, we give a specific example of excluding a particular tree as a subgraph. We also raise questions about path-width of classes of graphs that exclude a particular tree.

Small Steps, Big Results: The Art and Science of Mentoring Future Scholars

Kwadwo Antwi-Fordjour ⟨kantwifo@samford.edu⟩
Samford University

This talk presents a practical and replicable model for engaging undergraduate students in publishable mathematical research through intentional scaffolding and mentorship. I illustrate this model using a joint publication with an undergraduate coauthor as a case study. The key is to take small, well-designed research steps rooted in undergraduate coursework and computational exploration. These steps can lead to substantive scholarly outcomes. I focus on an applied mathematical modeling project and describe how students are introduced to research through accessible entry points like numerical experimentation, parameter exploration, and visualization. They then progress toward interpretation, refinement, and contributing to a final manuscript.

Using ChatGPT in teaching mathematics

Hoa Dinh ⟨trunghoa.math@gmail.com⟩
Troy University

This paper presents a semester-long implementation of an AI-integrated pedagogy using ChatGPT in two small undergraduate mathematics courses at Troy University. The instructional design combines a flipped classroom, AI-supported self-study, in-class critical dialogue with AI as a "third voice," and project-based assessment. Using qualitative student feedback, we examine how generative AI supported conceptual understanding, research skills, and learner confidence, while also highlighting challenges such as misconceptions and over-reliance. Situating this case within recent scholarship on artificial intelligence in education and AI literacy, we propose a three-layer AI-Integrated Pedagogy model—Foundation, Integration, and Innovation—and a conceptual framework of AI as Third Voice in the Mathematics Classroom. We argue that, when carefully balanced with verification and traditional assessment, generative AI can enhance mathematics learning and better prepare students for an AI-enabled future.

Convergence in the Hausdorff Metric for Filled Julia Sets

Joanna Furno ⟨jfurno@southalabama.edu⟩
University of South Alabama

The Hausdorff metric gives a distance between two compact sets. The talk will review the definition and some results on the convergence of Julia sets in the Hausdorff metric, before discussing an example in two complex variables from joint work with Scott Kaschner.

Longest Narrow Path Polyominoes

Daniel Hodgins ⟨djh0081@auburn.edu⟩
Auburn University

Polyominoes are two-dimensional shapes formed by a series of orthogonally connected unit squares on the integer lattice. In this talk, we will investigate the Longest Narrow Path Polyominoes problem: given a fixed collection of polyominoes, what is the maximum possible length of a corridor that can be created by packing them together. The corridor is required to be exactly one square wide and fully enclosed by the polyominoes, with no self-contact or branching. All tiles meet edge to edge, such that each square in the corridor is only adjacent to polyomino tile(s) and the neighboring square(s) of the corridor. After introducing the problem and giving some new results, we will also discuss how this problem can be adapted into an engaging outreach activity.

Using the Pi-Base for Undergraduate Research

Daniel Leary ⟨del2522@jagmail.southalabama.edu⟩
University of South Alabama

The π-Base is a database devoted to general topology, listing topological spaces, their properties, and theorems relating properties together. In this talk, I will show how I used the π-Base as an undergraduate student to discover interesting research problems. As an example, I will show how the π-Base led to me proving that a non-semiregular almost discrete space must be the disjoint union of the Sierpiński space and a discrete space.

Dynamics of the La Crosse Virus

George Lytle ⟨glytle@montevallo.edu⟩
University of Montevallo

La Crosse Encephalitis is one of the leading causes of pediatric arboviral encephalitis in the United States. This mosquito-borne illness can be transmitted through multiple pathways within the mosquito population, which leads to interesting questions about the dynamics. In this talk, we will discuss a model for these transmission pathways. This preliminary work is joint with Kyle Dahlin and Benjamin Lebdaoui.

Non-Compliant Graphs and Intrinsic Knotting

Andrei Pavelescu ⟨andreipavelescu@southalabama.edu⟩
University of South Alabama

For a graph G, $S \subseteq V(G)$ is a *dominating set* of G if every vertex in $V \backslash S$ is adjacent to at least one vertex in S. The *connected domination number* $\gamma_c(G)$ of G is the minimum cardinality of dominating sets S of G which induce a *connected* subgraph $G[S]$ of G. Non-compliant graphs are graphs such that both the graph and its complement have "large" connected domination numbers. We present some sharp bounds for $\gamma_c(G)$ and use them to tackle questions about intrinsic knotting in graphs and their complements.

Categorification without Categories - On the book that I will probably never finish...

Arik Wilbert ⟨wilbert@southalabama.edu⟩
University of South Alabama

In this talk, I will tell you about a book I am trying to write. The book is supposed to contain fancy pictures of mathematical knots. To create a knot, take a piece of string or rope, tie a knot in it, and then glue the ends together. So far, I have had a hard time deciding what knots I would like to feature in my book. I will introduce you to the Jones polynomial and explain how it has been a helpful tool in making decisions. However, at this point, I still do not know how to finish the book. In graduate school, I learned about a mathematical field called "categorification". Categorification is an active area of research, and I will survey some of its results and applications. Maybe categorification is exactly what I need to finish my book?

Visualization of Nurse Stress at University Hospital

Bridgette Wilson ⟨blw2121@jagmail.southalabama.edu⟩
University of South Alabama

Nursing is a high-demand profession characterized by emotional strain, unpredictable workloads, and chronic exposure to stressors that can lead to burnout and reduced well-being. This study examines perceived stress among nurses at University Hospital using the Perceived Stress Scale (PSS-10). Survey data were collected from nurses across two hospital units and included item-level responses and total PSS scores. Exploratory data analysis was then conducted to characterize stress patterns. Principal Component Analysis (PCA) was used to identify underlying dimensions of stress, followed by K-means clustering and Gaussian Mixture Modeling to uncover distinct stress profiles within the nursing population. Monte Carlo simulation and bootstrapping were employed to evaluate whether observed stress levels differed meaningfully from chance and from an external control group. Results indicate that nurses at University Hospital experience elevated perceived stress, particularly among female nurses, with total PSS scores consistently higher than those observed in the control population. Together, these findings suggest that stress among nurses in this clinical setting is prevalent, systematic, and reflective of broader workplace pressures, underscoring the need for targeted organizational interventions to support nurse wellbeing and sustain quality patient care.

Deploying a 24/7 AI-Powered Math Tutor for Math 359: Mathematical Theory of Data Science

Jia Zhao ⟨jia.zhao@ua.edu⟩
University of Alabama

In this talk, I will share my experience developing and deploying a customized AI-powered teaching assistant for Math 359: Mathematical Theory of Data Science. The tutor is available 24/7 through a user-friendly web interface, built with the OpenAI API, and aligned with course materials, including lecture notes, practice problems, homework, and quizzes, to deliver course-specific support. Rather than providing direct solutions, the AI tutor is designed to coach students through structured explanations, targeted examples, and strategic hints. The goal is to promote productive struggle, strengthen conceptual understanding, and support independent problem-solving while maintaining academic integrity.

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