Program of Activities

For the 2018 Fall Meeting of the

Mathematical Association of America

Ohio Section

Fall 2018

Malone University

Canton, Ohio

October 26 – 27, 2018

Mathematical Association of America
Ohio Section

MAA Ohio Section - Fall 2018 Program
Friday, October 26, 2018

Time	Event	Location
12:00–4:00	Registration	JC Lobby
12:00–1:00	Committee Meetings:	
	CONCUR (Curriculum)	JC 201
	CONSACT (Section Activities)	JC 205
	CONTEAL (Teacher Education & Licensure)	JC 207
1:00–4:00	Vendor & Book Exhibits	JC Lobby
1:30–1:45	Welcome and Announcements	JC Sanctuary
1:45–2:45	Invited Address: Aparna Higgins "Adding (Repeatedly) and Finding Averages (Repeatedly)"	JC Sanctuary
2:45–3:00	Break	
3:00–4:00	Invited Address: JP Cossey "The Catalan Numbers for Grades K to Infinity"	JC Sanctuary
4:10–5:50	Executive Committee Meeting	JC 105
4:30–5:50	Contributed Paper Sessions	JC 205 JC 207
5:50–6:30	Social Time	
6:30–7:30	Banquet	JC 100
7:30–8:30	Invited Address: Jennifer Quinn "Epic Math Battles: Counting vs. Matching"	JC 100
8:30–	Business Meeting: Briefing by Daniel Otero	JC 100

Note: "JC" abbreviates the Johnson Center.

MAA Ohio Section - Fall 2018 Program
Saturday, October 27, 2018

Time	Event	Location
8:00–10:00	Registration	JC Lobby
8:00–10:00	Book Vendors and Exhibits	JC Lobby
8:00–8:50	Coffee and Pastries	JC Lobby
8:15–8:50	Committee On Local Arrangements	JC 101
8:15–8:50	Executive Committee Meeting (if needed)	JC 103
9:00–9:10	Welcome and Announcements	JC Sanctuary
9:10–10:10	Invited Address: Daniela Calvetti "Inverse Problems, Bayesian Inference and Sparse Solutions: A Bit of Magic in L^2"	JC Sanctuary
10:10–10:30	Break	
10:30–11:45	Contributed Paper Session	JC 101 JC 103
11:45–12:00	Break	
12:00–1:00	Invited Address: Jennifer Quinn "Digraphs and Determinants: Determinants Through Determined Ants"	JC 100
1:00-1:10	Closing Remarks	JC 100

1:30-3:30	CONSACT Workshop Presenter: M. B. Rao "Interactive graphics using R – Shiny package"	MH 301

Friday Invited Addresses

Speaker: Aparna Higgins
Title: Adding (Repeatedly) and Finding Averages (Repeatedly)

Abstract: Perhaps you entertained yourself in school by playing with numbers. I would take a number, add its digits, and repeat this with the sum that I had just obtained. What happened? "Inserting Plus Signs and Adding" (by Butler, Graham and Stong) answers that question in just one paragraph, and then continues to explore the topic. I will discuss some of the paths taken by the authors in their exploration. I confess that I was drawn to another paper, "M&m Sequences" (by Shultz and Shiflett), because the title reminded me of my favorite candy. Starting with three numbers, adjoin a fourth number so that the mean of the four numbers is the median of the original three numbers. Repeat in an obvious way, extending the sequence. I was surprised by the behavior exhibited by some of these sequences. We will explore some M&m sequences, and then consider questions asked in subsequent papers on this topic.

Speaker: JP Cossey
Title: The Catalan Numbers for Grades K to Infinity

Abstract: The Catalan numbers are a sequence of positive integers that have literally hundreds of combinatorial interpretations. In this talk I will begin with the basics of Catalan numbers, and discuss how they've led to research projects for undergraduates and masters students. This will be a talk with more questions than answers, and my hope is that these questions will be accessible to students and researchers at all levels.

Speaker: Jennifer Quinn
Title: Epic Math Battles: Counting vs. Matching

Abstract: Which technique is mathematically superior? The audience will judge during this tongue-in-cheek combinatorial competition between the mathematical techniques of counting and matching. Be prepared to explore 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? Which is superior? You decide.

Saturday Invited Addresses

Speaker: Daniela Calvetti
Title: Inverse Problems, Bayesian Inference and Sparse Solutions: A Bit of Magic in L^2

Abstract: Recasting a linear inverse problems within the Bayesian framework makes it possible to use partial or qualitative information about the solution to improve the computed solution in spite of the inherent ill - posedness of the problem and noise in the data. In this talk we will show how a suitably chosen probabilistic setting can lead to a very efficient algorithm for the recovery of sparse solutions that only requires the solution of a sequence of linear least squares problems. The fast convergence rate of the algorithm and its low computational cost will be discussed and illustrated with computed examples.

Speaker: Jennifer Quinn
Title: Digraphs and Determinants: Determinants Through Determined Ants

Abstract:

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

- Given a "pretty" matrix, can we design (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. This will be a hands-on session, so bring your creativity and be prepared to explore the mathematical connections.

Invited Speakers - Brief Biographies

Daniela Calvetti

Daniela Calvetti received her Laurea in Mathematics from the University of Bologna in 1980 and Masters and Ph.D. in Mathematics from the University of North Carolina at Chapel Hill in 1985 and 1989. After being on the faculty at Stevens Institute of Technology, she joined Case Western in 1997, where she is the James Wood Williamson professor in the Department of Mathematics, Applied Mathematics and Statistics. She enjoys mathematics for what it is and especially for its great potential in applications. The more mathematical side of her research focuses on computational inverse problems, numerical linear algebra, in particular iterative methods for large-scale linear systems, and orthogonal polynomials. Her research interests also include predictive computational mathematical models and parameter estimation within a Bayesian inference framework, motivated by and directed at medical and biological applications, in particular metabolism and neuroscience. She enjoys teaching and regards it as the most natural way to transferring her passion and enthusiasm for mathematics to her students. She has authored about 150 refereed articles and two monographs.

J.P. Cossey

James P Cossey is primarily a finite group theorist who dabbles in combinatorics. He received his Ph.D. at University of Wisconsin in 2005, and then spent three years as a post-doc at the University of Arizona. JP is now an associate professor at the University of Akron, and has been at Akron for eleven years.

Aparna Higgins

Aparna Higgins has taught at the University of Dayton since 1984. She grew up in India, where she completed her undergraduate education. She earned her Ph.D. at the University of Notre Dame in universal algebra in 1983. Eager to involve undergraduates in mathematics research, Aparna started working in graph theory. She has directed thirteen students' Honors theses, and co-directed research experiences for undergraduates in three summers. Aparna Higgins has been honored to receive four teaching awards, including one from the Ohio Section of the MAA in 1995, and the MAA's Deborah and Tepper Haimo Award for Distinguished College or University Teaching in 2005. Aparna has served the MAA on the Committee on Student Chapters, and as director of Project NExT. Aparna has also served as the Ohio Section President. The Ohio Section nominated her for an MAA Certificate for Meritorious Service in 2014. Her husband is Bill Higgins, a mathematician at Wittenberg University. Aparna enjoys reading, knitting, cooking Indian food and creating greeting cards (often with a mathematical design).

Jennifer Quinn

Jennifer Quinn is a professor of mathematics at the University of Washington Tacoma. She earned her B.A., M.S., and Ph.D. from Williams College, the University of Illinois at Chicago, and the University of Wisconsin, respectively. 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, and Second Vice President of the MAA. She is currently the Officer-at-Large on the MAA Board of Directors and the chair of its Council on Publications and Communications. She 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. 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.

Contributed Paper Sessions

Friday, October 26, 2018

4:30pm to 5:45pm

Session A - JC 205

Session Chair: Adam Parker

4:30 to 4:45	**Bounding the Stolarski Mean by Holder Means (Abstract 1)** Margarita Bustos Gonzalez*, Ohio University - Athens
4:50 to 5:05	**Solving elliptic partial differential equations by using Method of particular solutions (Abstract 12)** Anup R. Lamichhane, Ohio Northern University
5:10 to 5:25	**Modern analysis on e and $\zeta(2)$ (Abstract 5)** Zijian Diao, Ohio University - Eastern
5:30 to 5:45	**Eulerian Numbers and a 2-dimensional Random Walk Generating Function (Abstract 7)** Barbara H. Margolius, Cleveland State University

* Student Speaker

Contributed Paper Sessions

Friday, October 26, 2018

4:30am to 5:45pm

Session B - JC 207

Session Chair: Avishek Mallick

4:30 to 4:45	**Creating and Using Multimedia OER Modules for a Linear Algebra Course (Abstract 2)** Anna Davis, Ohio Dominican University, Paul Zachlin, Lakeland Community College
4:50 to 5:05	**Using K-12 Mathematics Standards to Design Mathematics Content Courses for Teachers (Abstract 4)** Bradford R. Findell, Ohio State University - Columbus
5:10 to 5:25	**Standard Deviation Bounds for Boxplots (Abstract 6)** Harrison D. Potter, Marietta College
5:30 to 5:45	**Applications of Basket Data Analysis in Social Networks and Genetics (Abstract 8)** M. B. Rao, University of Cincinnati

Contributed Paper Sessions

Saturday, October 27, 2018

10:30am to 11:45am

Session C - JC 101

Session Chair: Harrison Potter

10:30 to 10:45	**Processing Quadratic Residues with Ducci Iterations (Abstract 9)** Shannon Tefft*, Ohio Northern University
10:50 to 11:05	**Linear Complexities of Quadratic Residues and Primitive Roots Spacings (Abstract 11)** Aaron Kemats* & Travis Maenle*, Ohio Northern University
11:10 to 11:25	**Monochromatic Pairs with Nondecreasing Diameters (Abstract 17)** Michael W. Schroeder, Marshall University
11:30 to 11:45	**Bounds on Number of Positive First Differences for Algebraically Generated Costas arrays (Abstract 15)** Christopher N. Swanson, Ashland University

* Student Speaker

Contributed Paper Sessions

Saturday, October 27, 2018

10:30pm to 11:45am

Session D - JC 103

Session Chair: Ian Hogan

10:30 to 10:45	**Some particular angles between the Marden and Euler lines (Abstract 10)** Aurel I. Stan, Ohio State University - Marion
10:50 to 11:05	**The Gaussian Integral (Abstract 3)** Jaki Chowdhury, Ohio Northern University
11:10 to 11:25	**Solving Poisson's equation by using Method of particular solutions with the Oscillatory Radial Basis Function in 2D (Abstract 14)** Yu Wakayama*, Ohio Northern University
11:30 to 11:45	**Modeling of 2D Materials (Abstract 16)** Malena I. Espanol, The University of Akron

* Student Speaker

Abstracts of Contributed Papers

Friday, October 26, 2018, 4:30pm to 4:45pm

Bounding the Stolarski Mean by Hölder Means

Margarita Bustos Gonzalez*, Ohio University - Athens

Abstract 1: Given a real number n, find the largest p and the smallest q, both in terms in n, such that for all positive numbers a, b, the following holds: $H_p(a,b) \leq S_n(a,b) \leq H_q(a,b)$ where $H_i(a,b)$, $i \in \{p,q\}$, and $S_n(a,b)$ are the Hölder and Stolarski means, respectively. Calculus and algebra techniques determined p and q. The Jensen Inequality was used to prove q holds true, but the proof of p is still being investigated.

Creating and Using Multimedia OER Modules for a Linear Algebra Course

Anna Davis, Ohio Dominican University,
Paul Zachlin, Lakeland Community College

Abstract 2: The Ohio Department of Higher Education funded a statewide initiative to create open educational resources for 20+ college courses, including several mathematics courses. As part of this effort, a team of six faculty created a set of multimedia modules for an introductory Linear Algebra course. The modules utilize the open Ximera platform to provide an interactive experience to users through machine-graded exercises, embedded demos, and videos. In this presentation we will showcase the materials and discuss adoption strategies.

Friday, October 26, 2018, 4:50pm to 5:05pm

Solving elliptic partial differential equations by using Method of particular solutions

Anup R. Lamichhane, Ohio Northern University

Abstract 12: We present a meshless numerical method known as the Method of particular solutions (MPS) to solve the elliptic partial differential equations. We use a family of the Oscillatory radial basis functions (O-RBFs) and its recently derived closed-form particular solutions in MPS to solve elliptic partial differential equation in 2D.

Using K-12 Mathematics Standards to Design Mathematics Content Courses for Teachers

Bradford R. Findell, Ohio State University - Columbus

Abstract 4: Ohio, like all states, has adopted standards that describe the learning goals for school mathematics. University licensure programs for future mathematics teachers include mathematics content courses intended to develop depth in the mathematics they will teach. This talk will describe fruitful connections between the two, including examples at the elementary, middle, and high school level.

Friday, October 26, 2018, 5:10pm to 5:25pm

Modern analysis on e and $\zeta(2)$

Zijian Diao, Ohio University - Eastern

Abstract 5: The irrationality of e and evaluation of $\zeta(2)$ are two classical analysis problems which bear the marks of both Euler and Fourier. The former was proven by Euler via continued fraction and Fourier via standard series analysis. The latter is a hallmark achievement of Euler, which also allows for a wealth of different approaches originated from multiple branches of mathematics. While Fourier never supplied his own solution to $\zeta(2)$, quantum Fourier transform, an essential tool in quantum computing, has found its way into this problem. In this talk, we will present a no-calculus-required proof of the irrationality of e and a new approach for $\zeta(2)$ as a natural consequence of the quantum counting algorithm.

Standard Deviation Bounds for Boxplots

Harrison D. Potter, Marietta College

Abstract 6: A student taking an introductory statistics course states, when comparing two boxplots, that the wider boxplot has a larger standard deviation. You correct the student: the wider boxplot has a larger range. The student remains confused: how could a wider boxplot have a smaller standard deviation?

I answer this question and, in the process, determine upper and lower bounds on the standard deviation of a boxplot for a data set of size $4n+3$.

Friday, October 26, 2018, 5:30pm to 5:45pm

Eulerian Numbers and a 2-dimensional Random Walk Generating Function

Barbara H. Margolius, Cleveland State University

Abstract 7: A single server queueing process behaves like a random walk with a reflecting boundary at zero; that is, arrivals and departures are random, with the boundary condition that the walk cannot go below zero. We call the number in the queue the level. This corresponds to the location of the random walk. For a more complicated process, we might have a phase in addition to a level recording the state of the system. When arrivals and departures are Markovian, such processes are quasi-birth-death processes. As with the single server queue the process is bounded so that it cannot go below zero. The unbounded process is a 2-dimensional random walk. In this talk, we study the generating function that arises from the random walk corresponding to a single server pre-emptive priority queue with finite buffer for class-2 customers. Eulerian numbers appear in the generating function for this process. We explore why.

Applications of Basket Data Analysis in Social Networks and Genetics

M. B. Rao, University of Cincinnati

Abstract 8: The concept of Basket Data Analysis comes from business and grocery stores. The analysis is computationally very challenging. We start with a panoramic introduction to the subject. We will then outline possible applications to Social Networks and Cancer data.

Saturday, October 26, 2018, 10:30am to 10:45am

Processing Quadratic Residues with Ducci Iterations

Shannon Tefft*, Ohio Northern University

Abstract 9: We consider Ducci iterations starting from an initial binary vector corresponding to the sequence of quadratic residues and non-residues modulo a prime, p. In the cases we analyzed, we observed that the Ducci period coincides with the maximal Ducci period for games of the same size, $p-1$.

Some particular angles between the Marden and Euler lines

Aurel I. Stan, Ohio State University - Marion

Abstract 10: Gauss-Lucas Theorem says that the roots of the derivative of a polynomial, with complex coefficients, lie in the convex covering of the roots of that polynomial. In particular, Marden Theorem says that the two roots of the derivative of a cubic polynomial are the foci of the Steiner inellipse of the triangle with vertices at the roots of that cubic polynomial. In any triangle the circumcenter, centroid, and orthocenter belong to the same line, called Euler line. We describe the triangles for which the Marden line and Euler line are either the same or perpendicular.

Saturday, October 26, 2018, 10:50am to 11:05am

Linear Complexities of Quadratic Residues and Primitive Roots Spacings

Aaron Kemats* & Travis Maenle*, Ohio Northern University

Abstract 11: We analyze the linear complexities of the sequence of parities of spacings between quadratic residues and between the primitive roots modulo a prime, respectively. We conclude that aforementioned linear complexities are extremely high, which makes the the corresponding binary sequences potentially suitable to cryptography.

The Gaussian Integral

Jaki Chowdhury, Ohio Northern University

Abstract 3: We present different ways of evaluating the Gaussian Integral

$$J = \int_0^\infty e^{-x^2}\, dx.$$

Saturday, October 26, 2018, 11:10am to 11:25am

Monochromatic Pairs with Nondecreasing Diameters

Michael W. Schroeder, Marshall University

Abstract 17: Let n, m, r, and t be positive integers. We say a function $\Delta : \{1,2,\ldots,n\} \to \{1,2,\ldots,r\}$ is (m,r,t)-*permissible* if there exist t ordered, monochromatic m-subsets of $\{1,2,\ldots,n\}$ with respect to Δ whose diameters are nondecreasing (don't worry, we'll go through this definition in the talk, with examples!). It follows from classical results that if n is big enough, every function $\Delta : \{1,2,\ldots,n\} \to \{1,2,\ldots,r\}$ is (m,r,t)-permissible, and work has been done to establish a lower bound on n for specific values of m, r, and t, often with t and r fixed and m arbitrary.

In this talk, we establish this lower bound when $m = r = 2$ and t is arbitrary. This is joint work with Adam O'Neal, a graduate student at Marshall University.

Solving Poisson's equation by using Method of particular solutions with the Oscillatory Radial Basis Function in 2D

Yu Wakayama*, Ohio Northern University

Abstract 14: In this talk, we present the derivation of the closed form particular solutions of the oscillatory radial basis functions for the Laplace operator in 2D. These derived solutions are used to solve the poisson's equation using the method of particular solutions.

Saturday, October 26, 2018, 11:30am to 11:45am

Bounds on Number of Positive First Differences for Algebraically Generated Costas arrays

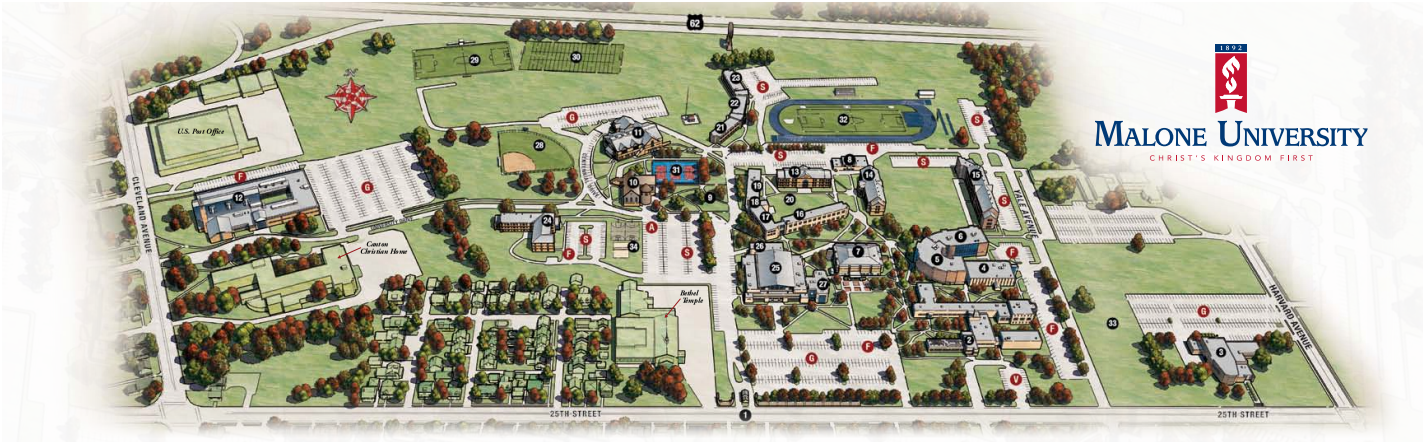
Christopher N. Swanson, Ashland University

Abstract 15: A Costas array is a permutation matrix such that all vectors between pairs of ones are distinct. Equivalently, a permutation matrix is a Costas array if the difference triangle corresponding to the permutation has distinct entries in each row. In this talk, I will present bounds on the number of positive entries in the first row of the difference triangle corresponding to some algebraically constructed Costas arrays.

Modeling of 2D Materials

Malena I. Espanol, The University of Akron

Abstract 16: In this talk, I will show how to develop different models of 2D materials. In particular, we will look at different carbon nanostructures and discuss some undergraduate and graduate research. We will formulate atomistic models and then upscale them to obtain continuum model.



Campus Map

- V Visitor Parking
- S Student Parking
- F Faculty/Staff Parking
- G General Parking
- A Admissions Parking

Please see flap for location of academic department offices.

1. **Alumni Entrance**
2. **Founders Hall (FH)**
   - Business Office
   - Center for Student Success
   - Graduate & Professional Studies Enrollment
   - Human Resources
   - Office of the Provost
   - Office of the Registrar
   - Performing Arts Hall
   - University Relations
3. **East Campus**
4. **Timken Science Hall (TS)**
5. **Mitchell Hall (MH)**
   - Fred F. Sills Auditorium
6. **Regula Hall (RH)**
   - Café
7. **Cattell Library (CL)**
   - IT Help Desk/Media Services
   - Studio Space, Editing Suites
8. **Strand Building (SB)**
   - Campus Safety
9. **Herbert W. Hoover Courtyard**
10. **Randall Campus Center (RC)**
    - Admissions Center
    - Bennett Lounge
    - Office of Spiritual Formation
    - Stewart Community Room
    - Student Development Offices
11. **Brehme Centennial Center (CC)**
    - Bookstore
    - Campus Mail Center
    - Conference Center
    - Double Room
    - Financial Aid
    - Froggy's Café
    - Homrighausen Dining Room
    - Hoover Dining Commons
12. **Johnson Center for Worship and the Fine Arts (JC)**
    - Advancement
    - Alumni and Parent Relations
    - Chapel/Sanctuary
    - Office of the President
    - Weaver Child Development Center and Primary School

RESIDENCE HALLS

13. **Haviland Hall (HA)**
    - Information Technologies
14. **Heritage Hall (HH)**
15. **Blossom Hall**
16. **Fox Hall**
17. **Whittier Hall**
    - Health Center
18. **Myers Lounge**
19. **Woolman Hall**
20. **The Quad**
21. **Penn Hall**
22. **Gurney Hall**
23. **Barclay Hall**
24. **DeVol Hall (DH)**

ATHLETIC FACILITIES

25. **Osborne Hall/Gymnasium (OH)**
    - Athletic Offices
26. **Ewing Varsity Center**
27. **Wellness Center (WC)**
28. **Softball Field**
29. **Soccer Field**
30. **Football Practice Field**
31. **Tennis Courts**
32. **Track/Intramural Field**
33. **Intramural Field**
34. **Basketball/Sand Volleyball Courts**

CAMPUS SAFETY

330.471.8111

Save this Date!

2019 Spring Ohio Section Meeting
University of Akron
April 5–6, 2019