Program of Activities

For the 2019 Fall Meeting of the

Mathematical Association of America

Ohio Section

Fall 2019

Shawnee State University

Portsmouth, Ohio

October 25-26, 2019

Mathematical Association of America

Ohio Section

MAA Ohio Section
Fall 2019 Program

Friday, October 25

12:00-4:00	Registration	Library Rotunda
12:00-1:00	Committee Meetings:	
	CONCUR (Curriculum)	Univ. Center 215
	CONSACT (Section Activities)	Univ. Center 220
	CONTEAL (Teacher Education & Licensure)	Univ. Center 230
1:00-4:00	Vendor & Book Exhibits	Library Rotunda
1:15-1:30	Welcome and Announcements	Library 204 (Flohr)
1:30-2:30	CONCUR Sponsored Panel Session: **"**My Experience Teaching a Co-Requisite Course**" Emily Dolsak, Shannon Miller-Mace, Najat Baji**	Library 204 (Flohr)
2:30-2:50	Break	Library Rotunda
2:50-3:50	Invited Address: **"**The ENIAC's 1949 Determination of Pi**" Brian Shelburne**	Library 204 (Flohr)
4:00-5:40	Executive Committee Meeting	Admin. 171 Richards Conf. Rm
5:00-6:15	Contributed Paper Sessions	Kricker 157, 250, 272
6:15-6:50	Social Time	Univ. Center 230
6:50-8:00	Banquet	Univ. Center 230
8:00-9:00	Invited Address by MAA Section Visitor: **"**Cool Results Involving Fibonacci Numbers and Compositions**" James Sellers**	Univ. Center 230

Saturday, October 26

8:00-10:00	Registration	Library Rotunda
8:00-10:00	Book Vendors and Exhibits	Library Rotunda
8:00-9:25	Coffee and Pastries	Library Rotunda
8:50-9:25	Committee on Local Arrangements	Library 205
8:50-9:25	Executive Committee Meeting (if needed)	Library 207
9:25-9:35	Welcome and Announcements	Library 204 (Flohr)
9:35-10:35	Invited Address by MAA Section Visitor: **"**Revisiting What Euler and the Bernoullis Knew About Convergent Infinite Series**" James Sellers**	Library 204 (Flohr)
10:35-10:50	Break	Library Rotunda
10:50-11:45	Contributed Paper Session	Kricker 157, 250, 272
11:45-12:00	Break	Library Rotunda
12:00-1:00	Invited Address: **"**Generating Functions as Tinkertoys**" Barbara Margolius**	Library 204 (Flohr)
1:00-1:10	Closing Remarks	Library 204 (Flohr)

Abstracts and Biographies of Plenary Speakers

Friday Invited Addresses

CONCUR Panel Session

Theme: My Experience Teaching a Co-Requisite Course

Speakers: Emily Dolsak, Youngstown State University
Shannon Miller-Mace, Marshall University
Najat Baji, Sinclair Community College

Speaker: Emily Dolsak, Youngstown State University

Title: *Co-Requisite College Algebra at Youngstown State University*

Abstract: Youngstown State University's Department of Mathematics has implemented an extended time/just-in-time remediation co-requisite model for several courses. Discussion will include the execution of this model specifically in College Algebra, the use of ALEKS as an online learning platform, and the impact the co-requisites have had on student success in these courses.

Speaker: Shannon Miller-Mace, Marshall University

Title: *Recognizing the Value of Co-Requisite Access to Mathematics Education*

Abstract: Traditional "gateway" courses are a tremendous barrier to accessing the "real mathematics" students need to be successful in higher education. These "pre-requisite" courses are often multi-semester, delivered electronically, non-reflective and non-collaborative, and sometimes taught by faculty or graduate students unfamiliar with the "disenchanted freshmen" or with minimal teaching experience. In addition to adopting mathematics "pathways", the MU Mathematics Department's implementation of "co-requisite" instruction, allowing students to register for their entry level mathematics course with

support, has allowed students find improved success in courses that count, rather than failing non-credit bearing courses. Instructors using this model are recognizing the value added by the "just-in-time" nature of the curriculum, which has drastically altered student expectations in these freshmen-level courses. Some of my classroom experiences focus on realizing the value of our work to promote student empowerment, using productive persistence to develop a growth mindset, collaboration to build a sense of community, and interactive instruction to develop ownership of learning.

Speaker: Najat Baji, Sinclair Community College

Title: *Just-in-Time Remediation*

Abstract: Recently, Sinclair College has provided just-in-time remediation for four courses based on anticipated needs of student learners. These courses include Introductory Statistics, College Algebra, Quantitative Reasoning, and Finite Mathematics for Business Analysis. Launched in spring 2017 with funding from the Ohio Department of Higher Education through the Bridges to Success Grant, these co-requisite courses were designed from scratch to ensure student success. The primary goal was to help learners progress through their degrees faster and provide just-in-time help to students taking these college-level courses without the previously required pre-requisite courses. While student success is dependent on learner involvement, these booster courses have shown to be beneficial to many students in achieving their academic goals. The pathway, method of teaching, and success rates for each course will be discussed as well as ideas for future offerings and adoption by other institutions of higher education.

Friday Invited Addresses

Speaker: Brian Shelburne, Wittenberg University

Title: *The ENIAC's 1949 Determination of Pi*

Abstract: Over the long Labor Day weekend in 1949, a team lead by George Reitwiesner at the US Army's Ballistic Research Laboratory in Aberdeen, Maryland, used the ENIAC to compute the decimal expansion of π out to 2,035 places, more than doubling the previous record of 808 digits. In addition, during the previous Independence Day holiday weekend, the ENIAC was used to compute *e* to 2,010 digits. The results of both calculations appeared in *Mathematical Tables and Other Aides to Computation* in 1950. This event is noteworthy for several reasons. This was the first use of an electronic computer to determine the value of π, a millennia-old problem. The ENIAC, a computer designed to compute ballistic tables, was not designed to perform the sort of high-precision calculation required for the determination of *e* and π. It could only store 200 decimal digits, whereas the determination of *e* and π required manipulating numbers more than 2,000 digits long. Thus, why were scarce computational resources allocated to this problem? How was it done? And finally, what was learned from the exercise?

Friday Invited Addresses

Speaker: James Sellers, University of Minnesota—Duluth

Title: *Cool Results Involving Fibonacci Numbers and Compositions*

Abstract: Compositions provide a wonderful backdrop for a number of well-known families of numbers, especially the Fibonacci numbers. In this talk, we will gently introduce the idea of a composition of an integer (which is just an ordered sum of integers), and then discuss how various families of compositions give rise to the Fibonacci numbers, Jacobsthal numbers, and a host of generalizations. The talk will be completely self-contained and understandable by all, especially undergraduate students interested in mathematics. Conjectures and opportunities for possible undergraduate research will be discussed at the end of the talk.

Saturday Invited Addresses

Speaker: James Sellers, University of Minnesota—Duluth

Title: *Revisiting What Euler and the Bernoullis Knew About Convergent Infinite Series*

Abstract: All too often in first-year calculus classes, conversations about infinite series stop with discussions about convergence or divergence. Such interactions are, unfortunately, not often illuminating or intriguing. Interestingly enough, Jacob and Johann Bernoulli and Leonhard Euler (and their contemporaries in the early 18th century) knew quite a bit about how to find the *exact* values of numerous families of convergent infinite series. In this talk, I will show two sets of *exact* results in this vein. The talk will be accessible to anyone interested in mathematics.

Saturday Invited Addresses

Speaker: Barbara Margolius, Cleveland State University

Title: *Generating Functions as Tinkertoys*

Abstract: Tinkertoys are a construction toy set for children that was created in 1914 and originally sold by the Toy Tinker Company. The toy is still marketed today with the rights now owned by Hasbro. Twenty-one years ago, the toy was inducted into the Toy Hall of Fame. The Tinker Toy set consists of a few simple pieces: sticks of various lengths, and spools with holes drilled in them to connect the sticks in more complex arrangements. Ferris Wheels were among the original creations used to demonstrate the toy, but per Wikipedia, the toy has been used to build a tic-tac-toe playing computer and many other complex objects.

With their book *Analytic Combinatorics*, Philippe Flajolet and Robert Sedgewick synthesized and distilled the work of many earlier mathematicians into an approach they call the symbolic method for analytic combinatorics. Combinatorial structures are typically defined by simple formal rules that are key to learning their properties. These simple rules lead to a symbolic transfer theorem from the combinatorial structure to the generating function for that structure. The form of the generating function leads to an analytic transfer theorem from the generating function to its asymptotic behavior. Just as we can build complex objects with Tinkertoys, so can we do the same with elementary combinatorial structures and elementary generating functions.

In this talk we will consider some examples of this approach related to random walks.

Biographies of Invited Speakers

Emily Dolsak, Youngstown State University

Emily Dolsak is a Lecturer of Mathematics at Youngstown State University. She holds a bachelor's degree in Mathematics and Economics from Westminster College (PA) and a master's degree in Mathematics from Youngstown State University. Emily has been teaching at YSU for the last 7 years, playing a considerable role in piloting and developing corequisite courses for College Algebra, Trigonometry, and Quantitative Reasoning.

Shannon Miller-Mace, Marshall University

Shannon Miller-Mace earned her Bachelor's and Master's degree in Mathematics from Marshall University in under 5 years, where her research focused on Chaotic Dynamical Systems back in 2006. At that time, she began teaching freshmen and sophomore mathematics courses for the MU Mathematics Department as a full-time instructor, and worked with upper level students as the faculty advisor for Pi Mu Epsilon. She fell into teaching courses targeting the "under-prepared" student, and coordinated initiatives like the MU Summer Bridge Program. She is currently seeking a Doctor of Education degree in Curriculum and Instruction from the Marshall University College of Education and Professional Development. She is also the co-developer, coordinator, and instructor of the MU Mathematics Department's dual-credit College Algebra and Trigonometry courses, as well as courses in Quantitative Reasoning and Statistics created in collaboration with the WV Higher Education Policy Commission. Shannon enjoys spending time with her husband, Rob-Roy Mace, an instructor in the MU Mathematics Department, and their 5-year-old son, Miller Iff Mace, who loves to read.

Najat Baji, Sinclair Community College

Najat Baji is a Professor of Mathematics at Sinclair College, Dayton, OH. She has been applying her diverse multinational teaching and learning background to connect with all Sinclair students since 2007. Previously, Najat taught at multiple institutions in New York, including the City University of New York. Mrs. Baji received a B.S. in Computer Science and an M.S. in Mathematics from CUNY. Inspiration for teaching came from Najat's experiences with explaining difficult material to college classmates to help them experience that "ah-ha" moment of understanding. That sense of joy of helping others continues to motivate Najat today as she believes student success influences not only Sinclair's success, but also her success as an educator. STEM Outreach to community youth is important to Najat as reflected in her chairing the planning committee for the highly successful 2019 WiSTEM (Women in STEM) Institute focused on CSI Forensics. While mathematics is Najat's primary language, she is also well versed in several computer languages, including C/C++, Java, HTML, R for statistical modeling, and several scripting languages, and is fluent in multiple spoken languages, including Arabic, French, Russian, and English. Najat's future plans include continuing to develop new courses within the Mathematics Department and always learning how to better help student learners succeed both within and outside the classroom.

Brian Shelburne, Wittenberg University

Brian J. Shelburne is a Professor of Mathematics and Computer Science at Wittenberg University in Springfield Ohio. He received his bachelor's degree in mathematics from Davidson College (1972), his M.A. (1974) and PhD (1978) in mathematics from Duke University and his M.S. in computer science (1985) from UNC Chapel Hill. He is a member of the Mathematical Association of America (MAA) the Association of Computing Machinery (ACM) and the IEEE Computer Society. His research interests lie in the intersection of mathematics and computer science and being somewhat stuck in the past, includes the history of computers and computing. He can be contacted at the Department of Mathematics and Computer Science, Wittenberg University, Springfield Ohio 45501 or at bshelburne@wittenberg.edu.

James Sellers, University of Minnesota—Duluth

James Sellers received his Ph.D. from Penn State University in 1992. After receiving his PhD, he taught at Cedarville University in Ohio for nine years before returning to his alma mater in 2001 to serve as a faculty member and the director of the undergraduate program in mathematics. In 2008, James served as a Visiting Fellow of the Isaac Newton Institute in Cambridge, and in 2012 he was privileged to be a Fulbright scholar, teaching and completing research at the Johannes Kepler University and the Research Institute for Symbolic Computation in Linz, Austria. Currently, James has over 100 papers listed in Mathematical Reviews, and he has won numerous awards from his department at Penn State and his section of the Mathematical Association of America for both his teaching and his service to the mathematical community. In February 2018, James turned his attention to a new and very exciting opportunity – serving as the Secretary of the MAA! And in August 2019, he moved to the University of Minnesota - Duluth to serve as professor and head of the Department of Mathematics and Statistics there.

Barbara Margolius, Cleveland State University

Barbara Margolius is Professor of Mathematics at Cleveland State University. She wandered about the academic disciplines earning a bachelor's degree in American Studies (Syracuse University), masters degrees in public policy (University of Michigan) and Operations Research (Case Western Reserve University) before finding a home in applied mathematics and earning a PhD at Case. Margolius is the recipient of Cleveland State's Distinguished Faculty Award for Service and the Jennie S. Hwang Award for Faculty Excellence. She served as founding director of CSU's Honors Program (which is now a College) and as a faculty fellow in the University President's Office. Margolius currently serves as director of CSU's Choose Ohio First Program, a state funded cohort program for STEM majors with more than 200 students participating. Margolius is active in a variety of mathematics professional societies and is presently co-chair of the program committee for MAM 11 (the 11th International Conference in Matrix Analytic Methods) to be held in Seoul South Korea in 2021 (join us!). She has written numerous articles on queueing theory and combinatorics and under an NSF grant, written many online apps for mathematics education in the WeBWorK homework platform.

Schedules of Contributed Talks

Contributed Paper Sessions

*denotes undergraduate student
**denotes graduate student

Friday, October 25
5:00—6:15

Time	**Session A** Kricker 157 Session Chair: Matt Davis
5:00 – 5:15	***Highly Irregular Graphs*** Aparna Higgins University of Dayton Abstract 1
5:20 – 5:35	***Hensel's p-adic Numbers*** Phil S. Blau Shawnee State University Abstract 4
5:40 – 5:55	***A Closed-Form Particular Solution of the Poisson Equation in 3D*** Steven Manns* Ohio Northern University Abstract 7
6:00 – 6:15	***Finding Algorithm Settings: Easy and Efficient Hyperparameter Optimization to Address some Artificial Intelligence "ilities"*** Trevor Bihl Air Force Institute of Technology Abstract 10

Contributed Paper Sessions

*denotes undergraduate student
**denotes graduate student

Friday, October 25
5:00—6:15

Time	**Session B** Kricker 250 Session Chair: Robert Mendris	**Session C** Kricker 272 Session Chair: Anup Lamichhane
5:00 – 5:15	***Effective Numbers*** Robert Mendris Shawnee State University Abstract 2	***Preliminary Calculations for a Multinomial Theorem for Functions with Expected Value Like Properties*** Shelby M. Dalton* Shawnee State University Abstract 3
5:20 – 5:35	***Applications of Symmetry and Group Theory in Chemistry*** Samuel Powell* Ohio Northern University Abstract 5	***Arithmetic of Base-Infinity Numbers*** Zijian Diao Ohio University—Eastern Abstract 6
5:40 – 5:55	***What Are the Chances of Getting Your Wallet Back If You Lose It?*** MB Rao University of Cincinnati Abstract 8	***Bounding the Stolarski Means by Holder Means*** Margarita Bustos Gonzalez** Ohio University—Athens Abstract 9
6:00 – 6:15	***Embeddings in Diagonally Cyclic Latin Squares*** Michael W. Schroeder Marshall University Abstract 11	***Analysis of the Derivative Operator on Finite and Infinite Dimensional Polynomial Vector Space*** Kevin S. Morrison** Miami University—Oxford Abstract 14

Contributed Paper Sessions

*denotes undergraduate student or high school student
**denotes graduate student

Saturday, October 26
10:50—11:45

Time	**Session A** Kricker 250 Session Chair: Christopher N. Swanson	**Session B** Kricker 272 Session Chair: Michael W. Schroeder
10:50–11:05	***Set-Valued Optimization on Ordered Topological Vector Spaces*** Jinlu Li Shawnee State University Abstract 12	***A Probability Game with Applications*** Zhijun Yin University of Akron Abstract 13
11:10–11:25		***Method of Approximate Particular Solutions with Oscillatory Radial Basis Solutions*** Anup Lamichhane Ohio Northern University Abstract 15
11:30–11:45	***Bounds on Number of Positive First Differences for Golomb Constructed Costas Arrays*** Christopher N. Swanson Ashland University Abstract 16	***DIY Proofs of Calculus Rules*** Alan Horwitz Marshall University Abstract 17

Abstracts for Contributed Papers

Friday 5:00-5:15

Highly Irregular Graphs

Aparna Higgins
University of Dayton

Abstract 1: A graph is defined to be "regular" if all its vertices have the same degree. Obvious examples of regular graphs are cycles and complete graphs. This expository talk follows attempts in the late 1980s at defining irregular graphs. We explore one of these attempts – "highly irregular graphs," in which every vertex is adjacent only to vertices with distinct degrees.

Effective Numbers

Robert Mendris
Shawnee State University

Abstract 2: We construct and analyze the theory of functions assigning the quantity (effective number) of objects endowed with probability weights. In a surprising outcome, the consistency of such probability-dependent measure assignments entails the existence of a minimal amount, realized by a unique effective number function. This result provides a well-founded solution to identity-counting problems in quantum mechanics such as counting the basis states contained in an output of a quantum computation.

Friday 5:00-5:15

Preliminary Calculations for a Multinomial Theorem for Funtions with Expected Value Like Properties

Shelby M. Dalton*
Shawnee State University

Abstract 3: In this presentation, we will recall a modified proof of the Strong Law of Large Numbers. Identify important characteristics of the expected values of sums of products of random variables raised to powers involved in one case of the proof. Then we will show computations of functions with similar properties to expected values evaluated at a few powers of sums of variables.

Friday 5:20-5:35

Hensel's p-adic Numbers

Phil S. Blau
Shawnee State University

Abstract 4: Kurt Hensel published his "Theory of Algebraic Numbers" in 1908. This talk will give a brief overview of the first four chapters of that work. In these chapters, Hensel constructed the field of p-adic numbers and proved the lemma that bears his name. The latter is a useful tool that can be used to help one decide whether a polynomial has a root in the integers mod p.

Applications of Symmetry and Group Theory in Chemistry

Samuel Powell*
Ohio Northern University

Abstract 5: Group theory and linear algebra are used extensively in chemistry, as the symmetry of molecules can be used to simplify various problems. Herein, we discuss differences in notation between mathematics and chemistry, and illustrate selected examples of the use of group theory in chemistry. Areas discussed include representation, spectroscopy, and quantum mechanics.

Arithmetic of Base-Infinity Numbers

Zijian Diao
Ohio University—Eastern

Abstract 6: What happens when we allow the base in a place value system to be infinity? It turns out that we can still construct a set of arithmetic operations for these numbers, which are similar to the everyday ones but full of surprising twists. We will interpret these operations by visualizing base-infinity numbers as snakes, thus offering a rudimentary perspective to a topic originated in Cantor's study of infinity.

Friday 5:40-5:55

A (Closed-Form) Particular Solution of the Poisson Equation in 3D

Steven Manns*
Ohio Northhern University

Abstract 7: In recent years, a new J Bessel function based radial basis functions (RBFs) known as oscillatory RBFs has been introduced. Despite the elusiveness surrounding the notion of a "closed-form", this presentation will cover the derivation of the (closed-form) particular solution of the Poisson equation in 3D by taking the oscillatory RBFs in the forcing term so that these particular solutions are useful in several numerical methods for solving partial differential equations.

What Are the Chances of Getting Your Wallet Back If You Lose It?

MB Rao
University of Cincinnati

Abstract 8: How does one answer such a question? How can one organize fieldwork to answer the question? We explore a recent study in great detail.

Bounding the Stolarski Means by Holder Means

Margarita Bustos Gonzalez**
Ohio University—Athens

Abstract 9: I will be giving an updated presentation on the research project I have been working on with Dr. Aurel I. Stan from Ohio State University-Marion campus. I would like to show more of the proofs that we have done, and a quite interesting observation that we found.

Friday 6:00-6:15

Finding Algorithm Settings: Easy and Efficient Hyperparameter Optimization to Address Some Artificial Intelligence "ilities"

Trevor Bihl
Air Force Institute of Technology

Abstract 10: Artificial Intelligence (AI) has many benefits, including the ability to find complex patterns, automation, and meaning making. Through these benefits, AI has revolutionized image process among numerous other disciplines. AI further has the potential to revolutionize other domains; however, this will not happen until we can address the "ilities": repeatability, explain-ability, reliability, use-ability, trust-ability, etc. Notably, many problems with the "ilities" are due to the artistic nature of AI algorithm development, especially hyperparameter determination. AI algorithms are often crafted products with the hyperparameters learned experientially. When applying the same algorithm to new problems, the algorithm may not perform due to inappropriate settings. This research aims to provide a straightforward and reliable approach to facilitating AI adoption and democratization of algorithms by automatically finding reasonable hyperparameter settings when given an AI algorithm.

Embeddings in Diagonally Cyclic Latin Squares

Michael W. Schroeder
Marshall University

Abstract 11: A (partial) Latin square is diagonally cyclic if cell (i+1,j+1) contains k+1 whenever cell (i,j) contains k. It is known when a diagonally cyclic partial Latin square with two diagonals may be embedded in a diagonally cyclic Latin square, and a conjecture was made for one with more diagonals. In this talk, we relate this problem to finding transversals in Cayley tables of cyclic groups, and with this correspondence we discuss the proof of the above conjecture for three diagonals.

Friday 6:00-6:15

Analysis of the Derivative Operator on Finate and Infinite Dimensional Polynomial Vector Space

Kevin S. Morrison**
Miami University—Oxford

Abstract 14: In this talk, the derivative operator on finite and infinite dimensional polynomial vector space will be explored. In particular, this talk will seek to explore the derivative operator on infinite dimensional polynomial vector space in an attempt to ascertain an essentially self-adjoint corresponding operator.

Saturday 10:50-11:05

Set-Valued Optimization on Ordered Topological Vector Spaces

Jinlu Li
Shawnee State University

Abstract 12: In this talk, we present some definitions and constructions of some ordering relations on the power sets of ordered sets and ordered topological vector spaces, which provide rules for ordering subsets. On the power sets of preordered sets, we introduce three preordering relations based on the given preorder relations, which are called the power preorder, upward power preorder and downward power preorder, respectively.

A Probability Game with Applications

Zhijun Yin
The University of Akron

Abstract 13: We will use a simple probability game to simulate the stock market behavior of a single user. We can try to understand the phenomenon why people lose money in the stock market.

Saturday 11:10-11:25

Method of Approximate Particular Solutions with Oscillatory Radial Basis Functions

Anup Lamichhane
Ohio Northern University

Abstract 15: The derivation of the closed-form particular solutions of the Poisson equation by taking oscillatory radial basis functions (RBFs) in the forcing term allow us to use the oscillatory RBFs in the Method of approximate particular solutions (MAPS) to numerically solve some partial differential equations. We present the MAPS with oscillatory RBFs and the numerical solutions of some PDEs obtained from this method.

Saturday 11:30-11:45

Bounds on Number of Positive First Differences for Golomb Constructed Costas Arrays

Christopher N. Swanson
Ashland University

Abstract 16: 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 Golomb constructed Costas arrays.

DIY Proofs of Calculus Rules

Alan Horwitz
Marshall University

Abstract 17: Proofs of basic differentiation rules in many textbooks are often lacking in rigor or poorly motivated. We will suggest proofs for the product, quotient and chain rule, which students might understand well enough to provide some of the steps.

Save this Date!

2020 Spring Ohio Section MAA Meeting
Bowling Green State University
April 3—4