Program of Activities

For the 2017 Fall Meeting of the

Mathematical Association of America

Ohio Section

Fall, 2017

Ohio University's Eastern Campus

St. Clairsville, Ohio

October 27-October 28, 2017

Mathematical Association of America

Ohio Section

MAA Ohio Section

Fall 2017 Program

Friday, October 27

12:00-4:00	Registration	Main Lobby, Shannon Hall
12:00-1:00	Committee Meetings:	
	CONCUR (Curriculum)	205
	CONSACT (Section Activities)	227
	CONTEAL (Teacher Education & Licensure)	235
1:00-4:00	Vendor & Book Exhibits	Art Gallery
1:15-1:30	Welcome and Announcements	Theater
1:30-2:30	CONCUR Sponsored address: **"***Ohio Mathematics Initiative – Re-visioning Post-Secondary Mathematics in Ohio***"** Michelle Younker	Theater
2:30-2:50	Break	Art Gallery
2:50-3:50	Invited Address: **"***Extracting Structural Information from NMR Spectroscopy as Inverse Problems***"** Partha Srinivasan.	Theater
4:00-5:40	Executive Committee Meeting	321
5:00-6:15	Contributed Paper Sessions	209,219,229
6:15-6:50	Social Time	Undo's (Hampton Inn)
6:50-8:00	Banquet	Undo's (Hampton Inn)
8:00-9:00	Invited Address: "*Martingales: For fun but not profit*" Aaron Montgomery	Undo's (Hampton Inn)

Saturday, October 28

8:00-10:00	Registration	Main Lobby, Shannon Hall
8:00-10:00	Book Vendors and Exhibits	Art Gallery
8:00-9:25	Coffee and Pastries	Art Gallery
8:50-9:25	Committee On Local Arrangements	205
8:50-9:25	Executive Committee Meeting (if needed)	321
9:25-9:35	Welcome and Announcements	Theater
9:35-10:35	Invited Address by winner of the Distinguished Teaching Award: "*What is the definition of definition? and other mathematical cultural conundrums*" Carol Schumacher	Theater
10:35-10:50	Break	Art Gallery
10:50-11:45	Contributed Paper Session	209,219,229
11:45-12:00	Break	Art Gallery
12:00-1:00	Invited Address: **"***Sequential Experiments with Primes***"** Mihai Caragiu	Theater
1:00-1:10	Closing Remarks	Theater

Abstracts of Invited Addresses

Friday

Speaker: Michelle Younker, Owens Community College

Title: *Ohio Mathematics Initiative – Re-visioning Post-Secondary Mathematics in Ohio*

Abstract: In 2014, the Ohio Mathematics Initiative (OMI) challenged faculty to re-envision post-secondary mathematics in Ohio's public colleges and universities. In response to this call, faculty from both two- and four-year institutions are working to develop high quality entry-level courses connected in meaningful ways to programs of study, updating Ohio Transfer Module (OTM) courses and learning outcomes, and implementing communication strategies that provide opportunities for members of the mathematics community from across the state to share data and ideas. The work of the Ohio Mathematics Initiative connects with other state initiatives to promote transfer of coursework and progress toward a credential for students in Ohio.

Speaker: Partha Srinivasan, Cleveland State University

Title: *Extracting Structural Information from NMR Spectroscopy as Inverse Problems*

Abstract: Over the last few decades, Nuclear Magnetic Resonance (NMR) spectroscopy has become a tool for extracting distance and orientation information for structures of biological samples like proteins. We will show how to extract information that is useful in obtaining protein structures using NMR experiments in solution, and describe how this extraction of information can be presented as an inverse problem in an appropriate system of ordinary differential equations.

In the case of NMR of solids, the information that is present is much more abundant, and it is much more challenging to isolate and obtain the information of interest.

We will outline the role of solid state NMR in structural biology. We will also address a few basic techniques used in this experimental method, and sketch a few advanced ideas.

Speaker: Aaron Montgomery, Baldwin Wallace University

Title: *Martingales: For fun but not profit*

Abstract: Loosely speaking, a martingale describes a sequence of random variables whose expected increments are all zero. For instance, a martingale might be used to describe the fortunes of a gambler who places a sequence of fair bets. In this talk, we will give an overview of martingales and state the Optional Stopping Theorem, from which we will wring a number of interesting corollaries ranging in topic from gambling to monkeys typing Shakespeare. This talk is intended to be accessible to anyone who enjoys mathematics.

Saturday

Speaker: Carol Schumacher, Kenyon College

Title: *What is the definition of definition? and other mathematical cultural conundrums*

Abstract: Helping our students think like mathematicians should be at the center of every class we teach. The particular topic will affect which parts of thinking mathematically we might address, but the goal of every math class should be to turn out students who can bring mathematical reasoning to bear in the context of the material taught in the course. In order to help our students think like mathematicians, we teachers must think deeply about what is going on in our students' heads. But this also takes an unusual amount of *self*-reflection. We need to understand how *we* think about things. Unfortunately, thinking mathematically is often something that comes naturally to people who eventually go on to get Ph.D.'s in mathematics. Thus we have no idea

how we learned to think this way, and we are often not even aware of how much is really going on in our own heads when we attack a mathematical question. I can attest to the fact that this was certainly true of me. As I have become more self-aware, I believe my teaching has improved tremendously. In addition to trying to illustrate some of the insights acquired over many years, the talk would be filled with illustrative examples of activities that can be used in different courses to help students engage the mathematical ideas of the course as mathematicians do every day.

Speaker: Mihai Caragiu, Ohio Northern University

Title: *Sequential Experiments with Primes*

Abstract: Simply put, we try to place prime numbers in "chambers of experimentation" with specific rules, and observe their behavior to produce knowledge. One such experimental setup involves recurrent sequences of primes in which every term is the greatest prime factor of a linear combination of preceding terms. Such sequences may exhibit wild oscillations at first, yet they appear to be ultimately periodic – a conjecture that we proved in special cases like "GPF-Fibonacci" sequences. Other experiments involve algebraic structures on the set of primes. For example, we may associate the greatest prime factor of 2p+q to a pair (p, q): a surprising observation this time is that under this operation, it appears that the prime 2 generates all primes! Similar experiments including Ducci-type games, non-associative cellular automata, and potential applications to cryptography, will also be discussed.

Brief Biographies of Invited Speakers

Michelle Younker, Owens Community College

Michelle (Chelle) Younker is Associate Professor and Chair of the Mathematics Department in the School of STEM at Owens Community College. She has been involved in Ohio's math pathways initiative since its inception in July 2013, serving on the Steering Committee whose recommendations called for changes in post-secondary mathematics. Younker serves on the Ohio Transfer Module Mathematics, Statistics, and Logic Review Panel and is Co-lead of the Communications, Outreach, and Engagement Subgroup for the Ohio Mathematics Initiative. She worked with the team who established learning outcomes for a quantitative reasoning course that is included in Ohio's transfer module. Younker is the current Midwest Regional Representative to the American Mathematical Association of Two-Year Colleges' (AMATYC) Placement and Assessment Committee and serves as a Math Advisory Group (MAG) member for Transforming Post-Secondary Education (TPSE) in Mathematics.

Partha Srinivasan, Cleveland State University

Partha Srinivasan joined the Department of Mathematics at Cleveland State University in 2008 after completing his postdoctoral work at the NSF funded Mathematical Biosciences Institute at the Ohio State University. His research is in mathematical biology, and he has worked on modeling various biological systems ranging from honey bees nest-site selection to the regeneration of axons of neurons.

Aaron Montgomery, Baldwin Wallace University

Aaron Montgomery is an Assistant Professor of Mathematics at Baldwin Wallace University. He obtained B.S. degrees in Mathematics and Physics from Northwest Nazarene University and received a PhD in Mathematics at the University of Oregon in 2013. Aaron is a national Project NExT fellow (Gold '14 dot) and has recently begun co-advising the Baldwin Wallace Math Club. His research interests include topics such as discrete stochastic processes and combinatorial designs, which he regards as the semi-natural progression of a lifelong obsession with dice and games of chance.

Carol Schumacher, Kenyon College

Carol Schumacher is Professor of Mathematics at Kenyon College faculty. She received her BA from Hendrix College and her Ph.D. in mathematics from The University of Texas at Austin. Schumacher is the recipient of Kenyon's Trustee Teaching Award and of the Ohio Section MAA's Distinguished Teaching Award. Schumacher has served three terms as department chair and recently completed a term as chair of the Kenyon faculty. She is the author of *Closer and Closer: Introducing Real Analysis* and *Chapter Zero: Fundamental Notions of Abstract Mathematics*, 2E.

Schumacher is active in the Mathematical Association of America. She was co-chair of the steering committee for the 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences and is Vice-President-Elect of the MAA. In recent years she has been invited to address the Project NExT fellows at their summer workshop and has been a workshop leader in workshops that help faculty incorporate inquiry into their classrooms.

Mihai Caragiu, Ohio Northern University

Mihai Caragiu is a Professor of Mathematics at Ohio Northern University. He received his M.S. in mathematics in 1988 from the University in Bucharest and his Ph.D. in mathematics in 1996 from Penn State. At Ohio Northern University since 2000, he got involved in undergraduate research resulting in 11 joint publications with students. Mihai's research interests are in experimental mathematics, elementary number theory and integer sequences or structures based on the greatest prime factor function or Conway's subprime function. Some of these ideas are presented in his new book "Sequential Experiments with Primes" (Springer 2017). He would like to acknowledge invaluable mathematical mentorship and inspiration from the late Serban Basarab from the Institute of Mathematics at Bucharest, and Leonid Vaserstein from Penn State.

Contributed Paper Sessions

*denotes undergraduate student
**denotes graduate student

Friday, October 27
5:00—6:15

Time	**Session A** 219 Session Chair: Kelly Bubp
5:00 – 5:15	***Different Scheme for Solving Fractional Differential Equations Using the Natural Decomposition Method*** Mahmoud S Rawashdeh Jordan University of Science and Technology Abstract 1
5:20 – 5:35	***Stochastic Analysis and Modelling to Determine the Network Security and Attackers Behavior*** Pubudu K Hitigala Kaluarachchilage Miami University – Middletown Abstract 4
5:40 – 5:55	***Stochastic Processes in Cost Accounting*** Harrison Potter Marietta College Abstract 7
6:00 – 6:15	***Particular solutions for the Laplace operator using oscillatory radial basis functions*** Alexander Sube* Ohio Northern University Abstract 10

Contributed Paper Sessions

*denotes undergraduate student
**denotes graduate student

Friday, October 27
5:00—6:15

Time	**Session B** 229 Session Chair: Najat Baji	**Session C** 209 Session Chair: Michael W. Schroeder
5:00 – 5:15	***The Discrete Sine Integral*** Treston H Brown* Fairmont State University Abstract 2	***Lebesgue's Measure of Magnitudes*** Phil Blau Shawnee State University Abstract 3
5:20 – 5:35	***Domain colorings -- how to plot complex-valued functions*** Tom Cuchta Fairmont State University Abstract 5	***Similarity reduction on Singular Manifold Expansion*** Ruma Dutta Ohio State University – Newark Abstract 6
5:40 – 5:55	***Finding Distinct Coverings for Rings of Quadratic Integers*** Aaron J Blodgett The University of Findlay Abstract 8	***An eclipse-inspired idea for a project*** Aparna Higgins University of Dayton Abstract 9
6:00 – 6:15	**An application of log-concavity of Holder means to Geometry** Aurel I Stan Ohio State University – Marion Abstract 11	

Contributed Paper Sessions

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

Saturday, October 28
10:50—11:45

Time	**Session A** 219 Session Chair: Glen E. Lobo	**Session B** 229 Session Chair: Katie Cerrone
10:50–11:05	***Solving Bayes' Theorem Problems Using Contingency Tables*** Christopher N. Swanson Ashland University Abstract 12	***Self-Polar Polytopes*** Alathea I Jensen** George Mason University Abstract 13
11:10–11:25	***Naive Bayes Classifiers in NLP*** Takumi Kijima Ohio Northern University Abstract 14	***On alternating partitions and their identities*** Hyeonseo Hwang* Korea Science Academy of KAIST in South Korea Abstract 15
11:30–11:45	***A Fibonacci-Lucas Experiment*** Aaron Kemats* Ohio Northern University Abstract 16	***An original, mathematical magic trick*** Jon Stadler Capital University Abstract 17

Abstracts of Contributed Papers

Friday 5:00-5:15

Different Scheme for Solving Fractional Differential Equations Using the Natural Decomposition Method

Mahmoud S Rawashdeh
Jordan University of Science and Technology

Abstract 1: In this article, a new scheme called the Fractional Natural Decomposition Method (FNDM) is presented to solve fractional partial differential equations (FPDEs). The FNDM is a combination of the well-known Adomian Decomposition Method (ADM) and the Natural Transform Method (NTM). We apply the FNDM to obtain analytical solutions and exact solutions in the case when Alpha=1 for various applications. The analysis of the FNDM is investigated for all many physical models. Comparing the results we obtained with other known techniques shows that the FNDM is powerful and effective method.

The Discrete Sine Integral

Treston H Brown*
Fairmont State University

Abstract 2: We define and investigate a function and a difference equation analogous to the classical sine integral function and its differential equation. Introduction to discrete calculus will be reviewed. This talk is accessible to a general audience.

Lebesgue's Measure of Magnitudes

Phil Blau
Shawnee State University

Abstract 3: While more well known for his role in the development of the the integral, Henri Lebesgue also investigated the abstract concept of magnitudes. He published "La Mesure des Grandeurs" (The Measure of

Magnitudes) serially between 1931 and 1935 in the journal L'enseignement des mathématiques (The Teaching of Mathematics). We will provide a brief overview of several chapters of this work.

Friday 5:20-5:35

Stochastic Analysis and Modelling to Determine the Network Security and Attackers Behavior

Pubudu K Hitigala Kaluarachchilage
Miami University - Middletown

Abstract 4: Any computer system with known vulnerabilities can be presented using attack graphs. An attacker generally has a mission to reach a goal state that he is expected to achieve. Expected Path Length (EPL) in the context of an attack graph describes the length or steps that the attacker has to take in achieving the goal state. However, EPL varies and it is based on the "state of vulnerabilities" in a given computer system. Any vulnerability throughout its life cycle passes through several stages that we identify as "states of the vulnerability life cycle". In our previous studies we have developed mathematical algorithms using Markov theory to estimate the probability for a given vulnerability being in a particular state of its life cycle. There, we have considered a typical model of a computer network system with two computers subject to three vulnerabilities, and developed a method driven by an algorithm to estimate the EPL of this network system as a function of time. This approach is important because it allows us to monitor a computer system during the process of being exploited. The proposed non-homogeneous model estimates the behavior of the EPL as a function of time and is therefore an index of the risk associated with the network system of being exploited.

Domain colorings -- how to plot complex-valued functions

Tom Cuchta
Fairmont State University

Abstract 5: In elementary algebra, a function f(x) is plotted by filling in ordered pairs of the form(x,f(x)) in the plane, where x is usually some real

number. This same process does not generalize to complex numbers very well: consider z=x+iy and a function g(z). The complex number z itself lies in the plane and g(z) also lies in the plane -- plotting it "the normal way" requires four dimensions!

In order to get around this limitation, it is common to use two dimensions to denote the placement of z and to use color and brightness to denote the argument and magnitude of f(z), respectively.

We shall review a process of coloring on some simple functions (e.g. z -> z^2). The rest of the talk will be reserved to examine pictures of some well-known special functions (e.g. Riemann zeta function) and videos created by manipulating parameters of some classical special functions (e.g. Bessel functions).

This talk will be accessible to a general audience, however knowing what complex numbers are helps a lot!

Similarity reduction on Singular Manifold Expansion

Ruma Dutta
Ohio State University - Newark

Abstract 6: We focus to study Symmetry Reduction method over singular manifold for solving non-linear differential equation. There exists intrinsic connection between integrability and invariance property of partial differential equation. Completely integrable partial differential equations possess almost all remarkable properties: i.e existence of multi-soliton solution, an infinite number of conservation laws, Backlund transformation and Painlevé property.

We will discuss classical method of Lie symmetry group analysis that leaves Invariant surface and non classical method which involves a similarity variable as reduction parameter to solve non-linear differential equation. Our focus will remain to study non-local symmetry and Integrability of Non-harmonic Oscillator equation in general. The equation is of the form

$$'\ddot{x} + 3x\dot{x} + x^3 + f(t)(\dot{x} + x^3) + g(t)x + h(t) = 0$$

It is very well known equation in physical sciences. This type of equation arises in motion of free particle in a space of constant curvature, operator Yang-Baxter Equations.

Friday 5:40-5:55

Stochastic Processes in Cost Accounting

Harrison Potter
Marietta College

Abstract 7: In cost accounting all factory overhead costs must be allocated to production departments so that those costs can be included in the cost of goods sold for the appropriate products. This includes costs incurred by service departments, which do not produce products. When service departments serve each other, proper allocation requires determining the stationary distribution of a transition matrix. An example is presented to illustrate this cost allocation process and to demonstrate its significance.

Finding Distinct Coverings for Rings of Quadratic Integers

Aaron J Blodgett
The University of Findlay

Abstract 8: Coverings of the integers have been used in a variety of problems in number theory. Here, the concept of coverings is abstracted to rings of quadratic integers. Specific and general examples will be shown, and techniques used to create these coverings will be discussed.

An eclipse-inspired idea for a project

Aparna Higgins
University of Dayton

Abstract 9: Eclipse-viewing glasses and home-made pin-hole viewers helped some of the faculty members and students of our department watch the solar eclipse in August. The coverage in our area was predicted to be 90%. I present some ideas for a possible project for a Calculus II

course addressing how far apart the centers of two equal discs should be if one disc must cover a given percentage of the second disc's area.

Friday 6:00-6:15

Particular solutions for the Laplace operator using oscillatory radial basis functions

Alexander Sube*
Ohio Northern University

Abstract 10: Particular solutions using radial basis functions are essential for the implementation of several radial basis functions method to numerically solve the partial differential equations. In this talk, we introduce particular solutions for the Laplace operator using some oscillatory radial basis functions.

An application of log-concavity of Holder means to Geometry

Aurel I Stan
Ohio State University - Marion

Abstract 11: We prove first that the *p*-Holder mean is logarithmic concave as a function of *p*. We define next the notion of α cevian in a triangle. We use the log-concavity property of the Holder means to find the smallest number *p,* such that an α cevian is less that the *p*-Holder mean of the two sides of the triangle that are adjacent to the cevian.

Saturday 10:50-11:05

Solving Bayes' Theorem Problems Using Contingency Tables

Christopher N. Swanson
Ashland University

Abstract 12: Bayes' Theorem can be a challenging topic for many students taking probability. While I believe I effectively present Bayes' Theorem so that students are able to apply it to straightforward

probability calculations, I have noticed they struggle with more difficult applications. These more difficult application problems can be solved more easily using contingency tables, avoiding the formula of Bayes' Theorem. In this talk, I will present an example of this technique.

Self-Polar Polytopes

Alathea I Jensen**
George Mason University

Abstract 13: A self-polar polytope is a self-dual polytope that is equal to a reflection or rotation of its own polar set. These polytopes were introduced by Lovasz as a means to address the chromatic number of distance graphs on the sphere and can be used to generate graphs with large chromatic number which are triangle-free. This talk focuses on basic questions such as when a self-dual polytope can be realized as self-polar, how these polytopes can be constructed, their facial structure, and algebraic properties of their indicator functions.

Saturday 11:10-11:25

Naive Bayes Classifiers in NLP

Takumi Kijima
Ohio Northern University

Abstract 14: In Natural Language Processing (NLP), classification means separating data in determined groups. The probability-based classical Naive Bayes Classifier is used in NLP research. Here we build classifier first with labeled data, then calculate probability and conclude a document most likely belongs to a certain group. In this talk, I introduce some Naive Bayes classifier models such as multivariate Bernoulli model and multinomial model.

On alternating partitions and their identities

Hyeonseo Hwang*
Korea Science Academy of KAIST in South Korea

Abstract 15: The theory of partitions has been well-developed and studied over many decades by numerous mathematicians. In this talk, we want to introduce alternating partitions and their interesting identities.

Saturday 11:30-11:45

A Fibonacci-Lucas Experiment

Aaron Kemats*
Ohio Northern University

Abstract 16: We consider an arbitrary sequence of generalized Fibonacci numbers G(N) side by side with the sequence of is partial sums, S(N). An interesting relation is noted between terms of the form G(2K+1) and those of the form S(4K-2) for K=1, 2, 3... The relation mediated by the Lucas numbers, thus establishing an interesting phenomenon.

An original, mathematical magic trick

Jon Stadler
Capital University

Abstract 17: We demonstrate an original mathematical magic trick in which an audience member's birthday is revealed, both the month and the day of the month. A classic, related trick is discussed in which the only the day of the month is determined using binary representations. We will examine an uncommon numeral system that provides the basis for the new illusion.

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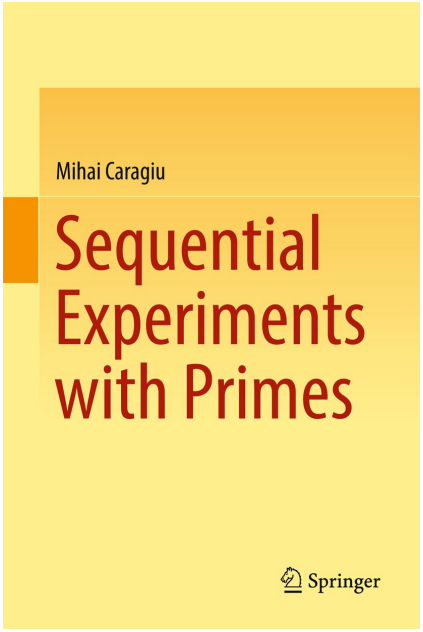

1st ed. 2017, XI, 279 p. 89 illus., 50 illus. in color.

M. Caragiu

Sequential Experiments with Primes

- Presents experimental and computational number theory in a new and interesting context
- Offers new mathematical ideas and problems involving prime numbers and related sequences
- Perfect for graduate and advanced undergraduate students studying applied and computational number theory

With a specific focus on the mathematical life in small undergraduate colleges, this book presents a variety of elementary number theory insights involving sequences largely built from prime numbers and contingent number-theoretic functions. Chapters include new mathematical ideas and open problems, some of which are proved in the text. Vector valued MGPF sequences, extensions of Conway's Subprime Fibonacci sequences, and linear complexity of bit streams derived from GPF sequences are among the topics covered in this book. This book is perfect for the pure-mathematics-minded educator in a small undergraduate college as well as graduate students and advanced undergraduate students looking for a significant high-impact learning experience in mathematics.

Printed book

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