MAA MATHFEST

July 31-Aug 3, 2019

PROGRAM

CINCINNATI

WELCOME TO MAA MATHFEST!

The MAA is pleased that you have joined us in Cincinnati for the math event of the summer.

What are my favorite things to do at MAA MathFest? Attend the Invited Addresses! When I think back on prior MAA MathFest meetings, the Invited Addresses are the talks that I still remember and that have renewed my excitement for mathematics. This year will continue that tradition. We have excellent speakers presenting on a variety of exciting topics. If you see an Invited Address title that looks interesting, go to that talk. It will be worth it.

Remember to attend the three 20-minute talks given by the MAA Adler Teaching Award winners on Friday afternoon. Jumpstart your passion for teaching and come hear these great educators share their insights on teaching, connecting with students, and the answer to "life, the universe and everything" (okay, maybe they won't talk about the last item, but I am sure they will give inspiring and motivating presentations).

I am excited that we will be giving the first ever MAA Inclusivity Award to a mathematician who has worked throughout their career to broaden participation in mathematics. This prize, along with other awards will be presented in the Prize Session on Friday at 9 a.m. Attend and find out who will be the first person to be honored with the MAA Inclusivity Award.

For something different at MAA MathFest, attend the President's Jubilee on Thursday from 6:00-7:30 p.m. This year we are trying something new at the Jubilee but it is still an event for all attendees– we have a set of performances in which mathematicians will be presenting magic, mime, recreational math, Latin America, and soap films and showing how these connect with mathematics.

Consider the PIC Math session on Saturday. PIC Math is an MAA program to prepare undergraduate students for careers in BIG (business, industry, and government) where students take a semester class in which they work as a team to solve a research problem that came directly from a BIG partner. At 10:00 a.m. on Saturday, there will be two 25-minutes talks by mathematicians who work in industry. From 8:00-10:00 a.m. there will be short student talks and from 12:00-1:30 p.m. there will be a student poster session. During both of these students will describe the problems they worked on and their results as part of the PIC Math program. If you want to learn more about what type of problems mathematicians work in industry, drop by the PIC Math session.

My favorite activity during MAA MathFest is catching up with friends and meeting new people. Whether you are a student attending your first MAA MathFest or a seasoned faculty member, I encourage you to get out of your comfort zone and meet people. This will help you find out about new ideas, activities, and programs. Please don't hesitate to introduce yourself to me. People are the strength of the MAA, and all of us have things to share. I am eager to hear about your concerns and your new ideas (except if you have a one-page proof using high school geometry of the Riemann Hypothesis ☺)

Above all, enjoy yourself.

Michael Dorff
MAA President

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WELCOME TO CINCINNATI!

While you are at MAA MathFest, explore all that Cincinnati has to offer. Right outside of the Duke Energy Convention Center, located in the heart of downtown, you will find museums, eclectic shopping, nationally acclaimed restaurants, and more. For more information, visit cincyusa.com.

Wireless Internet Access at the Duke Energy Convention Center

There is complimentary wireless internet in the Expresso Café, located at the Fifth and Elm entrance of the facility, and in the Third Floor Lounge, outside of the Junior Ballrooms.

Meet Attendees and Exhibitors in the Exhibit Hall

The MAA Exhibit Hall is located in Grand Ballroom B, Third Floor. Be sure to stop by to network colleagues, whenever taking breaks from education sessions, or stroll through the exhibitors' booths and discover all the Exhibit Hall has to offer, including the MAA Pavilion. Poster sessions will be taking place in the Exhibit Hall on Thursday and Friday.

Coffee breaks will be available in the Exhibit Hall

Thursday, August 1:
10:00 a.m. – 10:30 a.m., 3:00 p.m. – 3:30 p.m.

Friday, August 2:
10:00 a.m. – 10:30 a.m., 2:00 p.m. – 2:30 p.m.

Saturday, August 3:
10:00 a.m. – 10:30 a.m.

MAA Registration & Information

Wednesday, July 31:
3:00 p.m. – 8:00 p.m.

Thursday, August 1:
8:00 a.m. – 6:00 p.m.

Friday, August 2:
8:00 a.m. – 6:00 p.m.

Saturday, August 3:
8:00 a.m. – 3:00 p.m.

EARLE RAYMOND HEDRICK LECTURE SERIES

EARLE RAYMOND HEDRICK LECTURE SERIES

Complex Dynamics and Elliptic Curves

Laura DeMarco
Northwestern University

LECTURE 1: THURSDAY, AUGUST 1, 11:00 A.M. - 11:50 A.M.
DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

LECTURE 2: FRIDAY, AUGUST 2, 10:20 A.M. - 11:10 A.M.
DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

LECTURE 3: SATURDAY, AUGUST 3, 10:00 A.M. - 10:50 A.M.
DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

In a series of three talks, I will present connections between recent research in dynamical systems and the classical theory of elliptic curves and rational points. On the dynamical side -- specifically in the study of iteration of rational functions (Julia sets, bifurcations, the Mandelbrot set) -- the first connections were observed about 100 years ago. On the arithmetic side, it was probably the 1960s when dynamical ideas were first used as tools to understand the arithmetic geometry of elliptic curves and higher-dimensional varieties. My goal is to provide an overview of how these relationships developed and where they have brought us today. The three lectures will be independent.

Laura DeMarco Biography

Laura DeMarco is Professor of Mathematics at Northwestern University. She earned her PhD in 2002 from Harvard, and her undergraduate degree is in mathematics and physics from the University of Virginia. DeMarco's research is focused on the dynamics of polynomial or rational mappings on algebraic varieties, especially in dimension 1, with the primary goal of understanding notions of stability and bifurcation. Her recent work explores connections between dynamical properties of maps and the arithmetic geometry of the underlying varieties.

DeMarco was awarded the AMS Satter Prize in 2017, and she was an Invited Speaker at the 2018 International Congress of Mathematicians. She held a Simons Fellowship in 2015-2016, and she was a Kreeger-Wolf Distinguished Visiting Professor in the mathematics department at Northwestern University for one year before moving there in 2014. Prior to Northwestern, DeMarco was at the University of Illinois at Chicago, and before that she held an NSF Postdoctoral Fellowship and Dickson Instructorship at the University of Chicago. DeMarco received the NSF Career Award and a Sloan Fellowship in 2008. She became a Fellow of the American Mathematical Society in the inaugural class of 2012.

Earle Raymond Hedrick Lecture Series History

The Earle Raymond Hedrick Lectures was established by the Board of Governors of The Mathematical Association of America at their meeting in St. Louis in 1952. Its purpose is to present to the Association a lecturer of known skill as an expositor of mathematics, "who will present a series of at most three lectures accessible to a large fraction of those who teach college mathematics." These lectures are named for the first President of the MAA, Earle Raymond Hedrick, who was also President of the American Mathematical Society from 1929 to 1930. Hedrick was born in Union City, Indiana in 1876. He attended the University of Michigan (BA 1896) and Harvard University (AM 1898), before getting his PhD at Göttingen in 1901. He taught at Yale and the University of Missouri before becoming head of the Mathematics Department at the University of California at Los Angeles, where he eventually became Vice President and Provost. His mathematical research was in the areas of differential equations, calculus of variations, and functions of a real variable. Generations of mathematics students remember him as a translator of Goursat's Cours d'Analyse. In addition to research papers and works on the teaching of mathematics and engineering at the college and university level, he also wrote and edited a series of secondary school texts. He is one of six who have been President of both the AMS and the MAA. Professor Hedrick died in 1943.

Recent Speakers

2018: Gigliola Staffilani, *Massachusetts Institute of Technology*
2017: Dusa McDuff, *Barnard College, Columbia University*
2016: Hendrik Lenstra, *Universiteit Leiden*
2015: Karen Smith, *University of Michigan Ann Arbor*
2014: Bjorn Poonen, *Massachusetts Institute of Technology*
2013: Olga Holtz, *University of California-Berkeley and Technische Universität Berlin*
2012: Bernd Sturmfels, *University of California-Berkeley*
2011: Manjul Bhargava, *Princeton University*
2010: Robert L. Devaney, *Boston University*
2009: Ravi Vakil, *Stanford University*
2008: Erik Demaine, *Massachusetts Institute of Technology*

Special Events at the MAA Pavilion

Check out the member engagement events happening in the MAA Pavilion. You'll find a diverse selection of events and activities for the mathematical community who are curious to learn more about the various programs offered by MAA. All are welcome.

Dancing Transformations
Wednesday, July 31, 6:00 PM - 6:30 PM

Organizer: Dr. Diana Cheng

Join SIGMAA Sports members as they create a dance by rolling a die (to select a geometric transformation named) and picking a card (to select a body part).

For example: the dice roll could say "rotate" and the body part could be "shoulder" so the participant would find a movement that involves rotating the shoulder. Participants would do multiple iterations of this and have a full dance using the transformations.

25 and 50 Year Member Reception
Wednesday, July 31, 7:00 PM - 8:00 PM

Organizer: Steve Coollbaugh

MAA's Board of Directors and staff will recognize and celebrate our 25-and 50-year members at the MAA Pavilion. We welcome these members to come celebrate their long-term relationship with the MAA. Wine and light snacks will be served.

Sample activities from the MAA PRESS book, *"Tactile Learning Activities in Mathematics: A Recipe Book for the Undergraduate Classroom."*
Thursday, Aug. 1, 2:00 PM - 3:00 PM

Organizer: Julie Barnes

Come try out some hands on teaching activities from the new MAA Press Book, Tactile Learning Activities in Mathematics. Sample activities span a variety of undergraduate mathematics classes and utilize Wiki Stix, puzzle pieces, blocks, and more!

Student Ice Cream Social
Thursday, Aug. 1, 4:00 PM - 5:00 PM

Organizer: Membership Committee

Students! Come enjoy a scoop while you give the MAA Membership Committee the scoop on what you'd like from your membership both before and after graduation. Don't forget to sign up for raffles and prizes.

The Program Review Experience
Friday, Aug. 2, 12:30 PM - 1:30 PM

Organizer: The MAA Committee on Program Review

Via their posters, presenters from several campus will tell the story of their program review experiences. They describe what was expected of them, what difficulties they encountered, and what the outcomes of the review were.

Math & Magic
Friday, Aug. 2, 4:00 PM - 5:00 PM

Organizer: Art Benjamin

Art Benjamin will display feats of magic and mind, based on mathematical principles.

Sports Analytics: Get in the Game
Time TBD

Organizer: Tim Chartier

Join Tim and Tanya Chartier with interactive sports analytics activities. Get in the game with math!

Be sure to visit the MAA Pavilion for a complete list of events and activities.

#MAAthFest

INVITED ADDRESSES

AMS-MAA JOINT INVITED ADDRESS

Learning in Games

Éva Tardos
Cornell University

THURSDAY, AUGUST 1, 10:00 A.M. - 10:50 A.M.
DUKE ENERGY CONVENTION CENTER,
GRAND BALLROOM A

Selfish behavior can often lead to suboptimal outcome for all participants, a phenomenon illustrated by many classical examples in game theory. Over the last decade we have studied Nash equilibria of games, and developed good understanding how to quantify the impact of strategic user behavior on overall performance in many games (including traffic routing as well as online auctions). In this talk we will focus on games where players use a form of learning that helps them adapt to the environment. We ask if the quantitative guarantees obtained for Nash equilibria extend to such out of equilibrium game play, or even more broadly, when the game or the population of players is dynamically changing and where participants have to adapt to the dynamic environment.

Éva Tardos Biography

Éva Tardos is a Jacob Gould Schurman Professor of Computer Science at Cornell University, and she was Computer Science department chair from 2006 to 2010. She received her BA and PhD from Eötvös University in Budapest. She joined the faculty at Cornell in 1989. Tardos's research interest is algorithms and algorithmic game theory, after a number of years as a postdoc, including a year at MSRI in Berkeley. She is most known for her work on network-flow algorithms and quantifying the efficiency of selfish routing. She has been elected to the National Academy of Engineering, the National Academy of Sciences, the American Academy of Arts and Sciences, and is an external member of the Hungarian Academy of Sciences. She is the recipient of a number of fellowships and awards including the Packard Fellowship, the Gödel Prize, Dantzig Prize, Fulkerson Prize, ETACS prize, and the IEEE von Neumann Medal. She is editor editor-in-Chief of the Journal of the ACM, has been editor-in-Chief of SIAM Journal of Computing (2003-09), and editor of several other journals including Combinatorica; she served as problem committee member for many conferences, and was program committee chair for the ACM-SIAM Symposium on Discrete Algorithms (1996), as well as the IEEE Symposium on the Foundations of Computing (2005) and the ACM Conference on Economics and Computing (2013).

MAA INVITED ADDRESS

Uncertainty: The Mathematics of What we Don't Know

Ami Radunskaya
Pomona College

THURSDAY, AUGUST 1, 9:00 A.M. - 9:50 A.M.
DUKE ENERGY CONVENTION CENTER
GRAND BALLROOM A

Over the past few centuries, the theory of probability has been developed to quantify possibilities and to help us make decisions with incomplete knowledge. More recently, this theory has been refined to include predictions based on randomly perturbed dynamical systems, as well as providing a measure of our belief in future events based on observed data. As mathematicians, we like precision, patterns, predictions. As human beings we want to make wise, informed decisions. In this talk I will explore three questions: how can we quantify the uncertainty in our predictions, how do we make decisions in the face of uncertainty, and when is a bit of uncertainty helpful … or fun?

Ami Radunskaya Biography

A California native, Professor Radunskaya received her Ph.D. in Mathematics from Stanford University. She has been a faculty member in the Math Department at Pomona College since 1994. In her research, she specializes in ergodic theory, dynamical systems, and applications to various "real-world" problems. Some current research projects involve mathematical models of cancer immunotherapy, developing strategies for targeted drug delivery to the brain, and studying stochastic perturbations of dynamical systems. Prior to her academic career, Professor Radunskaya worked extensively as a cellist and composer. Her music, described as "techno-clectic", combines traditional forms with improvisation, acoustic sounds with electronic, computer-generated, and found sounds.

Contrary to popular belief, Professor Radunskaya thinks that anyone can succeed in mathematics, and she has committed herself to increasing the participation of women and underrepresented groups in the mathematical sciences. She is the Past-President of the Association for Women in Mathematics, and co-directs the EDGE (Enhancing Diversity in Graduate Education) program, which won a "Mathematics Program that Makes a Difference" award from the American Mathematics Society in 2007, and a Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) in 2015.

Professor Radunskaya was recently elected a Fellow of the American Math Society, and she is the recipient of several awards, including a WIG teaching award in 2012, and the 2017 AAAS Mentor award.

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MAA INVITED ADDRESS

A Vision of Multivariable Calculus

Robert Ghrist
University of Pennsylvania

SATURDAY, AUGUST 3, 11:00 A.M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

This talk will address certain challenges in teaching multivariable calculus. Classical texts emphasize calculus in dimensions two or three, based on 19th and 20th century applications to physics. At present, many of our students are more motivated by data and systems in higher dimensions. How can a calculus course best adapt to these needs, without overwhelming students (or professors)? This talk will outline a plan for increasing both the dimension and sophistication of multivariable calculus instruction with the use of video. Topics covered will include the use of visualization, matrix algebra, and differential forms.

Robert Ghrist Biography

Robert Ghrist is the Andrea Mitchell University Professor of Mathematics and Electrical & Systems Engineering at the University of Pennsylvania. He is a recognized leader in the field of applied algebraic topology, with awards including the NSF CAREER, NSF PECASE, SciAm50, and Vannevar Bush Faculty Fellowship. He is a recipient of the Chauvenet Prize, the highest award given for mathematical expository writing. He is also a dedicated communicator of mathematics, with teaching awards that include the MAA James Crawford Prize, Penn's Lindback Award, and the S. Reid Warren award in Engineering at Penn.

MAA INVITED ADDRESS

Solving Algebraic Equations

Irena Swanson
Reed College

FRIDAY, AUGUST 2, 11:20 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Abel and Ruffini, and later Galois showed that general polynomials of degree five or higher are not solvable with the usual arithmetic operations. Nevertheless, algebra offers powerful methods for solving many equations and for determining the structure of solutions even when the solutions themselves cannot be found. In this talk I will cover some classical and more recent methods, including Hilbert's Nullstellensatz and Gröbner bases. A running theme will be computational complexity, and the talk will end with more recent results in commutative algebra.

MAA JAMES R.C. LEITZEL LECTURE

What's at Stake in Rehumanizing Mathematics?

Rochelle Gutiérrez
University of Illinois

SATURDAY, AUGUST 3, 9:00 A.M. - 9:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Embracing an "equity" standpoint that has been poorly defined (Gutiérrez, 2002) or constantly shifting (NCTM, 2008) has led to a state of "tinkering" as opposed to real change within mathematics (Gutiérrez, 2017). That is, our progress has often focused on, and ended with, closing the achievement gap or recruiting more diverse students into the mathematical sciences, but not trying to radically reimagine a mathematics that supports students, teachers, and members of society to thrive, something I refer to as Rehumanizing Mathematics. This approach begins with 1) acknowledging some of the dehumanizing experiences in mathematics for students, teachers, and citizens and 2) designing ways for people to be provided with windows and mirrors onto the world and relating to each other with dignity through mathematics. This focus on Rehumanizing Mathematics allows us to think differently about student misconceptions, teachers as identity workers, the histories of mathematics, our bodies in relation to mathematics, and why it is not just that diverse people need mathematics but mathematics needs diverse people. In this talk, I explore "what's at stake" along two dimensions: 1) what it means for teachers, students, and society if we do not rehumanize mathematics and 2) what knowledge bases, sensibilities, and forms of risk taking it will require from us as mathematicians (and mathematics educators) if we commit deeply to rehumanizing mathematics.

Rochelle Gutiérrez Biography

Rochelle Gutiérrez is Professor of Curriculum and Instruction and Latina/Latino Studies at the University of Illinois, Urbana-Champaign USA. Her research interrogates the unearned privilege that mathematics holds in society and the roles that race, class, language, and gender play in teaching and learning mathematics so as to open up new possible relationships between living beings, mathematics, and the planet. Her current research projects include: theorizing the roles of mathematics in relation to power, identity, the body, and authority in society; supporting mathematics teachers who engage their students in rigorous and creative mathematics and who are committed to social justice; and documenting moments of "Nepantla" and "creative insubordination" in the everyday practices of mathematics teachers.

INVITED ADDRESSES

AWM-MAA ETTA ZUBER FALCONER LECTURE

Dance of the Astonished Topologist ... or How I Left Squares and Hexes for Math

Tara Holm
Cornell University

FRIDAY, AUGUST 2, 1:30 P.M. - 2:20 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Topology is often called ``rubber sheet geometry" and is described as ``floppy" while geometry is more ``rigid". Symplectic geometry, the natural geometry of classical mechanics, is floppier than Riemannian geometry but more rigid than topology. I will give a friendly introduction to some geometric and algebraic techniques in topology, proving along the way that a topologist can turn her trousers inside out without taking them off. I will then give an overview of the floppy/rigid spectrum, motivated by many pictures and examples. I will conclude with a description of how covering spaces have been useful in my own work in symplectic geometry, and how they can make square dancing more challenging.

Tara Holm Biography

Tara Holm is a Professor of Mathematics at Cornell University. She was an undergraduate at Dartmouth College, studied in Budapest through the Budapest Semesters in Mathematics, and earned a PhD at MIT. She serves on the Board of Governors of Transforming Post-Secondary Education in Mathematics and is the President/CEO of Pro Mathematica Arte, the non-profit corporation which runs the Budapest Semesters in Mathematics and the Budapest Semesters in Mathematics Education.

Holm is an expert in symplectic geometry, the mathematical framework for classical and quantum mechanics. Her research has been supported by the National Science Foundation, the Association for Women in Mathematics, and the Simons Foundation. In 2012, Holm was named a Fellow of the American Mathematical Society. She has served as an Oliver Smithies Lecturer and Visiting Fellow at Balliol College, Oxford, and a von Neumann Fellow at the Institute for Advanced Study, Princeton. She will be a Fellow at Clare Hall, Cambridge, in 2019-2020.

MAA CHAN STANEK LECTURE FOR STUDENTS

Secrets of Grad School Success

Mohamed Omar
Harvey Mudd College

THURSDAY, AUGUST 1, 1:30 P.M. - 2:20 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Around this time of year many rising seniors and even rising juniors are wondering what to do after college, and many contemplate the idea of going to graduate school. Naturally, they seek advice from peers, professors at their college and the internet. In this talk, we'll give some pretty unconventional advice based on the speaker's experiences through the same process.

Mohamed Omar Biography

Dr. Mohamed Omar is an associate professor in the Department of Mathematics at Harvey Mudd College. He is one of the 2018 recipients of the MAA's Henry L. Alder Award for Distinguished Teaching, and has been featured online in Forbes and Scientific American. Dr. Omar's mission is to change the world from math phobic to math loving, fiercely devoting his life to inclusion in mathematics.

MARTIN GARDNER LECTURE

Recreational Mathematics and Computer Science: Martin Gardner's Influence on Research

Erik Demaine
Massachusetts Institute of Technology

SATURDAY, AUGUST 3, 2:00 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Martin Gardner's beautiful writing about fascinating mathematics, puzzles, and magic tricks has attracted and inspired many people to become mathematicians. At an even deeper level, Martin's writings highlighted exciting research directions and posed open problems which directly influenced mathematical research. Much of my own research was deeply influenced by Martin Gardner, in both recreational mathematics and a branch I call "recreational computer science". While most of this research may have started out recreational, many of the results also have practical applications. I will give a tour of many examples of Gardner's writings and how it inspired new research, from paper folding to mazes to penny puzzles to polyomino packing to magic. I encourage you all to read more Martin Gardner and look for more unsolved research questions and directions.

Erik Demaine Biography

Erik Demaine is a Professor in Computer Science at the Massachusetts Institute of Technology. Demaine's research interests range throughout algorithms, from data structures for improving web searches to the geometry of understanding how proteins fold to the computational difficulty of playing games. He received a MacArthur Fellowship as a "computational geometer tackling and solving

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difficult problems related to folding and bending—moving readily between the theoretical and the playful, with a keen eye to revealing the former in the latter". He appears in the origami documentaries Between the Folds and NOVA's The Origami Revolution, cowrote a book about the theory of folding (Geometric Folding Algorithms) and a book about the computational complexity of games (Games, Puzzles, and Computation), and coedited two books in tribute to Martin Gardner (Tribute to a Mathemagician and A Lifetime of Puzzles). Together with his father Martin, his interests span the connections between mathematics and art, including curved-crease sculptures in the permanent collections of the Museum of Modern Art in New York, and the Renwick Gallery in the Smithsonian.

PI MU EPSILON J. SUTHERLAND FRAME LECTURE

Alice in Numberland --- Adventures in Cryptography, Number Theory, and Life

Alice Silverberg
University of California, Irvine

WEDNESDAY, JULY 31, 8:00 P.M. - 8:50 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

I will give an account of some of my adventures in the wonderlands of mathematics and cryptography, offering some food for thought on how mathematics can be useful in cryptography, and mentioning some useful things I learned along the way that I wish I had learned sooner.

Alice Silverberg Biography

Alice Silverberg is Distinguished Professor in the Department of Mathematics at the University of California, Irvine, with an additional appointment in Computer Science. Her research areas are cryptography and number theory. She earned her undergrad degree summa cum laude from Harvard University, a Masters degree and PhD from Princeton University, and a Master of Advanced Study degree from the University of Cambridge. She was also a Professor at the Ohio State University, and has held visiting positions at industrial labs and international research centers.

Silverberg is an inaugural Fellow of the American Mathematical Society and a Fellow of the Association for Women in Mathematics, and has been awarded Humboldt, Bunting, Sloan, IBM, and NSF Fellowships. She has given over 300 invited lectures, has consulted for film and television, writes about Alice's Adventures in Numberland (at https://sites.google.com/site/numberlandadventures/), and occasionally writes mathematically-inspired Scottish country dances.

NAM DAVID HAROLD BLACKWELL LECTURE

Dudeney's No Three-In-Line Problem: Problem, Solutions, Conditions, Progress, and Conjectures

Johnny L. Houston
Elizabeth City State University

FRIDAY, AUGUST 2, 4:00 P.M. - 5:45 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

In 1917, Henry Dudeney, an Englishman who had done some intriguing things with mathematical puzzles and games, posed an interesting question for persons interested in discrete geometry. Let an n x n grid be given in the Euclidean plane for any natural number n, what is the maximum number of points that can be identified in the grid so that no three of these points are in the same line (no 3 colinear). For various natural numbers n, solutions have been discovered and certain conditions have been encountered.

The presenter discusses many of these solutions and conditions. For large natural numbers n, even for some $n < 60$, progress (or lack of progress) is being made slowly. By the Pigeon Hole Principle, the maximum number of such points that can exist is $2n$. The problem of finding for which n this value is reached is known as the No-Three-In-Line Problem. Several conjectures exist. These conjectures and their motivations are discussed as well as some related problems. However, the No-Three-In-Line Problem is still an open problem.

The year 2019 is the centennial year of the honoree for which this lecture was named. The presenter will also discuss the life and contributions of David H. Blackwell.

Additionally, a light reception will follow the lecture to celebrate the National Association of Mathematicians' 100th anniversary.

Johnny L. Houston Biography

Johnny L. Houston is Professor Emeritus at Elizabeth City State University-ECSU (1984-2010) in Elizabeth City, NC and Executive Secretary Emeritus of the National Association of Mathematicians- NAM (1975-2000); he is also a Founder of NAM (1969). He earned three degrees in mathematics: BA, Morehouse College (1964); MS, Clark Atlanta University/AU. (1966); and PhD, Purdue University. (1974) {Dissertation title: "On the Theory of Fitting Classes in Certain Locally Finite Groups," Eugene Schenkman, Adviser}; he did additional study at the University of GA (Sum-1969) and at L'Universite Strasbourg in France, 1966-67. Nationally Selected as a Science History Maker (recorded in the Library of Congress, USA), Houston has received some $15 million dollars in grants for development of scholarly activities; he has produced some 30 publications, including 7 books (some in French), of which he is author, co-author or editor-in-chief; and he has made scores of scholarly presentations as an Invited Speaker while traveling globally: 6 continents, 70 different countries (25 in Africa), and all 50 states in the USA. He has taught and guided many students in scholarly pursuits at the

BS, MS and doctoral levels while teaching at ECSU, CAU/Atlanta U., Fort Valley St. U., Savannah St. U, Purdue U, Stillman College and Morehouse College as well as while administering national programs for NAM and while serving in positions of Vice Chancellor for Academic Affairs, Senior Research Professor, Callaway Professor of Computer Science, Dept Chair: Math and SC, Dir. of a Computational Science - Scientific Visualization Center and Dir. of a Global Leadership Academy. He has served as a Visiting Scientist at NASA Langley Research Center, Lawrence Livermore Nat'l Lab, Argonne Nat'l Lab, Oak Ridge Nat'l Lab, and the Nat'l Center for Atmospheric Research. Houston's Current Research Interests are Computational Science, Combinatorics, Discrete Geometry and the History of Mathematics. He plans to publish another book by 2020: "Profiles of African American Mathematicians." Houston is a Life Member of NAM, SIAM, MAA (Bd of Gov, 1992-95), Purdue National Alumni Association, Clark Atlanta National Alumni Association, Morehouse College National Alumni Association, NAACP and has been a member of AMS, ACM, IEEE, ADMI (2nd VP, 1990-94), MSRI (Advisory Com, 1993-98), NC Super Computer Center (Advisory Com, 1994-2003), APARC, Benjamin Banner Assn, Purdue University Mathematics Dept (Advisory Com 1999-2002); and in Community: EC-RCCDC, Bd Ch; EC-Airport Auth. Bd Ch; Soc Ser-Bd Ch; EC-PC Found Bd-V Ch.; His. Soc. Bd; PC Adj Bd. Houston is also active in ecumenical and missionary activities and in his local church.

Houston has received many honors-recognitions, including being a guest at the White House for a State Dinner (Sept 2008), Who's Who in America, the annual Johnny L. Houston Mathematical Sciences Colloquium (every Oct, ECSU) in his honor, NAM's Lifetime Achievement Award, NAM's Founder Award, QEM Award of Excellence in Teaching Mathematics and Science, UNC Board of Governor's Teaching Excellence Award, NC Governor's Award for Outstanding Volunteer Services, ECSU Foundation Award, ECSU Chancellor Award, Selected to establish the Professor. Claude B. Dansby Display at Morehouse College, and the Purdue University Black Cultural Center (BCC) Pioneer Award (Houston was the first Manager/Director of Purdue's Black Cultural Center in 1971-72); the BCC is celebrating its 50th Anniversary in 2019)

In 1969, Houston married Virginia Lawrence of Macon, GA. They have two daughters:.Mave T. Houston, PhD (Computer Sc) and Kaiulani M. Houston, PhD (Bio-Chem). Houston was born Nov. 19, 1941 in Sandersville, GA, the youngest son of the late Mrs. Catherine Houston Vinson, whose Centennial Year he is Celebrating in 2019.

INVITED PAPER SESSIONS

INVITED PAPER SESSIONS

The Serious Side of Recreational Mathematics

FRIDAY, AUGUST 2, 1:30 P.M. - 3:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

More than a pastime, recreational mathematics runs the gamut from the combinatorial questions to the mathematical structures in the game SET to using juggling to create a proof in number theory. In this invited paper session, experts in recreational math show how starting with a fun puzzle, game, or story can take one on a trip to deep mathematics.

Organizer:
Robert Vallin, *Lamar University*

Sponsor:
SIGMAA on Recreational Mathematics

Bingo Paradoxes
1:30 P.M. - 1:50 P.M.
Art Benjamin, *Harvey Mudd College*

Garden of Eden Partitions for Bulgarian and Austrian Solitaire
2:00 P.M. - 2:20 P.M.
James Sellers, *Penn State University*

Geometry, Combinatorics and the Game of SET
2:30 P.M. - 2:50 P.M.
Liz McMahon, *Lafayette College*

Throwing Together a Proof of Worpitzky's Identity
3:00 P.M. - 3:20 P.M.
Steve Butler, *Iowa State University*

Domino Variations
3:30 P.M. - 3:50 P.M.
Bob Bosch, *Oberlin College*

Cryptography and the Mathematics Behind It

THURSDAY, AUGUST 1, 1:30 P.M. - 4:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Modern day society and the security of our voting, banking, and military systems rely on cryptography to ensure privacy and allow secure communication. Important problems in cybersecurity are being solved using number theory, algebraic geometry, and the mathematics of lattices. This session on the mathematics behind cryptography is aimed at a general mathematical audience.

This session will have expository talks aimed at a general mathematical audience and will be suitable for both students and faculty.

Organizer:
Alice Silverberg, *University of California, Irvine*

Language, Probability, and Cryptography
1:30 P.M. - 1:50 P.M.
Adriana Salerno, *Bates College*

Inrtoduwtion to Erorr Dwtetcion and Czorrectmon
2:00 P.M. - 2:20 P.M.
Steven J. Miller, *Williams College*

Post-quantum Key Exchange Based on "Learning with Errors" Problems
2:30 P.M. - 2:50 P.M.
Jintai Ding, *University of Cincinnati*

Public-key Cryptography from Supersingular Elliptic Curve Isogenies
3:00 P.M. - 3:20 P.M.
David Jao, *University of Waterloo*

$x^n + x + a$
3:30 P.M. - 3:50 P.M.
Kumar Murty, *University of Toronto*

INVITED PAPER SESSIONS CONTINUED

The Mathematics of Uncertainty

FRIDAY, AUGUST 2, 10:10 A.M. - 12:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

We encounter uncertainty everywhere, at all levels of consciousness, in all of our endeavors. Even things of which we are certain: the sun rises tomorrow, our existence has a finite time span, are subject to imprecision. How has mathematics helped us understand uncertainty and unpredictability?

In this session we present mathematics that guides decisions under incomplete information or cognitive limitations.

Organizer:
Ami Radunskaya, *Pomona College*

Crossing the Threshold: The Role of Demographic Stochasticity in the Evolution of Cooperation
10:10 A.M. - 10:30 A.M.
Tom LoFaro, *Gustavus Adolphus College*

Stochastic Perturbations of the Logistic Map
10:40 A.M. - 11:00 A.M.
Kim Ayers, *Pomona College*

Logic for Reasoning about Uncertainty Dynamics and Informational Cascades
11:10 A.M. - 11:30 A.M.
Joshua Sack, *California State University, Long Beach*

Probability As a Tool for Studying Problems in Behavioral Economics
11:40 A.M. - 12:00 P.M.
Aloysius Bathi Kasturiarachi, *Kent State University*

Equity and Justice in the Context of Inquiry

THURSDAY, AUGUST 1, 1:50 P.M. - 4:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

Inquiry pedagogies offer rich learning experiences that can support under-served populations in collegiate mathematics. However, elements of these environments can alienate exactly the students instructors are hoping to support. So equity and inquiry must be theorized and researched together in order to offer justice for all students. This session brings research agendas into direct conversation for mathematicians and educators.

Organizer:
Brian Katz, *Augustana College*

Sponsors:
SIGMAA on Inquiry-Based Learning (IBL SIGMAA)
SIGMAA on Research in Undergraduate Mathematics Education (SIGMAA on RUME)

Introduction to the Session
1:50 P.M. - 2:00 P.M.
Brian Katz, *Augustana College*

Inquiry and Equity: Necessary But Not Sufficient
2:00 P.M. - 2:20 P.M.
Sandra Laursen, *University of Colorado Boulder*

The IBL Experience When Students of Color Are in the Majority
2:30 P.M. - 2:50 P.M.
Robin Wilson and Stacy Brown, *California State Polytechnic University, Pomona*

Examined Inquiry-Oriented Instructional Moves with an Eye Toward Gender Equity
3:00 P.M. - 3:20 P.M.
Jessica Smith, *Florida State University*
Christine Andrews-Larson, *Florida State University*
Daniel L. Reinholz,*San Diego State University*
Amelia Stone-Johnstone, *San Diego State University*
Brooke Mullins, *Virginia Polytechnic Institute and State University*

TBA
3:30 P.M. - 3:50 P.M.
Rochelle Gutiérrez, *University of Illinois*

Panel Discussion
4:00 P.M. - 4:20 P.M.

INVITED PAPER SESSIONS

Mathematical Diversity in Mathematical Biology

FRIDAY, AUGUST 2, 1:30 P.M. - 5:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Mathematical biology is grab-bag description for using mathematics to understand biological phenomena. The math used is not restricted to a particular sub-discipline within math, but rather is as diverse as the biological systems themselves. In this session, the 2018 Project NExTers will showcase the diversity of mathematics used to better understanding biology. It is geared for an undergraduate audience.

Organizers:
Nicholas A. Battista, *The College of New Jersey*
Rebecca Everett, *Haverford College*

Comparing Intervention Strategies for Reducing *Clostridium difficile* Transmission: An Agent-Based Modeling Study
1:30 P.M. - 1:50 P.M.
Brittany Stephenson, *Lewis University*

Enhanced Coupling of Cilia Through Cell Rocking
2:00 P.M. - 2:20 P.M.
Forest Mannan, *Colorado School of Mines*

Parameter Informatics for Nonlinear Models
2:30 P.M. - 2:50 P.M.
Reginald McGee, *College of the Holy Cross*

Role of Resource Allocation and Transport in Emergence of Cross-feeding in Microbial Consortia
3:00 P.M. - 3:20 P.M.
Diana Schepens, *Whitworth University*

k-Foldability of RNA
3:30 P.M. - 3:50 P.M.
Garner Cochran, *Berry College*

Mixing and Pumping by Pairs of Helices in a Viscous Fluid
4:00 P.M. - 4:20 P.M.
Amy Buchmann, *University of San Diego*

Modeling the Impacts of Disturbances: What Can We Learn about Population Responses and Possible Management Strategies?
4:30 P.M. - 4:50 P.M.
Amy Veprauskas, *University of Louisiana at Lafayette*

Don't Be Jelly: Modeling Effective Jet Propulsion
5:00 P.M. - 5:20 P.M.
Nicholas A. Battista, *The College of New Jersey*

Commutative Algebra

SATURDAY, AUGUST 3, 9:00 A..M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

Commutative algebra is a central discipline at the intersection of algebraic geometry, number theory, combinatorics, and so on. Many of the foundations were laid by Emmy Noether. Modern commutative algebra combines techniques from computational symbolic algebra, combinatorics, graph theory, and homological and homotopical algebra. The session will cover many flavors with a broad appeal towards the subject's natural influence.

Organizers:
Irena Swanson, *Reed College*
Lance Miller, *University of Arkansas, Fayetteville*

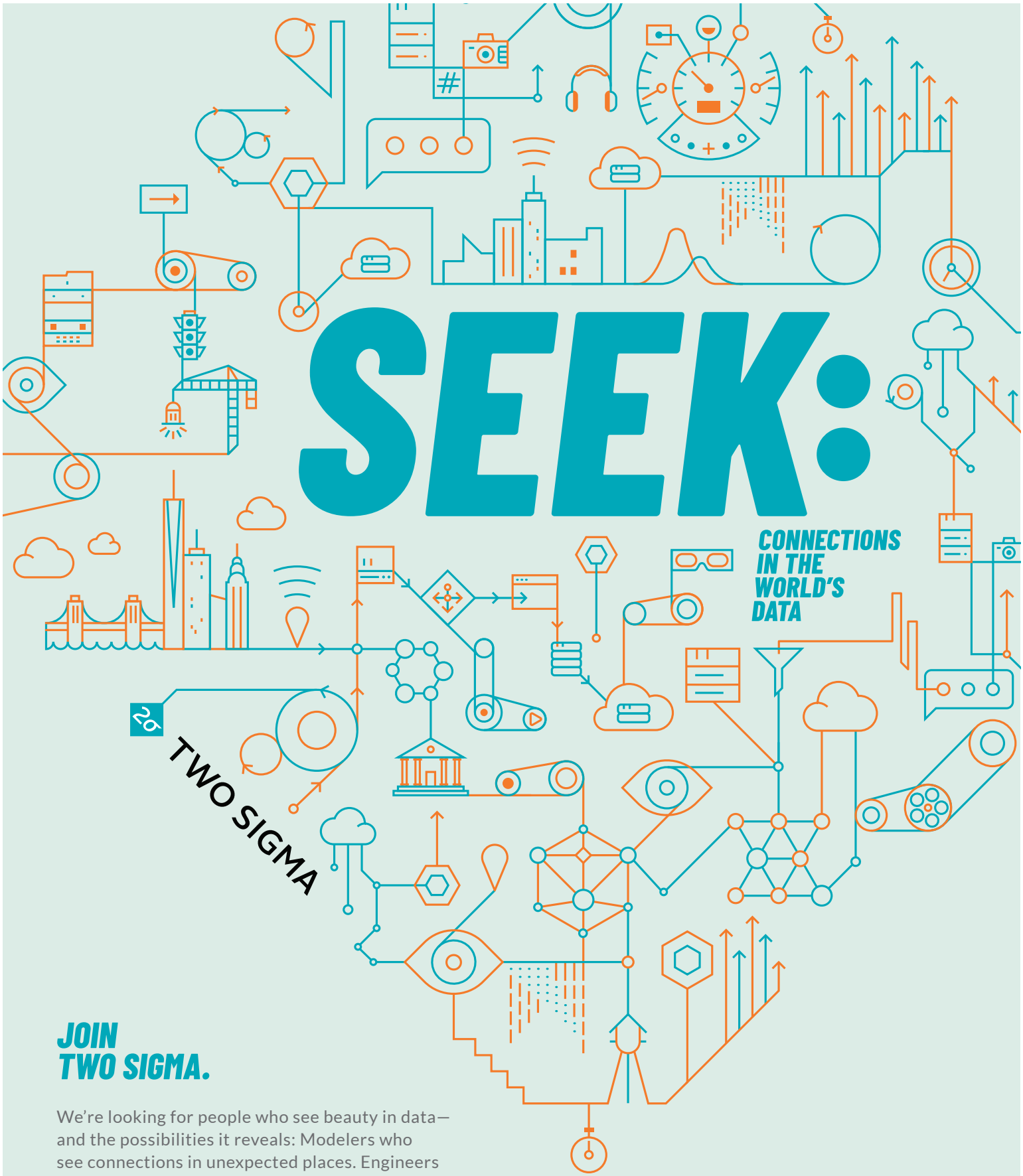
Convergence of Rees Valuations
9:00 A.M. - 9:20 A.M.
Matthew Toeniskoetter, *Florida Atlantic University*

An Algebraic Condition that Allows Us to Do Intersection Theory
9:30 A.M. - 9:50 A.M.
Patricia Klein, *University of Kentucky*

On Flavors of Factorization in Commutative Rings with Zero Divisors
10:00 A.M. - 10:20 A.M.
Ranthony A.C. Edmonds, *Ohio State University*

Direct-sum Decompositions of Modules: The Good, the Bad, and the Ugly (aka Interesting)
10:30 A.M. - 10:50 A.M.
Nicholas Baeth, *Franklin and Marshall College*

Syzygy - When Submodules Align
11:00 A.M. - 11:20 A.M.
Courtney Gibbons, *Hamilton College*



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MAA PRIZE SESSION

Friday, August 2

9:00 A.M. – 10:00 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

This session is organized by James Sellers, Pennsylvania State University, MAA Secretary, and is moderated by Michael Dorff, Brigham Young University, MAA President. For full awards information please visit https://www.maa.org/2019awards.

MAA AWARD FOR INCLUSIVITY

Sylvia Trimble Bozeman
In her four decades as a Professor of Mathematics, Dr. Sylvia Trimble Bozeman has taught, supervised and mentored countless students, showing an unwavering commitment to bringing more African-Americans—as well as women and individuals from other under-represented groups—into the field of mathematics.

CARL B. ALLENDOERFER AWARDS

William Dunham
"The Early (and Peculiar) History of the Möbius Function," *Mathematics Magazine*, 91:2, 83–91, DOI: 10.1080/0025570X.2017.1413921.

In a most entertaining way, "this tale reminds us – if we need reminding – that the history of mathematics can provide a host of unexpected rewards."

Jordan Bell and Viktor Blåsjö
"Pietro Mengoli's 1650 Proof that the Harmonic Series Diverges," *Mathematics Magazine*, 91:5, 341–347, DOI: 10.1080/0025570X.2018.1506656.

The reader comes away marveling at how mathematics can be a conversation across centuries.

PAUL R. HALMOS - LESTER R. FORD AWARDS

Adrian Rice
"Partnership, Partition, and Proof: The Path to the Hardy–Ramanujan Partition Formula," *The American Mathematical Monthly*, 125:1, 3–15, DOI: 10.1080/00029890.2017.1389178.

This beautiful article celebrates the centennial of the partition formula, taking the reader on a tour through its historical development, including later contributions of Rademacher and criticism of Selberg.

Jonathan M. Borwein and Robert M. Corless
"Gamma and Factorial in the Monthly," *The American Mathematical Monthly*, 125:5, 400–424, DOI: 10.1080/00029890.2018.1420983.

The authors show how the gamma function appears in different areas of mathematics, from geometry to analysis to number theory, and that the gamma function is "transcendentally transcendental."

Andrew Granville
"Using Dynamical Systems to Construct Infinitely Many Primes," *The American Mathematical Monthly*, 125:6, 483–496, DOI: 10.1080/00029890.2018.1447732.

This welcoming invitation to arithmetic dynamics will appeal to every reader's curiosity.

Kenneth S. Williams
"Everything You Wanted To Know About $ax^2 + by^2 + cz^2 + dt^2$ But Were Afraid To Ask"
The American Mathematical Monthly, 125:9, 797–810, DOI: 10.1080/00029890.2018.1503003

Through a lively series of questions and answers we are taken from the very basic result of every integer being the sum of four squares up through the current state of the art in quadratic forms, a journey of over two hundred years.

MAA PRIZE SESSION

GEORGE PÓLYA AWARDS

Stanley R. Huddy and Michael A. Jones
"The Calculus Behind Generic Drug Equivalence," *The College Mathematics Journal*, 49:1, 2–9, DOI: 10.1080/07468342.2017.1391502.

The authors skillfully illustrate the interplay between applied and theoretical mathematics: understanding the properties of a mathematical model may involve different tools than were required to formulate the model in the first place.

Peter McGrath
"Newton's Shell Theorem via Archimedes' Hat Box and Single Variable Calculus," *The College Mathematics Journal*, 49:2, 109–113, DOI: 10.1080/07468342.2018.1411655.

This lovely short paper revisits some classical theorems in a lively fashion.

TREVOR EVANS AWARD

Stan Wagon
"Resolving the Fuel Economy Singularity," *Math Horizons*, 26:1, 5–9, DOI: 10.1080/10724117.2018.1460120.

Combining the subtleties of an everyday phenomenon with a dash of exposé, the author makes a strong case for considering fuel economy in gallons per 100 miles (GPM) rather than the traditional miles per gallon (MPG).

MERITORIOUS SERVICE AWARDS

John Thoo, Golden Section

While John's work for the section is so empowering and valuable to our mission, it is clear that John's service to mathematics in general is nothing short of incredible.

Richard Alan (Rick) Gillman, Indiana Section

Anecdotally, if you mention Rick's name at Mathfest or the JMM, it is likely that the person you are talking to knows him.

John Travis, Louisiana-Mississippi Section

Dr. Travis has provided unprecedented service to the Section and is a leader in pedagogy through his contributions to various open source resources.

Dave and Muriel Skoug, Nebraska Southeast South Dakota Section

Their continued stalwart presence in the section has provided invaluable mentoring for the current and next generation of leadership and perspective on the section's growth and future.

Christopher Swanson, Ohio Section

Dr. Swanson is a devoted supporter and leader of Project NExT and is passionate about student related activities within the MAA.

Martha Abell, Southeastern Section

We are privileged to honor Martha for the excellent service she has contributed to the Mathematical Association of America and to mathematics in general over the last many years.

MERTON M. HASSE PRIZE

David Treeby
"Further Thoughts on a Paradoxical Tower," *The American Mathematical Monthly*, 125:1, 44–60, DOI: 10.1080/00029890.2018.1390375.

David Treeby's article exemplifies the way a simple inquiry can prompt far-reaching mathematical exploration.

MAA PRIZE SESSION CONTINUED

MARY P. DOLCIANI AWARD

Joseph Gallian
Professor Gallian exemplifies the combination of excellence in both mathematical research and mathematics education that the Mary P. Dolciani Award honors.

DANIEL SOLOW AWARD

Timothy Chartier
Dr. Chartier engages his readers through his enthusiasm for mathematics, and his writings illustrate his extraordinary ability to reach a wide range of audience.

HENRY L. ALDER AWARDS

PJ Couch, Lamar University
Through the use of active learning, Dr. Couch "designs his classes to motivate his students to work in ways that lead to success."

Pamela Harris, Williams College
One student writes, "Dr. Harris always pushed us towards the deeper questions… and pushed us to think and learn in ways that were not always within our comfort zone."

Alicia Prieto Langarica, Youngstown State University
Dr. Prieto Langarica recognizes that her students cannot succeed academically if they fail to thrive personally.

THE WILLIAM LOWELL PUTNAM MATHEMATICAL COMPETITION DECEMBER 1, 2018

The William Lowell Putnam Mathematical Competition is an annual contest of the Mathematical Association of America for college students established in 1938 in memory of its namesake. Each year on the first Saturday in December, over 4000 students spend six hours (in two sittings) trying to solve twelve problems.

The Five Highest Ranking Individuals (in alphabetical order)

1. **Dongryul Kim, Harvard University**
2. **Shyam Narayanan, Harvard University**
3. **David Stoner, Harvard University**
4. **Yuan Yao, Massachusetts Institute of Technology**
5. **Shengtong Zhang, Massachusetts Institute of Technology**

Team Winners

1. **Harvard University**
   Dongryul Kim, Shyam Narayanan, David Stoner
2. **Massachusetts Institute of Technology**
   Junyao Peng, Ashwin Sah, Yunkun Zhou
3. **University of California, Los Angeles**
   Ciprian Mircea Bonciocat, Xiaoyu Huang, Konstantin Miagkov
4. **Columbia University**
   Quang Dao, Myeonhu Kim, Matthew Lerner-Brecher
5. **Stanford University**
   David Kewei Lin, Hanzhi Zheng, Yifan Zhu

The Elizabeth Lowell Putnam Prize, established in 1992, is awarded periodically to a woman whose performance on the Putnam Exam is deemed particularly meritorious.

The prize this year goes to:
Danielle Wang, Massachusetts Institute of Technology

MAA PRIZE SESSION

THE UNITED STATES OF AMERICA MATHEMATICAL OLYMPIAD

The USAMO (United States of America Mathematics Olympiad) provides a means of identifying and encouraging the most creative secondary mathematics students in the country. It serves to indicate the talent of those who may become leaders in the mathematical sciences of the next generation. The USAMO is part of a worldwide system of national mathematics competitions, a movement in which both educators and research mathematicians are engaged in recognizing and celebrating the imagination and resourcefulness of our youth. The USAMO is a six-question, two-day, nine-hour essay/proof examination. This year it was held April 17–18.

Winners (in alphabetical order)
Vincent Bian, Poolesville High School, MD
Milan Haiman, Stuyvesant High School, NY
Vincent Huang, Plano West Senior High School, TX*
Kevin Liu, Carmel High School, IN
Luke Robitaille, Robitaille Home School, TX*
Victor Rong, Marc Garneau Collegiate Institute, ON
Carl Schildkraut, Lakeside School, WA
Colin Shanmo Tang, Lakeside School, WA*
Edward Wan, Saint John's School, PR*
Brandon Wang, Saratoga High School, CA*
Guanpeng Xu, Phillips Academy Andover, MA
Daniel Zhu, Montgomery Blair High School, MD*

**Member of the 2019 International Mathematical Olympiad USA Team*

THE EUROPEAN GIRLS' MATHEMATICAL OLYMPIAD

The European Girls' Mathematical Olympiad (EGMO) is a mathematical olympiad for girls which started in 2012. The eighth EGMO was held in Kyiv, Ukraine, April 7–13, 2019. The United States was represented by a team of four who took first place with three individual gold medals and one individual silver medal.

Team Members (in alphabetical order)
Yuting Qin, The Webb School, CA
Ishika Shah, Cupertino High School, CA
Catherine Wu, Saratoga High School, CA
Janabel Xia, Lexington High School, MA

THE ROMANIAN MASTER OF MATHEMATICS

The Romanian Master of Mathematics is an annual competition for students in the pre-university level, held in Bucharest, Romania; the 11th RMM was held February 20–25, 2017. The United States was represented by a team of four who took first place with three individual gold medals and one individual silver medal.

Team Members (in alphabetical order)
Benjamin Qi, Princeton High School, NJ
Carl Schildkraut, Lakeside School, WA
Luke Robitaille, Robitaille Home School, TX
Daniel Zhu, Montgomery Blair High School, MD

CONGRATULATIONS

Congratulations to our MAA members celebrating 25 or more years of membership.

Please join your colleagues at the MAA Prize Session on Friday, August 2, 9:00 – 9:50 a.m., in Grand Ballroom A of the Duke Energy Convention Center, where we'll recognize our long-term members and prize winners.

25 Years
Reza Abbasian
Rob Bradley
Jeremy Case
Judith Covington
Scott Dillery
Nancy Heinschel
J. Lyn Miller
Matthew Pons
Emily Puckette
Thomas Wakefield

26 Years
Bud Boman
William Harris
David Kung
Gavin LaRose
Alex McAllister
Ann Podleski
Charlie Ragozzine
Amy Shell-Gellasch
Bruce Torrence

27 Years
James Alvarez
WIlliam Ardis
Stuart Boersma
Tim Chartier
Lynne Ipina
Linda McGuire
Vicki Powers
Anne Quinn
Charlie Smith
Eve Torrence
Homer White

28 Years
Robert Bozeman
Dennis Davenport
Marepalli Rao

29 Years
Martha Abell
Jennifer Beineke
Carol Bell
Mark Bollman
Paul Coe
Afshin Ghoreishi
Keven Hansen
George Heine
Krysi Leganza
Glen Lobo
Abraham Mantell
Bruce Palka
Christopher Swanson

30 Years
Julie Barnes
Jack Bookman
Adam Coffman
Michael Dorff
Paul Fishback
Clare Hemenway
Ockle Johnson
Jennifer Quinn
Nell Rayburn
Robert Vallin
Virginia Watson

31 Years
Janet Barnett
Annalisa Crannell
Geoffrey Hagopian
Jeff Ibbotson
Gail Kaplan
Larry Lehman
Tommy Ratliff
James Sellers
Hortensia Soto
John Wierman

32 Years
Edward Aboufadel
Miriam Byers
Jenna Carpenter
Erica Flapan
Michael Jones
Suzanne Lenhart
Chuck Lindsey
Sarah Mabrouk
Pamela Pierce
Margaret Robinson
Steven Schlicker
John Thoo

33 Years
Dennis Collins
Barbara D'Ambrosia
Frank Farris
Deanna Haunsperger
Edward Keppelmann
Tom Richmond
Andrew Simoson
Daniel Teague
Colleen Vachuska

34 Years
Bill Fenton
Matthew Haines
Aparna Higgins
Johnny Houston
John Mayer
Paul Olson
Susan Wildstrom
Steven Wilkinson

35 Years
John Cade
Benjamin Collins
Roland Minton
Michael Pearson
Theresa Rahikka
Lynn Reed
Therese Shelton
T. Christine Stevens
Daniel Ullman

36 Years
Art Benjamin
John Emert
Jay Schiffman
Roma Wong

37 Years
Jim Conklin
Doug Ensley
Rick Gillman
Bill Higgins
George Jennings
Stephen Kennedy
Jerry Lodder
Peter Vachuska

38 Years
Suzanne Dorée
Jim Freeman
Cathy Gorini
Emelie Kenney
Carol Schumacher
Brian Shelburne
Robert Sefton Smith

39 Years
Robert Devaney
Anne Dow
Greg Foley
Ken Gittelson

40 Years
Allen Butler
Dan Callon
Donald Hooley
David Housman
Matthew Richey
Robert Rogers

41 Years
Jeffrey Clark

42 Years
Susan Colley
Gary Gordon
Dan Kalman
David Shannon

43 Years
Sylvia Bozeman
David Bressoud
Ray Collings
Jim Daniel
Daniel Otero
J. Paul Vicknair

44 Years
John Best
Jimmy Buchanan
Joe Gallian
Michael Starbird
Gerard Venema

45 Years
Steven Blasberg
Bud Brown
Daniel Curtin
Penny Dunham
William Dunham
Norm Richert
Stephen St John
Paul Zorn

46 Years
Donna Beers
Michael Cohen
Jon Johnson
Kathy Lewis
Andy Rich

47 Years
Catherine Aust
Jean Bee Chan
William Feldman
Sue Geller
William “Bus” Jaco

48 Years
Tom Bengtson
Amy Cohen
Dan Kennedy
Christine Shannon
Cal Van Niewaal

49 Years
Jonathan Kane
John Sieben
Edward White

50 Years
Nickolas Backscheider
Thomas Banchoff
Judith Meckley
Jon Scott

51 Years
Joel Cunningham
Albert Lewis
Jeffrey Nunemacher
Martha Siegel
David Stone
Philippe Tondeur
Roger Waggoner

53 Years
Chris Christensen
Jennifer Galovich
Eileen Poiani

54 Years
Carl Cowen
David Kullman

55 Years
Walter Stromquist
Brian Winkel

56 Years
Stephen Gagola, Jr.
Dan Kemp
David Smith

57 Years
Joanne Peeples
Kenneth Williams

58 Years
Warren Page

59 Years
Lowell Beineke
Florence Fasanelli
Joan Leitzel
Catherine Murphy

62 Years
Jack Graver

63 Years
Ken Ross

Members included in this listing include all registered as of June 10, 2019

Honor Roll of Donors

June 1, 2018 – May 31, 2019

We thank the following individuals, corporations, foundations, societies, and organizations for their contributions of $500 or more to the Mathematical Association of America.

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Lynn A. & Mary F. Steen

2014
Tom Leighton & Bonnie Berger Leighton

2012
Michael & Ellen Pearson

2011
Barbara T. & Doug Faires
Laurence Penn & Jill Oberlander

2010
Roger & Susan Horn
Tom & Jane Apostol

2008
Gerald Alexanderson
Gerald J. & Judith R. Porter

2007
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2000
Henry L. Alder
Edith Ross & Edward Brinn
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Mary Alice & Marvin Schaefer

COMMITTEE MEETINGS

Tuesday, July 30

Meetings Management Committee

9:30 A.M. - 11:00 A.M., HILTON CINCINNATI NETHERLAND PLAZA, MAA SUITE

MAA Board of Directors

12:00 P.M. - 6:00 P.M., HILTON CINCINNATI NETHERLAND PLAZA, SALON A

Wednesday, July 31

Pi Mu Epsilon Committee Meeting

8:00 A.M. - 11:00 A.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

MAA Congress

8:30 A.M. - 5:00 P.M., HILTON CINCINNATI NETHERLAND PLAZA, ROSEWOOD ROOM

MAA Committee on Undergraduate Students

2:30 P.M. - 4:00 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

SIMIODE NSF Workshop Gathering

4:00 P.M. - 5:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201

Thursday, August 1

MAA Committee on Sections

7:30 A.M. - 9:00 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 209

Council on the Profession

7:30 A.M. - 9:00 A.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

MAA FOCUS Editorial Board

8:00 A.M. - 9:00 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM COAT CHECK

MAA Subcommittee on Research

8:00 A.M. - 9:00 A.M., DUKE ENERGY CONVENTION CENTER, GREEN ROOM

Monthly Editorial Board Meeting

12:00 P.M. - 1:00 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

Committee on Competitions

1:00 P.M. - 2:30 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

CMJ Editorial Board Meeting

1:00 P.M. - 2:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM COAT CHECK

MAA Committee on Faculty & Departments

1:30 P.M. - 2:30 P.M., DUKE ENERGY CONVENTION CENTER, GREEN ROOM

Membership Committee

2:00 P.M. - 3:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 209

Mathematics Magazine Editorial Board

2:00 P.M. - 3:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM COAT CHECK

MAA Committee on Early Career Mathematicians (ECM)

3:00 P.M. - 4:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM COAT CHECK

Mathematics Magazine Editorial Board

3:30 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, GREEN ROOM

SIMIODE NSF Grant Co-PI Meeting

4:00 P.M. - 5:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 236

Math Horizons Editorial-Elect Board Meeting

4:30 P.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM COAT CHECK

Outgoing Math Horizons Editorial Board Celebration

5:00 P.M. - 6:00 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

COMMITTEE MEETINGS CONTINUED

Friday, August 2

Council on Communities

7:30 A.M. - 8:30 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM COAT CHECK

Council on Prizes and Awards

7:30 A.M. - 8:30 A.M., DUKE ENERGY CONVENTION CENTER, GREEN ROOM

Committee on Journals

1:00 P.M. - 2:30 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

Committee on Graduate Students

1:30 P.M. - 3:30 P.M., DUKE ENERGY CONVENTION CENTER, GREEN ROOM

Council on Publications

2:00 P.M. - 3:00 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

MAA Committee on Faculty & Departments - Focus Group

3:30 P.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 209

Council on Meetings

4:00 P.M. - 5:30 P.M., DUKE ENERGY CONVENTION CENTER, PRESS ROOM

Saturday, August 2

MAA Business Meeting

1:15 P.M. - 1:45 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM D

CHRONOLOGICAL SCHEDULE

Wednesday, July 31

COMMITTEE MEETING
MAA Congress Meeting

8:30 A.M. - 5:00 P.M., HILTON CINCINNATI NETHERLAND PLAZA, ROSEWOOD ROOM

Registration & Information

3:00 P.M. - 8:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM LOBBY

SESSION FOR UNDERGRADUATE STUDENTS
MAA-PME Student Reception

4:30 P.M. - 5:30 P.M., DUKE ENERGY CONVENTION CENTER 200

Undergraduate students are invited to come for refreshments and a welcome to MAA MathFest.

SESSION FOR UNDERGRADUATE STUDENTS
Math Jeopardy

5:30 P.M. - 6:15 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 206

Answer: A fun undergraduate mathematics contest to lead off MathFest.

Question: What is Mathematics Jeopardy?

Four teams of students will provide the questions to go with the mathematical answers in many categories. All interested students in the audience can enter their names to be chosen to play on one of the four teams of four players. There will be prizes for all the participants.

Come cheer for your favorite team. The session will be emceed by Michael Berry.

Organizers:
Robert W. Vallin, *Lamar University*
Michael W. Berry, *University of Tennessee*

SOCIAL EVENT
Exhibit Hall & Grand Opening Reception

6:00 P.M. - 8:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B

The MAA MathFest Grand Opening Reception will launch this year's MAA MathFest on a high note. This event is intended to draw attendees together in a spirit of camaraderie. We warmly invite you to enjoy complimentary light hors d'oeuvres while you mix and mingle in the Exhibit Hall with other registered participants and guests, sponsors, and exhibitors.

INVITED ADDRESS
Pi Mu Epsilon J. Sutherland Frame Lecture

Alice in Numberland — Adventures in Cryptography, Number Theory, and Life
8:00 P.M. - 8:50 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Alice Silverberg, *University of California, Irvine*

I will give an account of some of my adventures in the wonderlands of mathematics and cryptography, offering some food for thought on how mathematics can be useful in cryptography, and mentioning some useful things I learned along the way that I wish I had learned sooner.

Thursday, August 1

Registration & Information

8:00 A.M. - 6:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM LOBBY

Exhibit Hall

9:00 A.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B

UNDERGRADUATE STUDENT PAPER SESSION
Pi Mu Epsilon Student Paper Sessions

8:30 A.M. - 10:45 A.M., DUKE ENERGY CONVENTION CENTER, ROOMS 205, 234, 236, 264

Pi Mu Epsilon student members who wish to represent their chapters as student speakers or official delegates should visit the PME website at http://pme-math.org/ for more information.

Please note: all student presenters are required to be registered for MAA MathFest.

Organizer:
Darci Kracht, *Kent State University*

UNDERGRADUATE STUDENT PAPER SESSION
MAA Student Paper Sessions

8:30 A.M. - 10:45 A.M., DUKE ENERGY CONVENTION CENTER, ROOMS 210, 211, 235, 251

Organizers:
Eric Ruggieri, *College of the Holy Cross*
Chasen Smith, *Georgia Southern University*

CHRONOLOGICAL SCHEDULE

Thursday, August 1

MAA INVITED ADDRESS

Uncertainty: The Mathematics of What We Don't Know

9:00 A.M. - 9:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Ami Radunskaya, *Pomona College*

Over the past few centuries, the theory of probability has been developed to quantify possibilities and to help us make decisions with incomplete knowledge. More recently, this theory has been refined to include predictions based on randomly perturbed dynamical systems, as well as providing a measure of our belief in future events based on observed data. As mathematicians, we like precision, patterns, predictions. As human beings we want to make wise, informed decisions. In this talk I will explore three questions: how can we quantify the uncertainty in our predictions, how do we make decisions in the face of uncertainty, and when is a bit of uncertainty helpful … or fun?

CONTRIBUTED PAPER SESSION

Plug and Play Data Science Lessons, Part A

9:00 A.M. - 10:40 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 233

In this session, papers include data science lessons that attendees can seamlessly incorporate into courses such as Finite Math, Calculus, Linear Algebra, Discrete Mathematics, Mathematical Modeling, and others. Presentations include such elements as an overview of the lesson, student learning objectives, assessments, and a summary of the effectiveness of the lesson if available.

Organizers:
Michael Boardman, *Pacific University*
Timothy Chartier, *Davidson College*
Jason Douma, *University of Sioux Falls*

Sponsor:
Committee for the Undergraduate Program in Mathematics (CUPM)

Teaching Elements of Machine Learning in A Quantitative Reasoning Course
9:00 A.M. - 9:15 A.M.
Mutiara Sondjaja, *New York University*

A Climate Data Set in Applied Calculus
9:20 A.M. - 9:35 A.M.
Andrew S. Leahy, *Knox College*

Modeling Regional Bird Count Data in Calculus I and Differential Equations
9:40 A.M. - 9:55 A.M.
Christopher Brown, *California Lutheran University*

Teaching Riemann Sums and Multiple Integration with Messy Data
10:00 A.M. - 10:15 A.M.
Drew C. Youngren, *Columbia University*

Querying An Open Sports Database for Research and Education
10:20 A.M. - 10:35 A.M.
Megan Olivia Powell, *University of North Carolina Asheville*

CONTRIBUTED PAPER SESSION

History of Mathematics in a Math Circle, Part A

9:00 A.M. - 10:40 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238

During this session, presenters will share mathematical topics and problems of a historical nature for use in a math circle. This can include such ideas as, but not limited to, working a class of problems using historical methods, discovering methods of calculation from a former time or culture, discovering how mathematical concepts were discovered or used historically or culturally.

Organizers:
Amy Shell-Gellasch, *Eastern Michigan University*
Philip Yasskin, *Texas A&M University*

Sponsors:
SIGMAA on Math Circles for Students and Teachers (SIGMAA MCST)

The History of Mathematics SIGMAA (HOM SIGMAA)

Cryptography
9:00 A.M. - 9:15 A.M.
Seongchun Kwon, *University of Central Florida*

Red Rock Math Circle (R^2MC)
9:20 A.M. - 9:35 A.M.
Jie Liu, *Dixie State University*
Clare Banks, *Dixie State University*
Vinodh Chellamuthu, *Dixie State University*

Geometry Machines in Greek Antiquity
9:40 A.M. - 9:55 A.M.
Viktor Blasjo, *Utrecht University*

Multiplication with Ancient Chinese Rod Numerals
10:00 A.M.- 10:15 A.M.
Amy Shell-Gellasch, *Eastern Michigan University*

Drafting Japanese Crest Designs in a Math Circle Activity for High School Teachers
10:20 A.M. - 10:35 A.M.
Felicia Tabing, *University of Southern California*

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

CONTRIBUTED PAPER SESSION

Inquiry-Based Learning and Teaching, Part A

9:00 A.M. - 10:35 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 230 & 231

Inquiry-based learning (IBL) transforms students from consumers to producers of mathematics. IBL methods aim to develop a deep understanding of mathematical concepts and processes by putting students in direct contact with mathematical phenomena, questions, and communities. This session invites scholarly presentations on the use and effects of IBL methods for teaching and learning.

Organizers:
Victor Piercey, *Ferris State University*
Susan Crook, *Loras College*
Brian Katz, *Augustana College*
Eric Kahn, *Bloomsburg University*
Amy Ksir, *United States Naval Academy*

Sponsor:
The SIGMAA on Inquiry-Based Learning (IBL SIGMAA)

Mission: Possible - A Whole Class REU Project?!
9:00 A.M. - 9:15 A.M.
Min-Lin Lo, *California State University, San Bernardino*

Proof Bridges
9:20 A.M. - 9:35 A.M.
Audrey Malagon, *Virginia Wesleyan University*

Fundamentals of Teaching Fundamentals of Mathematical Proof
9:40 A.M. - 9:55 A.M.
Kayla B. Dwelle, *Ouachita Baptist University*

Writing and Implementing a Set of Rings-First IBL Course Notes
10:00 A.M. - 10:15 A.M.
Melissa Lindsey, *Dordt University*
Mike Janssen, *Dordt University*

Computational IBL in Number Theory
10:20 A.M. - 10:35 A.M.
John Asplund, *Dalton State College*

CONTRIBUTED PAPER SESSION

Enhance Your Teaching through Best Practices That Align with the Instructional Practices Guide, Part A

9:00 A.M. - 10:40 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 260, 261, & 262

Speakers in this session share teaching innovations through a scholarly lens by pegging their work to specific evidence-based practices in the MAA Instructional Practices (IP) Guide. Each talk will clearly lay out both the pedagogical technique as well as how it pertains to at least one of the subsections of the IP Guide.

Organizers:
Carolyn A. Yackel, *Mercer University*
Mindy Capaldi, *Valparaiso University*

Sponsor:
Committee on the Teaching of Undergraduate Mathematics (CTUM)

Guided Explorations in College Geometry
9:00 A.M. - 9:15 A.M.
William Fenton, *Bellarmine University*

A Comparison of Homework vs. Exam Averages, or What Kind of Homework Assignments Work Best?
9:20 A.M. - 9:35 A.M.
Eric C. Johnson, *U.S. Coast Guard Academy*

Calculus III TEAM Activities: Success of Modified Peer Instruction
9:40 A.M. - 9:55 A.M.
Alan Von Herrmann, *University of Tennessee*

Teaching Calculus with SageMath Widgets
10:00 A.M. - 10:15 A.M.
Yuanting Lu, *Department of Mathematics, Mercer University*
Jeff Denny, *Department of Mathematics, Mercer University*

Implementing Mastery Grading in Calculus 2
10:20 A.M. - 10:35 A.M.
Nora Strasser, *Friends University*

CONTRIBUTED PAPER SESSION

Math + X: Mathematics Courses, Curriculum, and Projects Serving Professional Disciplines

9:00 A.M. - 10:15 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 232

Mathematics departments have provided content supporting partner and professional disciplines for decades. For disciplines such as business and engineering, numerous resources support a contextualized curriculum. This session highlights curricular elements for professions, disciplines, and math pathways where supporting materials for contextualized student learning are lacking. Of particular interest are successful examples of nontraditional curricula that match students' future work environment.

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

Organizers:

Francisco Savina, *Charles A. Dana Center, University of Texas at Austin*
Stuart Boersma, *Central Washington University*

Mathematics and Nursing: Narrowing the Classroom-Practice Gap with Authentic Dosage Activities
9:00 A.M. - 9:15 A.M.
Daniel Ozimek, *Pennsylvania College of Health Sciences*
Lindsay Good, *Pennsylvania College of Health Sciences*
Gayle Watson, *Pennsylvania College of Health Sciences*
Anna Wendel, *Pennsylvania College of Health Sciences*

Innovative Pathways in STEM Teacher Preparation
9:20 A.M. - 9:35 A.M.
Thomas J. Clark, *Dordt College*

In-context, Small Project Based Delivery of a Basic Statistics Course for Nursing, Physical Therapy and Allied Health Students
9:40 A.M. - 9:55 A.M.
Katherine Radler, *Saint Louis University*
Kimberly Druschel, *Saint Louis University*
Michael May, *Saint Louis University*
Sadita Salihovic, *Saint Louis University*

Data-Driven Design: A Course on Data Analysis for Entrepreneurs
10:00 A.M. - 10:15 A.M.
Benjamin C. Gaines, *Iona College*

CONTRIBUTED PAPER SESSION

Mathematics and the Life Sciences: Initiatives, Programs, Curricula, Part A

9:00 A.M. - 10:35 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 207 & 208

The 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences identified the life sciences as a key path through the mathematics major to graduate programs and the workforce. Topics include scholarly contributions addressing initiatives, programs, curricula, and course materials at the interface of mathematics and the life sciences that have been implemented and tested at institutions of higher education.

Organizers:
Timothy D. Comar, *Benedictine University*
Raina Robeva, *Sweet Briar College*
Carrie Diaz Eaton, *Bates College*

Sponsor:
SIGMAA on Mathematical and Computational Biology (BIO SIGMAA)

Modeling Calculus: A First Course for Everyone Including Biology Majors
9:00 A.M. - 9:15 A.M.
Mariah Birgen, *Wartburg College*

Mathematical Modeling and Applied Calculus
9:20 A.M. - 9:35 A.M.
Joel Kilty, *Centre College*
Alex M. McAllister, *Centre College*

Linking Introductory Mathematics Courses to the Life Sciences
9:40 A.M. - 9:55 A.M.
Bori Mazzag, *Humboldt State University*

Mathematical Modeling for the Life Sciences: A Curricular Update
10:00 A.M. - 10:15 A.M.
Douglas Norton, *Villanova University*

Strengthening the STEM Curriculum through the Introduction of an Undergraduate Quantitative Bio-track Program
10:20 A.M. - 10:35 A.M.
Sanjukta Hota, *Fisk University*

CONTRIBUTED PAPER SESSION

Recreational Mathematics: Puzzles, Card Tricks, Games, Gambling and Sports, Part A

9:00 A.M. - 10:35 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 206

Puzzles, card tricks, board games, game shows, gambling, and sports provide an excellent laboratory for testing mathematical strategy, probability, and enumeration. The analysis of such diversions is fertile ground for the application of mathematical and statistical theory. Solutions to new problems as well as novel solutions to old problems are welcome. Submissions by undergraduates or examples of the use of the solutions of these problems in the undergraduate classroom are encouraged.

Organizers:
Paul R. Coe, *Dominican University*
Sara B. Quinn, *Dominican University*
Kristen Schemmerhorn, *Concordia University Chicago*
Andrew Niedermaier, *Jane Street Capital*

Sponsor:
SIGMAA on Recreational Mathematics (Rec SIGMAA)

Exploring and Extending the Impossible Card Location Trick
9:00 A.M. - 9:15 A.M.
Samantha Pezzimenti, *Penn State Brandywine*

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

Guess My Birthday - An Original Mathematical Magic Trick
9:20 A.M. - 9:35 A.M.
Jon Stadler, *Capital University*

Five Card Study: A Magic Divination
9:40 A.M. - 9:55 A.M.
Jeremiah Paul Farrell, *Butler University*

A Factorial Card Trick
10:00 A.M. - 10:15 A.M.
Tom Edgar, *Pacific Lutheran University*

Buffon's Needle and Coin Problems on Hyperspheres
10:20 A.M. - 10:35 A.M.
Daniel Pritikin, *Miami University*
Nathaniel Coffin, *Miami University*

WORKSHOP
Create and Recreate: A Celebration of Women in Recreational Mathematics

9:00 A.M. - 10:20 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 201
Recreational mathematics is an area of active research, and one that has the potential to draw undergraduate researchers into mathematics research. In this hands-on workshop, a variety of women working in recreational mathematics will introduce participants to topics that have the potential to lead to research projects both for the participants and their students.The workshop is AWM sponsored and the primary target audience is female mathematicians, but of course, anyone can attend the workshop.

Organizers:
Janet Fierson, *La Salle University*
Emelie Kenney, *Siena College*
Cassie Williams, *James Madison University*
Sarah Wolff, *Denison University*

MINICOURSE
Minicourse 3. Game Theoretic Modeling for Math Majors, Part A

THURSDAY, AUGUST 1, 9:00 A.M. - 11:00 A.M., DUKE ENERGY CONVENTION CENTER, ROOMS 202 & 203
Mathematical modeling bridges the distance between the real world in which we operate and the abstract world that provides guiding structures. We use game theory as a mathematical tool when modeling scenarios having multiple interacting decision makers: people, businesses, governments, animals, and genes. This mini-course introduces some game theoretic tools and their applications in settings appropriate for math majors.

Organizer:
Rick Gillman, *Valparaiso University*

MINICOURSE
Minicourse 4. Introduction to WeBWorK: An Open Source Alternative to Generate and Deliver Online Homework Problems, Part A

9:00 A.M. - 11:00 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 204
Participants will learn to utilize the opensource online homework system WeBWorK. Adopted by over 1200 institutions, WeBWorK includes an extensive, curated library of over 35,000 exercises encompassing the collegiate curriculum. Subjects include College Algebra, Calculus, ODEs, Linear Algebra, Statistics, and Introduction to Proofs. Participants will learn how to utilize WeBWorK in their classrooms and to edit WeBWorK exercises.

Organizers:
Tim Flowers, *Indiana University of Pennsylvania*
Robin Cruz, *College of Idaho*
Stacey Rodman, *Augustana College*

Sponsor:
MAA Committee on Technology in Mathematics Education (CTME)

INVITED ADDRESS
AMS-MAA Joint Invited Address

Learning in Games
10:00 A.M. - 10:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Éva Tardos, *Cornell University*

Selfish behavior can often lead to suboptimal outcome for all participants, a phenomenon illustrated by many classical examples in game theory. Over the last decade we have studied Nash equilibria of games, and developed good understanding how to quantify the impact of strategic user behavior on overall performance in many games (including traffic routing as well as online auctions). In this talk we will focus on games where players use a form of learning that helps them adapt to the environment. We ask if the quantitative guarantees obtained for Nash equilibria extend to such out of equilibrium game play, or even more broadly, when the game or the population of players is dynamically changing and where participants have to adapt to the dynamic environment.

POSTER SESSION
General Contributed Poster Session I

10:00 A.M. - 10:45 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B
Given last year's success with the MAA Contributed Poster Session (CPS), the MAA is pleased to continue with this session at MAA MathFest in Cincinnati. We will rotate the poster categories throughout the meeting and the number of rotations will depend on the number of accepted posters.

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

1. The Integration of Mathematics and Science: A Plan for a High School Integrated Pre-Calculus and Physics Course
Courtney Fox, *Clermont Northeastern High School/University of Cincinnati*

2. Towson University's Pre-Service Teachers' STEM Modeling Activities with Baltimore City Middle School Students
Diana Cheng, *Towson University*
Rachael Talbert, *Towson University*
Kimberly Corum, *Towson University*

3. Dancing through Mathematics: Kinesthetic Activities in Figure Skating Camps
Rachel Schmitz, *Towson University*

4. Mathematical Misconceptions and Teaching Implications at the Secondary Level
Rachel Balthrop, *Cheatham County Central High School*
Kassi Rye, *Northwest High School*
Jackie Vogel, *Austin Peay State University*

5. UVU PREP — Intensive Summer STEM Program
Liz Andrus, *Utah Valley University*
Daniel Horns, *Utah Valley University*
Violeta Vasilevska, *Utah Valley University*
Krista Ruggles, *Utah Valley University*

6. Maps, Bridges, Networks, and Art Galleries: Introducing Secondary Students to Graph Theory through Classic Problems
Jessica Oehrlein, Columbia University

7. Math Outreach Activities for Secondary School Students
Lauren DeDieu, University of Calgary

8. Sorting: Easy as 1, 2, 3!
Iris Tong, *University of Illinois at Urbana-Champaign*
Kagen Quiballo, *University of Illinois at Urbana-Champaign*

9. Coloring Mapematics!
Yasir Silviano Badillo Acosta, *University of Illinois Urbana-Champaign*
Kelly A. Jezior, *University of Illinois Urbana-Champaign*
Iris Y. Tong, *University of Illinois Urbana-Champaign*
Kagen J. Quiballo, *University of Illinois Urbana-Champaign*

10. Examples of Real Time Modeling in Differential Equations Courses
Brian Winkel, *SIMIODE*

11. Resequencing Calculus at a Small Liberal Arts College: Balancing the Needs of Math Majors and Pre-Meds within Staffing Budget Constraints
Joan Lubben, *Dakota Wesleyan University*

12. A POGIL-Style Activity to Introduce or Review Vectors
Chris Oehrlein, *Oklahoma City Community College*

13. StatPREP: Transforming Intro Stat using a Data-Centered Approach
Jenna P. Carpenter, *Campbell University*

14. Program-Level Assessment . . . Don't Run Away!
Alan Alewine, *McKendree University*

15. Building Career-Ready Skills in Undergraduate Mathematics Majors
Michele L. Joyner, *East Tennessee State University*

16. Improving Mathematics Education for Nurses: Updates on a National Initiative
Daniel Ozimek, *Pennsylvania College of Health Sciences*
John Clochesy, *University of Miami*
Martha Ellis, *Charles A. Dana Center*
Beth Kelch, *Delta College*
Kathryn Stuck Boyd, *Cleveland Clinic*
Anna Wendel, *Pennsylvania College of Health Sciences*
Michelle Younker, *Owens Community College*

17. Modeling Scenarios via Writing Projects
Eric Stachura, *Kennesaw State University*

18. SIMIODE: Let Mathematical Modeling Inspire Your Differential Equations Class
Patrice Tiffany, *Manhattan College*

19. Homework Revisions vs. Meeting with the Professor: Which Better Helps Precalculus Students Learn?
Rachel Epstein, *Georgia College*

20. Cooperative Learning in an Introduction to Topology Course
Erin Griesenauer, *Eckerd College*

21. Developing Students' Mathematical Background for University-Level Statistics Course in a Flipped Classroom, In-class Worksheets, Peer Interaction, and Class Projects in an Inclusive Classroom Environment
Chamila Kumari Ranaweera, *University of Colorado Boulder*

22. Using Art to Express Mathematics
Jonathan Keiter, *East Stroudsburg University*

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

23. Getting to the Top: Less Pain, More Gain
Kristopher Pruitt, *U.S. Air Force Academy*
Michael Brilleslyper, *U.S. Air Force Academy*

24.MYMathApps Calculus Tutorials
Philip B. Yasskin, *Texas A&M University*
Matthew Weihing, *Texas A&M University*
Joseph Martinsen, *Texas A&M University*
Akash Rao, *Texas A&M University*

25. Delivering Pre-Class Activities Via WeBWorK to Impact Student Learning
Mike Janssen, *Dordt University*
Valorie Zonnefeld, *Dordt University*

26. Construction of an Infinite Square Matrix to Observe Various Forms of Whole Numbers
Danny T. Lau, *University of North Georgia*

27. There are 70 Finite Regular Ternary Quadratic Forms
Frank Patane, *Samford University*
Raymond Herbert, *University of Alabama*

28. Exploring Asymmetrical Results in Mathematics
Brian J. Shelburne, *Wittenberg University*

29. Hensel's p-Adic Numbers
Phil Blau, *Shawnee State University*

30. CM Method and Expansion of Numbers
Abdulmajeed Abdurrahman, *Shippensburg University*

31. Preserving p-Adic Metrics
Robert W. Vallin, *Lamar University*

32. Multiplicity of Hexagon Numbers
Cameron G. Hale, *UAB*
Jonathan R. Kelleher, *UAB*
John C. Mayer, *UAB*

33. Mathematical and Artistic Creative Processes: Distilling Models, Mapping Interdisciplinary Intersections
Kerry O'Grady, *Johns Hopkins University*

34. Conjoint Analysis Approach for Defining Part Worth Utilities to Criteria Weighing into the "Go/No-Go" Decision Faced by NGOs in Disaster Response
Danilo R. Diedrichs, *Wheaton College*
Paul A. Isihara, *Wheaton College*

35. Data Arising from Destructive Samples: The Case of Spina Bifida
Rigwed R. Tatu, *University of Cincinnati*

INVITED ADDRESS
Earle Raymond Hedrick Lecture Series

Complex Dynamics and Elliptic Curves, Lecture I
11:00 A.M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Laura DeMarco, *Northwestern University*

In a series of three talks, I will present connections between recent research in dynamical systems and the classical theory of elliptic curves and rational points. On the dynamical side — specifically in the study of iteration of rational functions (Julia sets, bifurcations, the Mandelbrot set) — the first connections were observed about 100 years ago. On the arithmetic side, it was probably the 1960s when dynamical ideas were first used as tools to understand the arithmetic geometry of elliptic curves and higher-dimensional varieties. My goal is to provide an overview of how these relationships developed and where they have brought us today. The three lectures will be independent.

INVITED ADDRESS
MAA Chan Stanek Lecture for Students

Secrets of Grad School Success
1:30 P.M. - 2:20 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Mohamed Omar, *Harvey Mudd College*

Around this time of year many rising seniors and even rising juniors are wondering what to do after college, and many contemplate the idea of going to graduate school. Naturally, they seek advice from peers, professors at their college and the internet. In this talk, we'll give some pretty unconventional advice based on the speakers experiences through the same process.

INVITED PAPER SESSION
Equity and Justice in the Context of Inquiry

1:50 P.M. - 4:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200
Inquiry pedagogies offer rich learning experiences that can support under-served populations in collegiate mathematics. However, elements of these environments can alienate exactly the students instructors are hoping to support. So equity and inquiry must be theorized and researched together in order to offer justice for all students. This session brings research agendas into direct conversation for mathematicians and educators.

Organizer:
Brian Katz, *Augustana College*

Sponsors:
SIGMAA on Inquiry-Based Learning (IBL SIGMAA)
SIGMAA on Research in Undergraduate Mathematics Education (SIGMAA on RUME)

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

Introduction to the Session
1:50 P.M. - 2:00 P.M.
Brian Katz, *Augustana College*

Inquiry and Equity: Necessary But Not Sufficient
2:00 P.M. - 2:20 P.M.
Sandra Laursen, *University of Colorado Boulder*

The IBL Experience When Students of Color Are in the Majority
2:30 P.M. - 2:50 P.M.
Robin Wilson and Stacy Brown, *California State Polytechnic University, Pomona*

Examined Inquiry-Oriented Instructional Moves with an Eye Toward Gender Equity
3:00 P.M. - 3:20 P.M.
Jessica Smith, *Florida State University*
Christine Andrews-Larson, *Florida State University*
Daniel L. Reinholz, *San Diego State University*
Amelia Stone-Johnstone, *San Diego State University*
Brooke Mullins, *Virginia Polytechnic Institute and State University*

TBA
3:30 P.M. - 3:50 P.M.
Rochelle Gutiérrez, *University of Illinois*

Panel Discussion
4:00 P.M. - 4:20 P.M.

INVITED PAPER SESSION
Cryptography and the Mathematics Behind It

1:30 P.M. - 4:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Modern day society and the security of our voting, banking, and military systems rely on cryptography to ensure privacy and allow secure communication. Important problems in cybersecurity are being solved using number theory, algebraic geometry, and the mathematics of lattices. This session on the mathematics behind cryptography is aimed at a general mathematical audience.

This session will have expository talks aimed at a general mathematical audience and will be suitable for both students and faculty.

Organizer:
Alice Silverberg, *University of California, Irvine*

Language, Probability, and Cryptography
1:30 P.M. - 1:50 P.M.
Adriana Salerno, *Bates College*

Inrtoduwtion to Erorr Dwtetcion and Czorrectmon
2:00 P.M. - 2:20 P.M.
Steven J. Miller, *Williams College*

Post-quantum Key Exchange Based on "Learning with Errors" Problems
2:30 P.M. - 2:50 P.M.
Jintai Ding, *University of Cincinnati*

Public-key Cryptography from Supersingular Elliptic Curve Isogenies
3:00 P.M. - 3:20 P.M.
David Jao, *University of Waterloo*

$x^n + x + a$
3:30 P.M. - 3:50 P.M.
Kumar Murty, *University of Toronto*

CONTRIBUTED PAPER SESSION
Plug and Play Data Science Lessons, Part B

1:30 P.M. - 4:05 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 233

Organizers:
Michael Boardman, *Pacific University*
Timothy Chartier, *Davidson College*
Jason Douma, *University of Sioux Falls*

Sponsor:
Committee for the Undergraduate Program in Mathematics (CUPM)

Data at Disney: Using Clustering to Maximize Mickey Bar Sales
1:30 P.M. - 1:45 P.M.
Liz Bouzarth, *Furman University*
Kevin Hutson, *Furman University*

An In-Class Geo-Spatial Data Science Project... Inspired by a Comedian
1:50 P.M. - 2:05 P.M.
Russell Goodman, *Central College*

Movie Recommendation as an Introduction to Machine Learning Principles
2:10 P.M. - 2:25 P.M.
Jacob Price, *University of Puget Sound*
Jeremy Upsal, *University of Washington*

Enough Linear Algebra for Machine Learning
2:30 P.M. - 2:45 P.M.
Daniel T. Kaplan, Macalester College

A Lesson in Data Science and Computational Thinking Using Real Data
2:50 P.M. - 3:05 P.M.
Boyan Kostadinov, *City Tech, CUNY*

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

Discriminant Analysis and Logistic Regression Connections
3:10 P.M. - 3:25 P.M.
Jacqueline R. Herman, *Northern Kentucky University*

Two Data Science Projects in PIC Math Class
3:30 P.M. - 3:45 P.M.
Haiyan Su, *Montclair State University*

R Projects Can Complement the Inverted Classroom
3:50 P.M. - 4:05 P.M.
John T. Sieben, *Texas Lutheran University*
Reza O. Abbasian, *Texas Lutheran University*

CONTRIBUTED PAPER SESSION
Ethics in the Mathematics Classroom

1:30 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 260, 261 & 262

The mathematical sciences have a central role to address the use and misuse of mathematics and data that fueling a global ethics crisis. This session aims to describe the integration of ethics into the mathematics classroom and ethical issues surrounding the teaching of mathematics. Talks cover how ethics are addressed, and reflect upon the successes and challenges to implementation.

Organizers:
Victor Piercey, *Ferris State University*
Catherine Buell, *Fitchburg State University*

Sponsor:
Special Issue of PRIMUS: Ethics in Mathematics Education

Ethics in Mathematics: An Existence Theorem
1:30 P.M. - 1:45 P.M.
Catherine A. Buell, *Fitchburg State University*
Victor Piercey, *Ferris State University*

Ethics and Responsibility in STEM
1:50 P.M. - 2:05 P.M.
Dawn Nelson, *Saint Peter's University*

Ethical Perspectives Through Game Theory
2:10 P.M. - 2:25 P.M.
Andrew Windle, *Rockhurst University*

Fostering Ethical Reflection in the Mathematics Classroom through Interdisciplinary Approaches to Learning
2:30 PM. - 2:45 P.M.
Georges-Philippe Gadoury-Sansfacon, *Bishop's University*

Using Fairness as a Theme in General Education Mathematics Courses
2:50 P.M. - 3:05 P.M.
Adam Giambrone, *Elmira College*

Ethical Considerations in a Data-Driven World
3:10 P.M. - 3:25 P.M.
Stacy L. Hoehn, *Franklin College*

Ethics in Mathematics Curricula from the Beginning
3:30 P.M. - 3:45 P.M.
Patrice Tiffany, *Manhattan College*

Reflective Service Learning as a Means to Teach Ethics
3:50 P.M. - 4:05 P.M.
Erin Griesenauer, *Eckerd College*

CONTRIBUTED PAPER SESSION
History of Mathematics in a Math Circle, Part B

1:30 P.M. - 3:25 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238

Organizers:
Amy Shell-Gellasch, *Eastern Michigan University*
Philip Yasskin, *Texas A&M University*

Sponsors:
SIGMAA on Math Circles for Students and Teachers (SIGMAA MCST)
The History of Mathematics SIGMAA (HOM SIGMAA)

The Frobenius Stamped Coin McNugget
1:30 P.M. - 1:45 P.M.
Andy Martin, *Kentucky State University*

Problem Posing with Dice Probability in Mathematics Teacher Circles
1:50 P.M. - 2:05 P.M.
Chris Bolognese, *Columbus Academy*

Many Worlds History of Map Coloring
2:10 P.M. - 2:25 P.M.
Skona Brittain, *SB Family School*

Journal of Math Circles (JMC)
2:30 P.M. - 2:45 P.M.
Brandy S. Wiegers, *Central Washington University*
Emilie Hancock, *Central Washington University*

Math Circles Based on Newton's Mathematics
2:50 P.M. - 3:05 P.M.
Robert Sachs, *George Mason University*

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

Exploring Infinitesimals in a Math Teachers Circle
3:10 P.M. - 3:25 P.M.
Cymra Haskell, *University of Southern California*

CONTRIBUTED PAPER SESSION
Inquiry-Based Learning and Teaching, Part B

1:30 P.M. - 3:25 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 230 & 231

Organizers:
Victor Piercey, *Ferris State University*
Susan Crook, *Loras College*
Brian Katz, *Augustana College*
Eric Kahn, *Bloomsburg University*
Amy Ksir, *United States Naval Academy*

Sponsor:
The SIGMAA on Inquiry-Based Learning (IBL SIGMAA)

It Takes a Village to Learn Mathematics
1:30 P.M. - 1:45 P.M.
Jacci White, *Saint Leo University*
Monika Kiss, *Saint Leo University*

Using Videos, Reflections, and Portfolios to Promote Inquiry
1:50 P.M. - 2:05 P.M.
Megan Wawro, *Virginia Tech*

A Guided Reinvention Approach to Beginning Algebra
2:10 P.M. - 2:25 P.M.
Diana Underwood, *Purdue Northwest*

Euclidean and Non-Euclidean Geometries: Using Group-Work and IBL Methods in a Textbook-Free Approach to Teaching Non-Math Majors Logic and The Basics of Proof-Based Mathematics
2:30 P.M. -2:45 P.M.
Heidi Andersen, *University of Dallas*

Hands-on Activities for a Liberal Arts Math Course
2:50 P.M. - 3:05 P.M.
Grace McClurkin, *Saginaw Valley State University*

Quantitative Reasoning via Inquiry
3:10 P.M. - 3:25 P.M.
Gregory D. Foley, *Ohio University*
Stephen N. Shadik, *Ohio University*
Deependra Budhathoki, *Ohio University*

CONTRIBUTED PAPER SESSION
A Centennial Celebration of David Harold Blackwell

1:30 P.M.. - 3:25 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 232

David Harold Blackwell (April 24, 1919 - July 8, 2010) is arguably the most decorated and well-known of African Americans in the Mathematical Sciences. Blackwell would have turned 100 years old in 2019. To commemorate this, the National Association of Mathematicians (NAM) will host a Themed Contributed Paper Session for individuals to examine the influence Blackwell has had on the profession.

Organizers:
Edray Herber Goins, *Pomona College*
Janis D. Oldham, *North Carolina A&T*
Scott W. Williams, *SUNY Buffalo*

The Alternative Universes of David Blackwell and William Claytor
1:30 P.M. - 1:45 P.M.
Ronald Elbert Mickens, *Clark Atlanta University*

Game Theory: A Survey of an Intriguing Contribution of David Blackwell
1:50 P.M. - 2:05 P.M.
Asamoah Nkwanta, *Morgan State University*

Blackwell's Contribution to Dynamic Programming
2:10 P.M. - 2:25 P.M.
Mark Lewis, *Cornell University*

David Blackwell: Bayesian Statistics and Contributions to the Statistics Community
2:30 P.M. - 2:45 P.M.
Kimberly S. Weems, *North Carolina Central University*

Blackwell-Tapia 2000-2018
2:50 P.M. - 3:05 P.M.
Carlos Castillo-Chavez, *Arizona State University*

Behind the Scenes: The David Blackwell that I Knew
3:10 P.M. - 3:25 P.M.
Richard A. Tapia

CONTRIBUTED PAPER SESSION
Mathematics and the Life Sciences: Initiatives, Programs, Curricula, Part B

1:30 P.M. - 2:25 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 207 & 208

Organizers:
Timothy D. Comar, *Benedictine University*
Raina Robeva, *Sweet Briar College*
Carrie Diaz Eaton, *Bates College*

Sponsor:
SIGMAA on Mathematical and Computational Biology (BIO SIGMAA)

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

Pain Medication and Tree Leaves: Mathematical Modeling Tasks for Future Secondary Teachers
1:30 P.M. - 1:45 P.M.
Jacy Beck, *Utah State University*
Ricardo Cortez, *Tulane University*
Brynja Kohler, *Utah State University*

Engaging Undergraduates in Research in Mathematical Biology with Limited Resources
1:50 P.M. - 2:05 P.M.
Timothy D. Comar, *Benedictine University*

Data Analysis with Destructive Samples: Spina Bifida Case
2:10 P.M. - 2:25 P.M.
Marepalli B. Rao, *University of Cincinnati*
Rigwed Tatu, *University of Cincinnati*

CONTRIBUTED PAPER SESSION

Recreational Mathematics: Puzzles, Card Tricks, Games, Gambling and Sports, Part B

1:30 P.M. - 4:25 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 206

Organizers:
Paul R. Coe, *Dominican University*
Sara B. Quinn, *Dominican University*
Kristen Schemmerhorn, *Concordia University Chicago*
Andrew Niedermaier, *Jane Street Capital*

Sponsor:
SIGMAA on Recreational Mathematics (Rec SIGMAA)

Using Graph Theory to Analyze Ticket to Ride© Expansions
1:30 P.M. - 1:45 P.M.
Kimberly Jordan Burch, *Indiana University of Pennsylvania*

Chuteless and Ladderless
1:50 P.M. - 2:05 P.M.
Darren Glass, *Gettysburg College*
Stephen Lucas, *James Madison University*

Playing Farkle with N-sided Dice
2:10 P.M. - 2:25 P.M.
Jeremiah Bartz, *University of North Dakota*

Mathematical Results for New Versions of the Game of SET
2:30 P.M. - 2:45 P.M.
Anne Quinn, *Edinboro University of PA*

The Pólya Enumeration with the 1258 Game
2:50 P.M. - 3:05 P.M.
Jon-Lark Kim, *Sogang University*

The Q Queens Problem with P Pawns
3:10 P.M. - 3:25 P.M.
Doug Chatham, *Morehead State University*

Breaking and Remaking the New Zealand Puzzle
3:30 P.M. - 3:45 P.M.
Keith Brandt, *Rockhurst University*

Back to the Tower
3:50 P.M. - 4:05 P.M.
John Bonomo, *Westminster College*

You Only Need a Bit of Luck to Win MTV's Are You The One?
4:10 P.M. - 4:25 P.M.
Stanley R. Huddy, *Fairleigh Dickinson University*
Nomin Sukhbaatar, *Fairleigh Dickinson University*

PANEL SESSION

Living Proof: Stories of Resilience Along the Mathematical Journey

1:30 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

Living Proof is a collection of short stories written by those from all corners of the mathematical community with the hope to inspire current students, illustrating how mathematicians overcame hard content, sexism, questions of identity, and more. Panelists will discuss how the project evolved, why they contributed to the book, and what struggle and resilience mean in our discipline.

Organizers:
Emille Lawrence, *University of San Francisco*
Matthew Pons, *North Central College*
David Taylor, *Roanoke College*
Allison Henrich, *Seattle University*

Panelists:
Emille Lawrence, *University of San Francisco*
Matthew Pons, *North Central College*
Hortensia Soto, *University of Northern Colorado*
David Taylor, *Roanoke College*
Pamela Harris, *Williams College*

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

WORKSHOP

What's the Story? Research Presentations for an Undergraduate Audience

1:30 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201

Presenting recent and ongoing research to undergraduate students is fun and rewarding, but frequently challenging. The gory details of mathematical results often require a great deal of specific jargon and background knowledge. Nonetheless, the big idea — the "story" — can almost always be presented at a variety of levels. This workshop is designed to help graduate students formulate a presentation on their research that is appropriate for an audience of undergraduate students, something many colleges and universities require as part of a job interview. Moreover, the ability to communicate complex mathematical ideas is a valued trait in any context. As such, this session aims to develop a framework for creating an engaging and accessible presentation for undergraduates. Graduate students who will be going on the job market in the fall may find this workshop especially useful.

Organizer:
May Mei, *Denison University*

MINICOURSE

Minicourse 1. Beyond Traditional Grading Schemes, Part A

1:30 P.M. - 3:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 202 & 203

Mastery grading is an assessment approach in which students are provided clear learning objectives and grades are directly based on students' ability to demonstrate complete mastery of these objectives by the end of the semester. Recent trends indicate this grading structure encourages a growth-mindset, reduces test anxiety, and improves student gains. This minicourse is designed for new practitioners.

Organizers:
Jessica O'Shaughnessy, *Shenandoah University*
Jeb Collins, *Mary Washington University*
Amanda Harsey, *Lewis University*
Alyssa Hoofnagle, *Wittenberg University*
Mike Jansen, *Dordt College*

Sponsor:
MAA Committee on Assessment

Minicourse 2. Creating a Purposeful Student Learning Experience, Part A

1:30 P.M. - 3:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 204

Do your requirements for your departmental majors constitute an integrated framework for student success, or are they just a set of individual classes? Do your faculty work together effectively to achieve desired outcomes and to assess your progress? Do you strategically incorporate experiences outside the classroom in student learning? This minicourse will guide you in creating a learning-focused departmental culture.

Organizer:
Dan Callon, *Franklin College*
John Boardman, *Franklin College*
Paul Fonstad, *Franklin College*
Justin Gash, *Franklin College*
Stacy Hoehn, *Franklin College*
Angie Walls, *Franklin College*

UNDERGRADUATE STUDENT PAPER SESSION

MAA Student Paper Sessions

2:30 P.M. - 6:05 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 210, 211, 235, 251

Organizers:
Eric Ruggieri, *College of the Holy Cross*
Chasen Smith, *Georgia Southern University*

UNDERGRADUATE STUDENT PAPER SESSION

Pi Mu Epsilon Student Paper Sessions

2:30 P.M. - 6:05 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 234, 236, 264

Pi Mu Epsilon student members who wish to represent their chapters as student speakers or official delegates should visit the PME website at http://pme-math.org/ for more information.

Please note: all student presenters are required to be registered for MAA MathFest.

Organizer:
Darci Kracht, *Kent State University*

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

PANEL SESSION

Mathematical Knowledge for Teaching as an Integrated Application in Core Mathematics Major Courses

3:00P.M. - 4:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

Core mathematics majors' courses often have designated application problems from areas like physics or engineering. The MAA META Math project focuses on explicitly adding "secondary mathematics teaching" to the list of legitimate application areas of mathematics by creating resources for use in undergraduate mathematics courses. Panelists will describe a variety of initiatives that address mathematics courses for teaching.

Organizer:
Doug Ensley, *Shippensburg University*
Elizabeth Fulton, *Montana State University*

Panelists:
Elizabeth Burroughs, *Montana State University*
James Tanton, *Mathematical Association of America*
Rick Hudson, *University of Southern Indiana*
Lisa Berger, *Stony Brook University*

Sponsor:
SIGMAA on the Mathematical Knowledge of Teachers (SIGMAA MKT)

POSTER SESSION

General Contributed Poster Session II

3:00 P.M. - 3:45 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B

1. Universal Course Design for Linear Algebra Instruction
Roza Aceska, *Ball State University*
Crystal Lorch, *Ball State University*

2. My Favorite (algebra based) Math Contest Questions
Ashley Johnson, *University of North Alabama*

3. Hands-On Learning in a Mathematical Reasoning Course
L. Jeneva Clark, *University of Tennessee*

4. Using an Overview of All of Math History in a Math History Classroom: Highlighting Mathematicians and Mathematics
Daniel Kiteck, *Indiana Wesleyan University*

5. Active Learning Practices for First-Year Calculus
Kevser Erdem, *University of Cincinnati*
Casey Monday, *University of Cincinnati*

6. Adventures in Online Teaching with First Year Students
Grace E. Cook, *Bloomfield College*

7. The Carrot and the Stick: Attempts to Get Homework Completed when Due
Jennifer Szczesniak, *Hagerstown Community College*

8. Improving Student Understanding of Multivariable Calculus Concepts Using the CalcPlot3D Visualization Applet
Monica VanDieren, *Robert Morris University*
Paul Seeburger, *Monroe Community College*
Deborah Moore-Russo, *University of Oklahoma*

9. Changing the Culture of Calculus
James M. Talamo, *The Ohio State University*
Nela Lakos, *The Ohio State University*

10. The Traveling Mathematics Department
Duane Farnsworth, *Clarion University of Pennsylvania*
Jon Beal, *Clarion University of Pennsylvania*
Carey Childers, *Clarion University of Pennsylvania*
Daniel Shifflet, *Clarion University of Pennsylvania*
Marcella McConnell, *Clarion University of Pennsylvania*
Michael McConnell, *Clarion University of Pennsylvania*
Kate Overmoyer, *Clarion University of Pennsylvania*
Adam Roberts, *Clarion University of Pennsylvania*

11. Teaching Introductory Mathematical Modeling for Mathematics Majors
Nicole M. Panza, *Francis Marion University*

12. Developing a Mathematics through Illusion Course
Matthew J. Haines, *Augsburg University*

13. An Exit-Polling Project in a First-Year Seminar
Russell Goodman, *Central College*

14. Factors and Methods of STEM Student Retention
James Quinlan, *University of New England*

15. Using a Prerequisites Test to Improve Success in Applied Calculus
Nicholas Gewecke, *Dalton State College*

16. Implementing Inquiry Using POGIL (2.0)
Jill Shahverdian, *Quinnipiac University*

17. Cubic Curve Classifications: From Newton to Modern Day
Mark Bly, *Coastal Carolina University*

18. A Proof for the Algebraic Method to Find the Square Root of a Number
Alvin Chi Hi Ng, *Diligence (Tutor Centre)*

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

19. Pythagoras and Music Theory
Jillian Honea, *University of Tennessee*
Jackie Vogel, *Austin Peay State University*

20. Galois Groups of Even Quartics and Doubly Even Octic Polynomials
Chad Awtrey, *Elon University*

21. Cubics, Triangles, Cardano, & Statistics
G. Gerard Wojnar, *Frostburg State University*

22. h
Max Lind, *USP*
Eugene Fiorini, *Muhlenberg College*

23. Co-prime Labelings of Complete Bipartite Graphs
Michael Brilleslyper, *U.S. Air Force Academy*
Ethan Berkove, *Lafayette College*

24. Neighborhood-Prime Labelings of Hamiltonian Graphs
Norman Bradley Fox, *Austin Peay State University*

25. Breaking Graph Symmetry
Darren Narayan, *Rochester Institute of Technology*

26. Bounds on Number of Positive First Differences for Algebraically Generated Costas Arrays
Christopher N. Swanson, *Ashland University*

27. Finding the Intermediate and Largest Integers in the Primitive Pythagorean Triple When Only the Smallest is Known
Frederick D. Chichester, *Retired*

28. Percolation Threshold Values and Bounds for Archimedean Lattices
John C. Wierman, *Johns Hopkins University*

29. Complex Linear Algebra without Complex Numbers
Adam Coffman, *Purdue University Fort Wayne*

30. Disjointness Preserving Nonlinear and Point-wise Determined Maps on Banach Lattices
William Feldman, *University of Arkansas*

31. An Extended Deletion-Contraction Recurrence for the Chromatic Polynomial
Austin Mohr, *Nebraska Wesleyan University*

32. Comparing String-Similarity Algorithms in the Task of Name-Matching
Aleksandra Zaba, *University of Utah*

33. Experimental Estimation of a Sequence's Order of Convergence
Michelle Ghrist, *Gonzaga University*

34. Numerical Results for Linear Sequential Caputo Fractional Differential Equations with Initial and Boundary Conditions of Order 2q Using Laplace Transform Method
Bhuvaneswari Sambandham, *Dixie State University*

35. Program Review at Baldwin Wallace
Peggy Slavik, *Baldwin Wallace University*
Brent Daniel Strunk, *Baldwin Wallace University*

OTHER MATHEMATICAL SESSION

MAA Section Officers Meeting

3:00 P.M. - 4:50 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM C

This session is moderated by Lisa Marano, West Chester University, Chair of the MAA Committee on Sections. It is open to all section officers and their guests.

OTHER MATHEMATICAL SESSION

Speed Interview Marathon for Graduate Students

3:30 P.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM D

Employers suggest communication skills are a critical component of job interviews. This session for undergraduate students, graduate students and early career mathematicians helps participants hone these skills, with best practices and tips on job interviewing and three speed interviewing sessions to practice what participants have learned. Sessions include individual feedback for participants and opportunities to network with fellow interviewees.

Organizers:
Edray Goins, *Pomona College*
Jenna Carpenter, *Campbell University*

Sponsor:
MAA Committee on Graduate Students

CHRONOLOGICAL SCHEDULE

Thursday, August 1 CONTINUED

MINICOURSE

Minicourse 6. Mathematical Card Magic, Part A

3:40 P.M. - 5:40 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 202 & 203

A modern survey of self-working mathematical card magic, from classics such as binary and Gilbreath principle based entertainments to original principles and effects discovered by the presenter and previously shared at MAA.org. A special feature will be two-person card magic based on subtle mathematical communication principles: discrete mathematics, combinatorics and elementary probability. No prerequisites, and no sleight of hand skills are required.

Organizer:
Colm Mulcahy, *Spelman College*

MINICOURSE

Minicourse 5. Visualizing Projective Geometry Through Photographs and Perspective Drawings, Part A

3:40 P.M. - 5:40 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 204

We introduce hands-on, practical art puzzles that motivate the mathematics of projective geometry — the study of properties invariant under projective transformations. On the art side, we explore activities in perspective drawing or photography. These activities inform the mathematical side, where we introduce activities in problem solving and proof suitable for a sophomore-level proofs class. No artistic experience is required.

Organizer:
Annalisa Crannell, *Franklin & Marshall College*

Sponsor:
SIGMAA-ARTS

OTHER MATHEMATICAL SESSION

Read the Masters Session: Euler's *Introductio in Analysin Infinitorum*

3:40 P.M. - 5:40 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201

Leonhard Euler's *Introductio* (1748) is a key text in the history of mathematics. In it, Euler provided the foundation for much of today's mathematical analysis, focusing in particular on functions and their development into infinite series. At this event, a brief description of what is entailed in engaging historical texts, especially through small reading groups, will precede an open reading session of a portion of the *Introductio* (in English translation, with guiding questions) by attendees in small groups, followed by a general discussion. No experience with the history of mathematics is required.

Organizers:
Erik Tou, *University of Washington Tacoma*
Daniel Otero, *Xavier University*
Lawrence D'Antonio, *Ramapo College*
Robert Bradley, *Adelphi University*
Amy Shell-Gellasch, *Eastern Michigan University*

Sponsors:
Euler Society, ORESME, HoM SIGMAA, ARITHMOS, TRIUMPHS

CONTRIBUTED PAPER SESSION

Encouraging Effective Teaching Innovation, Part A

3:50 P.M. - 5:45 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 230 & 231

This session will consist of presentations of demonstrably effective and innovative classroom techniques that address the reasoning behind, design, and implementation of resources or activities. This may include whole course techniques (not necessarily original to the presenter) or drop-in activities to bolster student learning and reflection in any course. Materials will be shared after the session at: http://mathfest2019.davidfailing.com/

Organizers:
Susan Crook, *Loras College*
David Failing, *Lewis University*
Russ Goodman, *Central College*
Mami Wentworth, *Wentworth Institute of Technology*
Mel Henriksen, *Wentworth Institute of Technology*

Reducing Student Testing Anxiety by Implementing a Three-Stage Group Testing Method
3:50 P.M. - 4:05 P.M.
Suzanne Caulfield, *Cardinal Stritch University*

Investigation of Inverted and Active Pedagogies in STEM Disciplines, Final Report
4:10 P.M. - 4:25 P.M.
Reza O. Abbasian, *Texas Lutheran University*
Mike Czuchry, *Texas Lutheran University*

Changes to Student Self-efficacy and Motivation with Team-Based Learning
4:30 P.M. - 4:45 P.M.
Jeffrey M. Ford, *Gustavus Adolphus College*

Learning about Learning
4:50 P.M.- 5:05 P.M.
Alex M. McAllister, *Centre College*

Getting the Most out of Collaborative Learning
5:10 P.M. - 5:25 P.M.
Karen F. Smith, *UC Blue Ash College*

Using Learning Assistants to Encourage Active Learning
5:30 P.M. - 5:45 P.M.
Justin Dunmyre, *Frostburg State University*

CHRONOLOGICAL SCHEDULE CONTINUED

Thursday, August 1 CONTINUED

SIGMAA ACTIVITY
IBL Business Meeting, Reception, and Guest Lecture

4:30 P.M. - 5:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

OTHER MATHEMATICAL SESSION
Section NExT Leadership Meeting

5:00 P.M. - 5:50 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM C

This informal discussion will provide Section NExT Leaders the opportunity to compare notes, including challenges and opportunities. We will focus on the ways that Section NExT supports the MAA values of community, inclusivity, communication and teaching/learning. We will also think about ways the sections can support each other and how we might identify some standard practices that enable MAA HQ to support Section NExT. The session will be developed in consultation with Section NExT leaders and facilitated by MAA Deputy Executive Director Ray Levy.

Organizers:
Ray Levy, *Mathematical Association of America*
Cheryl Adams, *Mathematical Association of America*
Lisa Marano, *West Chester University*

SESSION FOR GRADUATE STUDENTS
Graduate Student Reception

5:00 P.M. - 6:00 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM B

Graduate students are invited for some refreshments and to meet several of the invited speakers.

Organizers:
Edray Goins, *Pomona College*
Eric Eager, *University of Wisconsin at La Crosse*

Sponsor:
MAA Committee on Graduate Students

OTHER MATHEMATICAL SESSION
The President's Membership Jubilee

6:00 P.M. - 7:30 P.M. DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Magic tricks, popular movies, achievements in sport, games and puzzles, mimes, soap bubbles are not what the general public associates with mathematics. But for many of us, these are another fun and exciting side of mathematics. During the MAA President's Jubilee, different presenters will highlight some of these areas of mathematics. Come join us.

Friday, August 2

Registration & Information

8:00 A.M. - 6:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM LOBBY

UNDERGRADUATE STUDENT PAPER SESSION
MAA Student Paper Sessions

8:30 A.M. - 10:45 A.M., DUKE ENERGY CONVENTION CENTER, ROOMS 210, 211, 235, 251

Organizers:
Eric Ruggieri, *College of the Holy Cross*
Chasen Smith, *Georgia Southern University*

UNDERGRADUATE STUDENT PAPER SESSION
Pi Mu Epsilon Student Paper Sessions

8:30 A.M. - 12:05 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 236, 264

Pi Mu Epsilon student members who wish to represent their chapters as student speakers or official delegates should visit the PME website at http://pme-math.org/ for more information.

Please note: all student presenters are required to be registered for MAA MathFest.

Organizer:
Darci Kracht, *Kent State University*

OTHER MATHEMATICAL SESSION
MAA Prize Session

9:00 A.M. - 10:00 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

The session is organized by MAA Secretary James Sellers, *Penn State University*, and is moderated by MAA President Michael Dorff, *Brigham Young University*.

Exhibit Hall

9:00 A.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B

MINICOURSE
Minicourse 3. Game Theoretic Modeling for Math Majors, Part B

10:00 A.M. - 12:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 202 & 203

Organizer:
Rick Gillman, *Valparaiso University*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

MINICOURSE

Minicourse 4. Introduction to WeBWorK: An Open Source Alternative to Generate and Deliver Online Homework Problems, Part B

10:00 A.M. - 12:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 204

Organizers:
Tim Flowers, *Indiana University of Pennsylvania*
Robin Cruz, *College of Idaho*
Stacey Rodman, *Augustana College*

Sponsor:
MAA Committee on Technology in Mathematics Education (CTME)

INVITED PAPER SESSION

The Mathematics of Uncertainty

10:10 A.M. - 12:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

We encounter uncertainty everywhere, at all levels of consciousness, in all of our endeavors. Even things of which we are certain: the sun rises tomorrow, our existence has a finite time span, are subject to imprecision. How has mathematics helped us understand uncertainty and unpredictability?

In this session we present mathematics that guides decisions under incomplete information or cognitive limitations.

Organizer:
Ami Radunskaya, *Pomona College*

Crossing the Threshold: The Role of Demographic Stochasticity in the Evolution of Cooperation
10:10 A.M. - 10:30 A.M.
Tom LoFaro, *Gustavus Adolphus College*

Stochastic Perturbations of the Logistic Map
10:40 A.M. - 11:00 A.M.
Kim Ayers, *Pomona College*

Logic for Reasoning about Uncertainty Dynamics and Informational Cascades
11:10 A.M. - 11:30 A.M.
Joshua Sack, *California State University, Long Beach*

Probability as a Tool for Studying Problems in Behavioral Economics
11:40 A.M. - 12:00 P.M.
Aloysius Bathi Kasturiarachi, *Kent State University*

CONTRIBUTED PAPER SESSION

Understanding Mathematics Through its History, Part A

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 207 & 208

Many mathematical concepts experienced a long and complex evolution before arriving on the pages of today's undergraduate textbooks. Often, understanding some of this history can greatly enhance a student's understanding of mathematics. Moreover, an exploration of history can show how mathematics is connected to the wider world of human inquiry, affected by the same cultural values and prejudices as other subjects. This session seeks to share interesting historical episodes or developments linked to undergraduate mathematics, for the benefit of students and teachers alike.

Organizer:
Erik Tou, *University of Washington*

Sponsor:
The Euler Society

Archimedes' Quadrature of the Parabola
10:10 A.M. - 10:25 A.M.
Bill Linderman, *King University*

The Ideal Result of Fermat's Taunt
10:30 A.M. - 10:45 A.M.
Holly Attenborough, *University of Wisconsin-Platteville*

Completing the Square with al-Khwārizmī a TRIUMPHS PSP
10:50 A.M. - 11:05 A.M.
Daniel Otero, *Xavier University*

Rules and Demonstration in Cardano's *Ars Magna* (1545)
11:10 A.M. - 11:25 A.M.
William Branson, *St Cloud State University*

Figurate Numbers from Nicomachus to Pascal
11:30 A.M. - 11:45 A.M.
Jerry M. Lodder, *New Mexico State University*

Introducing topology via Euler's formula
11:50 A.M. - 12:05 P.M.
Anne Duffee, *Sewanee: the University of the South*

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

CONTRIBUTED PAPER SESSION

Inquiry-Based Learning and Teaching, Part C

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 230 & 231

Inquiry-based learning (IBL) transforms students from consumers to producers of mathematics. IBL methods aim to develop a deep understanding of mathematical concepts and processes by putting students in direct contact with mathematical phenomena, questions, and communities. This session invites scholarly presentations on the use and effects of IBL methods for teaching and learning.

Organizers:
Victor Piercey, *Ferris State University*
Susan Crook, *Loras College*
Brian Katz, *Augustana College*
Eric Kahn, *Bloomsburg University*
Amy Ksir, *United States Naval Academy*

Sponsor:
The SIGMAA on Inquiry-Based Learning (IBL SIGMAA)

Something for Everyone
10:10 A.M. - 10:25 A.M.
Alex Rennet, *University of Toronto, Mississauga*

Supporting Instructors in the Transition to Inquiry Based Methods: A Preliminary Study on a Multi-Sectional Implementation in College Algebra
10:30 A.M. - 10:45 A.M.
Topaz Wiscons, *California State University, Sacramento*
Abigail Higgins, *California State University, Sacramento*
Sayonita Ghosh Hajra, *California State University, Sacramento*

Successes and Failures in an IBL Pre-Calculus Course
10:50 A.M. - 11:05 A.M.
Andrew-David Bjork, *Siena Heights University*

Characterizing Failure: The Case of Pre-Calculus
11:10 A.M. - 11:25 A.M.
Timothy Boester, *University of Maine*

Student Responses: Would You Take Another IBL Mathematics Course?
11:30 A.M. - 11:45 A.M.
Kelly Bubp, *Ohio University*
Harman Aryal, *Ohio University*
Deependra Budhathoki, *Ohio University*
Otto Shaw, *Ohio University*

Specification Grading in an Inquiry-based Introductory Differential Equations Course
11:50 A.M. - 12:05 P.M.
Mel Henriksen, *Wentworth Institute of Technology*
Mami Wentworth, *Wentworth Institute of Technology*

CONTRIBUTED PAPER SESSION

Diversity, Equity, and Inclusion in Mathematics, Part A

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 260, 261 & 262

National data trends indicate a need to shift representation in the mathematical sciences with respect to diversity, equity, and inclusion. In response, many departments and instructors have sought to understand the barriers that inhibit persistence and success in mathematics, particularly among underrepresented minority, first-generation, low-income, and female students. This session invites presenters to share how they engage diverse student populations.

Organizers:
Joel Kilty, *Centre College*
Ranthony A.C. Edmonds, *The Ohio State University*
Alison Marr, *Southwestern University*
Alex M. McAllister, *Centre College*

Beyond Leaky Pipes: Fostering Pathways and Persistence in the Mathematical Sciences
10:10 A.M. - 10:25 A.M.
Alison Marr, *Southwestern University*
Ranthony A. C. Edmonds, *The Ohio State University*
Joel Kilty, *Centre College*
Alex M. McAllister, *Centre College*

Informing and Encouraging All Math Majors
10:30 A.M. - 10:45 A.M.
Feryal Alayont, *Grand Valley State University*

Leveling the Playing Field: Effective Classroom Practices for First Generation College Students
10:50 A.M. - 11:05 A.M.
Rachel Frankel, *UC Blue Ash College*
Karen F. Smith, *UC Blue Ash College*

Finding Your Mathematical Roots
11:10 A.M. - 11:25 A.M.
Linda McGuire, *Muhlenberg College*

Change Is a Thing You Can Count On: Adjusting to Meet Diverse Student Needs
11:30 A.M. - 11:45 A.M.
Kathryn Cerrone, *The University of Akron*
Irina Chernikova, *The University of Akron*
Sukanya Kemp, *The University of Akron*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

Diversifying and Humanizing Mathematics through Community Collaboration
11:50 A.M. - 12:05 P.M.
Sayonita Ghosh Hajra, *California State University Sacramento*

CONTRIBUTED PAPER SESSION
Teaching Mathematics Through Games, Part A

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 206
Come see methods for engaging students in mathematics through the development or play of board, card, and video games. Developing a game often requires the application of mathematics and it also appears in how one plays the game. Presentations describe class activities, class projects, or undergraduate research applications of mathematics. This session will be of interest to gamers and instructors.

Organizers:
Heidi Hulsizer, *Benedictine College*
Nickolas Hein, *Benedictine College*
Mindy Capaldi, *Valparaiso University*
Martha Byrne, *Sonoma State University*

Recreational Mathematics. What? How? Why?
10:10 A.M. - 10:25 A.M.
Jorge Nuno Silva, *University of Lisbon*

Learning Mathematics through Games in a General Education Mathematics Course
10:30 A.M. - 10:45 A.M.
Amanda Harsy, *Lewis University*
Marie Meyer, *Lewis University*
Brittany Stephenson, *Lewis University*
Michael Smith, *Lewis University*

Problem Solving Through Board Games
10:50 A.M. - 11:05 A.M.
Adam M. Glesser, *California State University, Fullerton*
Matt Rathbun, *California State University, Fullerton*

Winning in a Quantitative Literacy Course
11:10 A.M. - 11:25 A.M.
Axel Brandt, *Northern Kentucky University*

A Simple Card Demonstration to Engage College Algebra Students
11:30 A.M. - 11:45 A.M.
Christopher Ryan Loga, *Southwestern Adventist University*

Graph Theory Games Designed by Pre-service Teachers
11:50 A.M. - 12:05 P.M.
David Clark, *Grand Valley State University*
Feryal Alayont, *Grand Valley State University*

CONTRIBUTED PAPER SESSION
Showcase of Modeling to Motivate Differential Equations, Part A

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 233
Differential equations is a pivotal STEM course. Student and faculty backgrounds, and departmental constraints provide for variations in the course. Modeling can be incorporated into any version to motivate the study of differential equations. Presenters will share modeling materials and data collection experiences that generate inquiry-oriented learning. Presenters may discuss the value of modeling, assessment techniques, pedagogical successes, and challenges.

Organizers:
Therese Shelton, *Southwestern University*
Rosemary Farley, *Manhattan College*
Patrice Tiffany, *Manhattan College*

DE and Social Justice: A Cholera Model with Bacterial Reservoir
10:10 A.M. - 10:25 A.M.
Therese Shelton, *Southwestern University*
Emma K. Groves, *North Carolina State University*
Sherry Adrian, *Southwestern University*

An Application of Compartmental Epidemic Models to Data from the 2016 Presidential Primary
10:30 A.M. - 10:45 A.M.
Eileen C. McGraw, *Stevenson University*

The Local Brewery: A Project to Introduce Differential Equations in an Intro Calculus Course
10:50 AM. - 11:05 A.M.
Jonathan Oaks, *Macomb Community College*

Pursuit Curves for Accelerating Prey
11:10 A.M. - 11:25 A.M.
Andrew Sward, *Augustana College*

Humans vs. Zombies: A Phase Plane Analysis Activity
11:30 A.M. - 11:45 A.M.
Hope McIlwain, *Mercer University*

Inquiry-Oriented Approach to Teaching Differential Equations through Modeling Projects
11:50 A.M. - 12:05 P.M.
Mary Vanderschoot, *Wheaton College*
Danilo R. Diedrichs, *Wheaton College*

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

CONTRIBUTED PAPER SESSION

Encouraging Effective Teaching Innovation, Part B

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238

Organizers:
Susan Crook, *Loras College*
David Failing, *Lewis University*
Russ Goodman, *Central College*
Mami Wentworth, *Wentworth Institute of Technology*
Mel Henriksen, *Wentworth Institute of Technology*

No Student is an Island: A Plethora of Pedagogical Practices for Collaborative Mathematics Classrooms
10:10 A.M. - 10:25 A.M.
David Taylor, *Roanoke College*

Read the Book! Improving Reading Comprehension in Mathematics
10:30 A.M. - 10:45 A.M.
Tom Mahoney, *Emporia State University*

Continuing the Conversation: Creating Learning Spaces via Dynamic Discussion Forums
10:50 A.M. - 11:05 A.M.
Melissa Soto, *California State University, Fullerton*

Structuring a Course Around Reading Mathematics
11:10 A.M.- 11:25 A.M.
Sean Droms, *Lebanon Valley College*

Teach Students to Prepare for Class AND to Think about Their Learning
11:30 A.M. - 11:45 A.M.
Charlotte Knotts-Zides, *Wofford College*

The Value of Reflective Writing in Mastery-based Grading Systems
11:50 A.M. - 12:05 P.M.
Adelaide Akers, *Emporia State University*

CONTRIBUTED PAPER SESSION

Professional Development in Mathematics: Looking Back, Looking Forward, on the Occasion of the 25th Anniversary of MAA Project NExT, Part A

10:10 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM D

Since MAA Project NExT was founded 25 years ago, a generation of mathematicians have participated in it and other PD programs. How have those programs impacted teaching and learning in mathematics? How have the challenges faced by college math instructors changed? Looking forward, how do we prepare today's math instructors for the changes to come in the next 25 years?

Organizers:
Dave Kung, *St. Mary's College of Mar yland*
Julie Barnes, *Western Carolina University*
Alissa Crans, *Loyola Marymount University*
Matt DeLong, *Marian University*

Activating Mathematics Instructors for Active Learning: The Role of Professional Development on Teaching
10:10 A.M. - 10:25 A.M.
Sandra Laursen, *University of Colorado Boulder*

Emotions, Behavior, Mythology, Passions, and Proof: Challenging Mathematical Culture and Transforming Our Teaching
10:30 A.M. - 10:45 A.M.
Benjamin Braun, *University of Kentucky*

What the K-12 Education Literature Can Tell Us about Effective Professional Development for Faculty
10:50 A.M. - 11:05 A.M.
Darryl Yong, *Harvey Mudd College*

Teaching Future Teachers and Mathematics Faculty Professional Learning
11:10 A.M. - 11:25 A.M.
Billy Jackson, *University of Louisville*
Shandy Hauk, *San Francisco State University*
David Tsay, *University of Texas Rio Grande Valley*

Distributed Leadership: A Framework for Continued Professional Development Workshops
11:30 A.M. - 11:45 A.M.
L. Jeneva Clark, *University of Tennessee*
Jack Bookman, *Duke University*

Online Faculty Collaboration: Supporting Instructional Change in a Big Way
11:50 A.M. - 12:05 P.M.
Karen Keene, *North Carolina*
Justin Dunmyre, *North Carolina*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

PANEL SESSION

Career Paths in Business, Industry, and Government

10:10 A.M. - 11:30 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

You're about to earn a degree in mathematics. Now what? There are many interesting job opportunities that don't necessarily involve teaching. Whether you are a student looking for a job once you graduate or an advisor looking for advice to give to future job-seeking students, this session will help you gain new perspectives on careers in business, industry, and government.

Organizer:
Emille D. Lawrence, *University of San Francisco*
David Stone, *Georgia Southern University*
Jeb Collins, *University of Mary Washington*
Aihua Li, *Montclair State University*

Panelists:
Richard Uber, *Air Force Institute of Technology*
Ryan Snyder, *State Auto Insurance Companies*
Mary Sefcik, *Cleveland Clinic*
Deming Zhuang, *Citi Group*

Sponsor:
MAA Committee on Undergraduate Students (CUSA)
MAA Committee on Business, Industry, and Government Mathematics (BIG)

WORKSHOP

Journal of Math Circles (JMC) Jam Session

10:10 A.M. - 11:30 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 201

Write for *Journal of Math Circles* (*JMC*), a new peer-reviewed, open-access journal! *JMC* seeks articles documenting outreach in alignment with Math Circle core values: using worthwhile mathematical tasks, fostering problem-solving habits of mind, and building communities of mathematical thinkers and problem solvers. The workshop will introduce *JMC* and provide support for writing lesson plan, program summary, and professional development articles.

Organizers:
Brandy S. Wiegers, *Central Washington University*
Emilie Hancock, *Central Washington University*

OTHER MATHEMATICAL SESSION

National Science Foundation Funding Opportunities in the Education and Human Resources Directorate

10:10 A.M. - 11:00 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 232

NSF offers a variety of grant programs that promote innovations and research in learning, teaching and broadening participation in the mathematical sciences. Included in these programs are the Graduate Research Fellowship Program (GRFP)and Improving Undergraduate STEM Education (IUSE). Following a presentation about these and other programs in the Directorate for Education and Human Resources, the remainder of the session will feature opportunities to engage in small group discussions with NSF staff about program features, current NSF policy changes, proposal preparation guidance, and other related topics. The recommended audience for this presentation is undergraduates who may be considering graduate school, graduate students, and faculty.

Organizers:
Karen Keene, *DUE NSF*
Talitha Washington, *National Science Foundation*
Sandra Richardson, *National Science Foundation*
Minerva Cordero, *National Science Foundation*

INVITED ADDRESS

Earle Raymond Hedrick Lecture Series

Complex Dynamics and Elliptic Curves, Lecture II

10:20 A.M. - 11:10 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Laura DeMarco, *Northwestern University*

INVITED ADDRESS

MAA Invited Address

Solving Algebraic Equations

11:20 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Irena Swanson, *Reed College*

Abel and Ruffini, and later Galois showed that general polynomials of degree five or higher are not solvable with the usual arithmetic operations. Nevertheless, algebra offers powerful methods for solving many equations and for determining the structure of solutions even when the solutions themselves cannot be found. In this talk I will cover some classical and more recent methods, including Hilbert's Nullstellensatz and Gröbner bases. A running theme will be computational complexity, and the talk will end with more recent results in commutative algebra.

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

OTHER MATHEMATICAL SESSION

A Conversation with AMS and MAA on the Future of Meetings

11:20 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM C

Last year's announcement that AMS and MAA would discontinue shared management of the Joint Mathematics Meetings has raised questions among many in our community about how we can sustain the value of the collaboration associated with this annual event beyond 2021.

This session will allow leadership of both organizations to share their vision for the future, including annual and section meetings, and new initiatives to provide professional opportunities for members of our community. You are also invited to provide feedback directly to AMS at http://www.ams.org/about-us/jmm-reimagined and to MAA at https://www.maa.org/meetings/jmm.

Organizers:
J. Michael Pearson, *Executive Director of the Mathematical Association of America*
Catherine A. Roberts, *Executive Director of the American Mathematical Society*

Sponsors:
Mathematical Assocation of America
American Mathematical Society

INVITED ADDRESS

AWM-MAA Etta Zuber Falconer Lecture

Dance of the Astonished Topologist ... or How I Left Squares and Hexes for Math

1:30 P.M. - 2:20 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Tara Holm, *Cornell University*

Topology is often called ``rubber sheet geometry" and is described as ``floppy" while geometry is more ``rigid". Symplectic geometry, the natural geometry of classical mechanics, is floppier than Riemannian geometry but more rigid than topology. I will give a friendly introduction to some geometric and algebraic techniques in topology, proving along the way that a topologist can turn her trousers inside out without taking them off. I will then give an overview of the floppy/rigid spectrum, motivated by many pictures and examples. I will conclude with a description of how covering spaces have been useful in my own work in symplectic geometry, and how they can make square dancing more challenging.

INVITED PAPER SESSION

The Serious Side of Recreational Mathematics

1:30 P.M. - 3:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 200

More than a pastime, recreational mathematics runs the gamut from the combinatorial questions to the mathematical structures in the game SET to using juggling to create a proof in number theory. In this invited paper session, experts in recreational math show how starting with a fun puzzle, game, or story can take one on a trip to deep mathematics.

Organizer:
Robert Vallin, *Lamar University*

Sponsor:
SIGMAA on Recreational Mathematics

Bingo Paradoxes
1:30 P.M. - 1:50 P.M.
Art Benjamin, *Harvey Mudd College*

Garden of Eden Partitions for Bulgarian and Austrian Solitaire
2:00 P.M. - 2:20 P.M.
James Sellers, *Penn State University*

Geometry, Combinatorics and the Game of SET
2:30 P.M. - 2:50 P.M.
Liz McMahon, *Lafayette College*

Throwing Together a Proof of Worpitzky's Identity
3:00 P.M. - 3:20 P.M.
Steve Butler, *Iowa State University*

Domino Variations
3:30 P.M. - 3:50 P.M.
Bob Bosch, *Oberlin College*

INVITED PAPER SESSION

Mathematical Diversity in Mathematical Biology

1:30 P.M. - 5:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Mathematical biology is grab-bag description for using mathematics to understand biological phenomena. The math used is not restricted to a particular sub-discipline within math, but rather is as diverse as the biological systems themselves. In this session, the 2018 Project NExTers will showcase the diversity of mathematics used to better understanding biology. It is geared for an undergraduate audience.

Organizers:
Nicholas A. Battista, *The College of New Jersey*
Rebecca Everett, *Haverford College*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

Comparing Intervention Strategies for Reducing *Clostridium difficile* Transmission: An Agent-Based Modeling Study
1:30 P.M. - 1:50 P.M.
Brittany Stephenson, *Lewis University*

Enhanced Coupling of Cilia Through Cell Rocking
2:00 P.M. - 2:20 P.M.
Forest Mannan, *Colorado School of Mines*

Parameter Informatics for Nonlinear Models
2:30 P.M. - 2:50 P.M.
Reginald McGee, *College of the Holy Cross*

Role of Resource Allocation and Transport in Emergence of Cross-feeding in Microbial Consortia
3:00 P.M. - 3:20 P.M.
Diana Schepens, *Whitworth University*

k-Foldability of RNA
3:30 P.M. - 3:50 P.M.
Garner Cochran, *Berry College*

Mixing and Pumping by Pairs of Helices in a Viscous Fluid
4:00 P.M. - 4:20 P.M.
Amy Buchmann, *University of San Diego*

Modeling the Impacts of Disturbances: What Can We Learn about Population Responses and Possible Management Strategies?
4:30 P.M. - 4:50 P.M.
Amy Veprauskas, *University of Louisiana at Lafayette*

Don't Be Jelly: Modeling Effective Jet Propulsion
5:00 P.M. - 5:20 P.M.
Nicholas A. Battista, *The College of New Jersey*

CONTRIBUTED PAPER SESSION

Understanding Mathematics Through its History, Part B

1:30 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 207 & 208

Organizer:
Erik Tou, *University of Washington*

Sponsor:
The Euler Society

The History of Calculus as a Guide to Teaching Calculus
1:30 P.M. - 1:45 P.M.
Eugene Boman, *Penn State, Harrisburg Campus*
Robert Rogers, *SUNY, Fredonia*

Because We Can: Proving the Generalized Binomial Theorem without Calculus
1:50 P.M. - 2:05 P.M.
Robert E. Bradley, *Adelphi University*

A Historical Approach to Infinite Series
2:10 P.M. - 2:25 P.M.
Alexander J. Barrios, *Carleton College*

The Totient Function Was Neither a Totient Nor a Function
2:30 P.M. - 2:45 P.M.
Erik R. Tou, *University of Washington, Tacoma*

Gnomonic Explorations: A Primary Source Project in Number Theory for Mathematics Majors, Elementary Teachers and Others
2:50 P.M. - 3:05 P.M.
Janet H. Barnett, *Colorado State University - Pueblo*

Mathematics in Astronomy at Harvard College Before 1839
3:10 P.M. - 3:25 P.M.
Amy Ackerberg-Hastings, *Independent Scholar*

Humanizing Mathematics Via Student-Generated Math History Plays
3:30 P.M. - 3:45 P.M.
Emily Dennett, *Ohio State*
Chris Bolognese, *Columbus Academy*

Challenging the Establishment
3:50 P.M. - 4:05 P.M.
Charlie Smith, *Park University*

Exploring Mathematics, Art, and History in Spain
4:10 P.M. - 4:25 P.M.
Mark A. Branson, Stevenson University

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

CONTRIBUTED PAPER SESSION

Inquiry-Based Learning and Teaching, Part D

1:30 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 230 & 231

Organizers:
Victor Piercey, *Ferris State University*
Susan Crook, *Loras College*
Brian Katz, *Augustana College*
Eric Kahn, *Bloomsburg University*
Amy Ksir, *United States Naval Academy*

Sponsor:
The SIGMAA on Inquiry-Based Learning (IBL SIGMAA)

Adapting IBL Questions for Large Classrooms
1:30 P.M. - 1:45 P.M.
Mihai Nica, *University of Toronto*

Engaged IBL Group Work: Vertical Non-Permanent Surfaces and Horizontal Movable Pieces
1:50 P.M. - 2:05 P.M.
V. Rani Satyam, *Virginia Commonwealth University*

Motivators and Characteristics of Creative Mathematical Inquiry: Aesthetics, Affect, and Epistemology
2:10 P.M. - 2:25 P.M.
Kerry O'Grady, *Johns Hopkins University*

Building Student-Community Ownership of Proof Validation
2:30 P.M. - 2:45 P.M.
Brian P. Katz, *Smith College*

CONTRIBUTED PAPER SESSION

Diversity, Equity, and Inclusion in Mathematics, Part B

1:30 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 260, 261 & 262

Organizers:
Joel Kilty, *Centre College*
Ranthony A.C. Edmonds, *The Ohio State University*
Alison Marr, *Southwestern University*
Alex M. McAllister, *Centre College*

Women Who Count: Experiential Education in Mathematics
1:30 P.M. - 1:45 P.M.
Jennifer R. Bowen, *The College of Wooster*

Mathematical Classroom Discussion of K-12 Emergent Bilinguals in North America Context: A Review of Literature
1:50 P.M. - 2:05 P.M.
Ying Luo, The Pennsylvania State University

Relational Practices in Mathematics Classrooms
2:10 P.M. - 2:25 P.M.
Helen E. Burn, *Highline College*
Eboni Zamani-Gallaher, *University of Illinois at Urbana-Champaign*
Vilma Mesa, *University of Michigan*
J. Luke Wood, *San Diego State University*

Community, Belonging, and the Putnam Exam
2:30 P.M. - 2:45 P.M.
Pat Devlin, *Yale University*

Program on Math Outreach in Panama
2:50 P.M. - 3:05 P.M.
Jeanette Shakalli, *National Secretariat of Science, Technology and Innovation*

Inclusive Teaching and Learning of Mathematics in an Afterschool Math Enrichment Program for Underrepresented Minority, First-Generation, Low-Income Students
3:10 P.M. - 3:25 P.M.
Alessandra Pantano, *UC Irvine*
Mark Yu, *UC Irvine*
Li-Sheng Tseng, *UC Irvine*

Early Access to Advanced Mathematics for Underrepresented Students
3:30 P.M. - 3:45 P.M.
Jacob Castaneda, *Bridge to Enter Advanced Mathematics*

Reaching Out: Introduction to Calculus
3:50 P.M. - 4:05 P.M.
David Easdown, *University of Sydney*

Effective Teams: Helping Students Understand the Importance of Diversity and Inclusion Through Teaming
4:10 P.M. - 4:25 P.M.
Jenna P. Carpenter, *Campbell University*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

CONTRIBUTED PAPER SESSION

Teaching Mathematics Through Games, Part B

1:30 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 206

Organizers:
Heidi Hulsizer, *Benedictine College*
Nickolas Hein, *Benedictine College*
Mindy Capaldi, *Valparaiso University*
Martha Byrne, *Sonoma State University*

Using Apples to Apples to Teach Set Theory
1:30 P.M. - 1:45 P.M.
Michael Martinez, *Charleston Southern University*

Integrating Puzzles and General Problem Solving Techniques into Undergraduate Mathematics Classes
1:50 P.M. - 2:05 P.M.
Benjamin Peet, *St. Martin's Univeristy*

Undergraduate Research with Lights Out
2:10 P.M. - 2:25 P.M.
William T. Jamieson, *Southern New Hampshire University*

World of Mathcraft: How Mathematical Analysis of Video Games Leads to Optimal Player Performance
2:30 P.M. - 2:45 P.M.
Joshua Steier, *Seton Hall University*

Mathematics in Interactive Fiction: A Beauty Cold and Austere
2:50 P.M. - 3:05 P.M.
Mike Spivey, *University of Puget Sound*

Activity Based Gaming
3:10 P.M. - 3:25 P.M.
Sarang Aravamuthan, *FogLogic*

CONTRIBUTED PAPER SESSION

Showcase of Modeling to Motivate Differential Equations, Part B

1:30 P.M. - 4:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 233

Organizers:
Therese Shelton, *Southwestern University*
Rosemary Farley, *Manhattan College*
Patrice Tiffany, *Manhattan College*

Mobile Apps that Enhance Modeling in Ordinary and Partial Differential Equations
1:30 P.M. - 1:45 P.M.
Timothy Lucas, *Pepperdine University*

Modeling with Census Data: the United States and Guatemala
1:50 P.M. - 2:05 P.M.
Jean Marie Linhart, *Central Washington University*
Gary Epp, *Central Washington University*

Flutter Mode vs. Resonance
2:10 P.M. - 2:25 P.M.
Jiyeon Suh, *Grand Valley State University*
Ciana Witherell, *Grand Valley State University*

Modeling Ornate Box Turtle Shell Growth
2:30 P.M. - 2:45 P.M.
Tyler Skorczewski, *University of Wisconsin Stout*

Simple Walking in 2-dimensional Space: Model and Experiment
2:50 P.M. - 3:05 P.M.
Na Yu, *Lawrence Technological University*

Modeling Thermal Data with Differential Equations for Sports and Engineering
3:10 P.M. - 3:25 P.M.
Malgorzata A. Marciniak, *City University of New York*

Incorporating Projects into a Differential Equations Course: Torricelli's Law of Fluid Flow
3:30 P.M. - 3:45 P.M.
Ibukun Amusan, *Kentucky State University*

Stability of Interconnected Automobile Platoons
3:50 P.M. - 4:05 P.M.
Hasala Senpathy K. Gallolu Kankanamalage, *Roger Williams University*

CONTRIBUTED PAPER SESSION

Encouraging Effective Teaching Innovation, Part C

1:30 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238

Organizers:
Susan Crook, *Loras College*
David Failing, *Lewis University*
Russ Goodman, *Central College*
Mami Wentworth, *Wentworth Institute of Technology*
Mel Henriksen, *Wentworth Institute of Technology*

Restructuring Lessons as an Antidote to Student Passivity in Introductory Courses
1:30 P.M. - 1:45 P.M.
Erin R. Moss, *Millersville University of Pennsylvania*

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

Core Quantitative Rasoning: The Specifications Grading Version
1:50 P.M. - 2:05 P.M.
Lauren Sager, *University of New Hampshire*

Precalculus Active Learning Labs: Focus on Functions
2:10 P.M. - 2:25 P.M.
Linda Burks, *Santa Clara University*

Graded Homework in 100-level Mathematics Courses: Should the Students Decide?
2:30 P.M. - 2:45 P.M.
Laura R. Tinney, *University of North Carolina Asheville*
Cathy Whitlock, *University of North Carolina Asheville*

How Flipping the Classroom Led to Better Outcomes for College Algebra and Foundations of Quantitative Reasoning Students
2:50 P.M. - 3:05 P.M.
Ralph Stikeleather, *University of Cincinnati- Blue Ash College*

Introducing the Notion of Variable to Young Children in Courses for Elementary Teachers
3:10 P.M. - 3:25 P.M.
Patricia Baggett, *New Mexico State University*
Andrzej Ehrenfeucht, *University of Colorado*

Teaching Elementary Statistics from A to Z
3:30 P.M. - 3:45 P.M.
Jason J. Molitierno, *Sacred Heart University*

Improving Student Ownership in Introductory Statistics Class through a Project-Based Approach
3:50 P.M. - 4:05 P.M.
Vinodh Kumar Chellamuthu, *Dixie State University*

Help! My Lesson Bombed: Recovering from a Classroom Failure
4:10 P.M. - 4:25 P.M.
Anil Venkatesh, *Ferris State University*

CONTRIBUTED PAPER SESSIONS

Professional Development in Mathematics: Looking Back, Looking Forward, on the Occasion of the 25th Anniversary of MAA Project NExT, Part B

1:30 P.M. - 3:10 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM D

Organizers:
Dave Kung, *St. Mary's College of Mar yland*
Julie Barnes, *Western Carolina University*
Alissa Crans, *Loyola Marymount University*
Matt DeLong, *Marian University*

Reflections on Lessons Learned from Project NExT
1:30 P.M. - 1:45 P.M.
Violeta Vasilevska, *Utah Valley University*

Reflections of a Peach Dot
1:50 P.M. - 2:05 P.M.
Mary Shepherd, *Northwest Missouri State University*

The MAA Mentoring Network: Supporting Early Career Mathematicians
2:10 P.M. - 2:25 P.M.
Lisa Driskell, *Colorado Mesa University*
Doug Ensley, *Shippensburg University*
Rachel Levy, *Mathematical Association of America*
Audrey Malagon, *Virginia Wesleyan University*

The State of Professional Development in Higher Ed Mathematics: Today and What's NExT
2:30 P.M. - 2:45 P.M.
Dave Kung, *St. Mary's College of Maryland*

Project NExT at Twenty Five and Counting
2:50 P.M. - 3:05 P.M.
T Christine Stevens, *American Mathematical Society*

PANEL SESSION

MAA Departmental Membership: Taking It to the Next Level

1:30 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

MAA departmental membership is much more than free student memberships! Join panelists from a variety of institutional settings to discuss how to tailor the myriad benefits of departmental membership to your particular needs. Conferences, books, journals, Great Courses, the online Career Resource Center – the list is long. Come share your ideas and get inspiration for your own students and institution.

Organizer:
Kira Hamnan, *Penn State University*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

Panelists:
Ximena Catepillan, *Millersville University*
Joyati Debnath, *Winona State University*
Spencer Hamblen, *McDaniel College*
Alicia Prieto Langarica, *Youngstown State University*

POSTER SESSION
General Contributed Poster Session III

1:30 P.M. - 2:15 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B

1. Riemann Sums Belong at the End of Integral Calculus, Not the Beginning
Robert R. Rogers, *SUNY Fredonia*

2. Take a Deep Breath and Behold the Mathematics
Mary B. Walkins, *The Community College of Baltimore County*

3. Revolution and Romance: Mathematics in the Romantic Age
Richard (Abe) Edwards, *Michigan State University*

4. Instruction Type and Student Major as They Relate to Student Success in College Level Developmental Mathematics Classes
Jean Coltharp, *Missouri Southern State University*

5. Confronting Underachievement in Introductory Math Classes: Improving Learning for All Students through Self-Regulation
Jane F. Reed, *Way to Succeed*

6. Calculus in Context - Results From Bringing Calculus and Physics Together
Kelly Black, *University of Georgia*
Guangming Yao, *Clarkson University*
Michael Ramsdell, *Clarkson University*
Craig Wiegert, *University of Georgia*

7. Mathematics of Paper Airplanes
Duk-Hyung Lee, *Asbury University*

8. Mathematics for Cybersecurity Majors
Gregory V. Bard, *University of Wisconsin-Stout*

9. Emergent Symbolization as a Student Learning Goal: Gathering and Responding to Students' Mathematical Meanings
Alan O'Bryan, *Arizona State University*

10. Between the Two Cultures: Teaching Math and Art to Engineers (and Scientists and Mathematicians)
Joshua Holden, *Rose-Hulman Institute of Technology*

11. Quantitative Reasoning: Everyday Considerations for Exploring Mathematics
Sarah L. Mabrouk, *Framingham State University*

12. Breaking 'R' Code: A First Attempt at Implementing R in Quantitative Biology
Margaret Rahmoeller, *Roanoke College*

13. Differences in Educational Gain for Calculus Concepts
Daniel L. Kern, *Florida Gulf Coast University*
Galen Papkov, *Florida Gulf Coast University*

14. Math Mindset in Early Courses
Heidi Hulsizer, *Benedictine College*
Angela Broaddus, *Benedictine College*

15. Modeling and Assessment of Student Retention at Hendrix College
Chris Camfield, *Hendrix College*

16. The Application of the Microsoft Office Suite to Enhance Mathematics Learning
Diane Cass Lussier, *Pima Community College*
Daniel E. Plummer, *Howard University*

17. Positive Solutions to Singular Second Order BVPs for Dynamical Equations
Curtis Kunkel, *University of Tennessee Martin*

18. Breaking the Vicious Limit Cycle: Addiction Relapse-Recovery as a Fast-Slow Dynamical System
Jacob P. Duncan, *Winona State University*
Monica McGrath, *Saint Mary's College, Notre Dame*
Teresa Aubele-Futch, *Saint Mary's College, Notre Dame*

19. The Effect of an Environmental Toxin on Competing Species
Jennifer Miller, *Bellarmine University*

20. An Inverse Source Problem with an Integral Overdetermination
Sedar Ngoma, *SUNY Geneseo*

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

21. Pricing Variance Swap for a Discrete BN-S Model Semere Kidane Gebresilasie, Wentworth Institute of Technology
Semere Kidane Gebresilasie, *Wentworth Institute of Technology*
Matthew Sears, *Wentworth Institute of Technology*

22. In to the Power Functions
Bianka Wang, *Saginaw Valley State University*
Hasan Al-Halees, *Saginaw Valley State University*

23. Equivalence Results for Implicit Junck-kirk Type Iterations
Hudson Akewe, *University of Lagos*

25. On the Existence of Fixed Points for Monotone Lipschitzian Mappings
Buthinah Bin Dehaish, *University of Jeddah*

26. Cotangent Averaging and Euler's Product Formula
Andrew Rich, *Manchester University*

27. Rainbow Geometry: Newton's Second Longbow
Dennis G. Collins, *University of Puerto Rico - Mayaguez*

28. The Transmission of Hindu-Arabic Numerals
Chuck Lindsey, *Florida Gulf Coast University*

29. Nineteenth Century Normal Mathematics
Jeff Johannes, *SUNY Geneseo*

30. Visualizing the Transformative Role of Mathematics in the Fin de Siècle Culture with Social Network Analysis
Donna Beers, *Simmons University*

31. On-cognitive Psychological Variables of Gender Inequalities in Developmental and Introductory Mathematics Courses
Camille A. McKayle, *University of the Virgin Islands*
Nadia Monrose, *University of the Virgin Islands*
Robert Stolz, *University of the Virgin Islands*

32. Adding Synthesis Tests to Mastery Based Testing
Haley A. Yaple, *Carthage College*

33. Dialogical Learning
Steven Wilkinson, *Northern Kentucky University*
Taraneh Wilkinson, *Foundation for Religious Studies, Bologna, Italy*

34. Explanation, Existence, and Indispensability
May Mei, *Denison University*
Seth Chin-Parker, *Denison University*
Sam Cowling, *Denison University*

35. The MPWR Seminar: Mentoring and Partnerships for Women in RUME
Megan Wawro, *Virginia Tech*
Jess Ellis Hagman, *Colorado State University*
Stacy Musgrave, *California State Polytechnic University, Pomona*

WORKSHOP

Mathematics of Gerrymandering: Engaging and Authentic Tasks with Civic Significance

1:30 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201

Gerrymandering refers to manipulating district boundaries to provide a political advantage and can be studied from many mathematical perspectives. This workshop will engage participants in three hands-on tasks, accessible to a general audience, exploring the mathematics of gerrymandering. The tasks include redistricting puzzles, examination of a numerical measure of gerrymandering (the efficiency gap), and an investigation of district compactness.

Organizers:
Kimberly Corum, *Towson University*
Sandy Spitzer, *Towson University*
James Rutter, *University of Virginia*
Julia Daniel, *Towson University*
Alexandria Wilhelm, *Towson University*

UNDERGRADUATE STUDENT ACTIVITY

Color Addition Across the Spectrum of Mathematics

1:30 P.M. - 2:20 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM C

In this talk we consider two family style games whose rules are mathematical in nature, but do not require any explicit mathematics, beyond simple counting, during game play. Both games are based on color mixing rules which yield a nice geometric visual presentation and admit several mathematical interpretations. We will discuss the nature of these color mixing rules, explore the related mathematical structures and see how all of this is related to finger paints and lightbulbs.

Presenter:
Ron Taylor, *Berry College*

CHRONOLOGICAL SCHEDULE

Friday, August 2 CONTINUED

OTHER MATHEMATICAL SESSION

Alder Award Session

2:30 P.M. - 3:50 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

The MAA established the Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member to honor beginning college or university faculty members whose teaching has been extraordinarily successful and whose effectiveness in teaching undergraduate mathematics is shown to have influence beyond their own classrooms. Each year, at most three college or university teachers are honored with this national award. The awardees are invited to make a presentation in this session. The session is moderated by MAA President Michael Dorff.

How I Learned to Stop Worrying and Love the School
2:30 P.M. - 2:50 P.M.
PJ Couch, *Lamar University*

"The Undergraduate Mathematics Classroom as a Publishing House: A New Type of Learning Community"
3:00 P.M. - 3:20 P.M.
Pamela Harris, *Williams College*

Teaching with H
3:30 P.M. - 3:50 P.M.
Alicia Prieto, *Youngstown State University*

UNDERGRADUATE STUDENT PAPER SESSION

MAA Student Paper Sessions

2:30 P.M. - 6:05 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 236, 264

Organizers:
Eric Ruggieri, *College of the Holy Cross*
Chasen Smith, *Georgia Southern University*

UNDERGRADUATE STUDENT PAPER SESSION

Pi Mu Epsilon Student Paper Sessions

2:30 P.M. - 6:05 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 236, 250, 264

Pi Mu Epsilon student members who wish to represent their chapters as student speakers or official delegates should visit the PME website at http://pme-math.org/ for more information.

Please note: all student presenters are required to be registered for MAA MathFest.

Organizer:
Darci Kracht, *Kent State University*

PANEL SESSION

Jumping into IBL Teaching: Reflections by First-Time Practitioners

3:00 P.M. - 4:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

Curious about Inquiry-Based Learning (IBL) but not sure where to start? So were they! In this panel, faculty who have recently taught an IBL-style course for the first time will reflect on their experiences. Panelists will share a typical day in the classroom along with lessons learned about what worked well and what they would change in the future. Courses represented will range from entry-level to upper divisional.

Organizers:
Angelynn Alvarez, *SUNY Potsdam*
Sarah Wolff, *Denison University*
Robert Kelvey, *The College of Wooster*

Panelists:
Emily Barnard, *Northeastern University*
Judit Kardos, *The College of New Jersey*
Sarah Nelson, *Lenoir-Rhyne University*
Kristen Pueschel, *Penn State University New Kensington*
Adam Giambrone, *Elmira College*

Sponsor:
SIGMAA on Inquiry-Based Learning (SIGMAA IBL)

TOWN HALL SESSION

Quantitative Literacy and Social Justice

3:00 P.M. - 4:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201

The relationship between quantitative literacy and social justice is complex, and there are many issues at stake as we teach in an era of alternative facts, dueling memes, and politically charged classrooms. SIGMAA-QL invites the mathematics community interested in issues of social justice as well as pathways toward a quantitatively literate society to a town hall discussion. At this discussion, we hope to initiate a conversation about the roles mathematicians play in promoting quantitative literacy for social justice (and vice versa). The organizers will bring questions to facilitate conversation, but everyone is invited to come and make their voices heard.

Organizers:
Gizem Karaali, *Pomona College*
Mark A. Branson, *Stevenson University*
Catherine Crockett, *Point Loma Nazarene University*
Victor Piercey, *Ferris State University*
Luke Tunstall, *Trinity University*

Sponsor:
SIGMAA on Quantitative Learning (SIGMAA QL)

CHRONOLOGICAL SCHEDULE CONTINUED

Friday, August 2 CONTINUED

POSTER SESSION

PosterFest 2019: Scholarship by Early Career Mathematicians

3:00 P.M. - 4:30 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM B

This poster session and networking event allows early career mathematicians to present and discuss their scholarly activities with senior mathematicians in an informal atmosphere. Untenured faculty and graduate students are especially encouraged to apply. Examples of scholarly activities suitable for this poster session include expository work, preliminary reports, scholarship of teaching and learning, and research reports. Please note that undergraduate submissions will not be accepted. Alternate opportunities for undergraduate students are available and can be found on the conference website. Questions regarding this session should be sent to the organizers.

Organizers:
Lisa Driskell, *Colorado Mesa University*
Holly Attenborough, *University of Wisconsin-Platteville*

Sponsors:
The MAA Committee on Early Career Mathematicians (ECM)
MAA Committee on Graduate Students
Young Mathematicians Network
MAA Project NExT

MINICOURSE

Minicourse 6. Mathematical Card Magic, Part B

3:40 P.M. - 5:40 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 202 & 203

Organizer:
Colm Mulcahy, *Spelman College*

MINICOURSE

Minicourse 5. Visualizing Projective Geometry Through Photographs and Perspective Drawings, Part B

3:40 P.M. - 5:40 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 204

Organizer:
Annalisa Crannell, *Franklin & Marshall College*

Sponsor:
SIGMAA-ARTS

INVITED ADDRESS

NAM David Harold Blackwell Lecture

Dudeney's No Three-In-Line Problem: Problem, Solutions, Conditions, Progress, and Conjectures

4:00 P.M. - 4:50 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A

Johnny L. Houston, *Elizabeth City State University*

In 1917, Henry Dudeney, an Englishman who had done some intriguing things with mathematical puzzles and games, posed an interesting question for persons interested in discrete geometry. Let an n x n grid be given in the Euclidean plane for any natural number n, what is the maximum number of points that can be identified in the grid so that no three of these points are in the same line (no 3 colinear). For various natural numbers n, solutions have been discovered and certain conditions have been encountered.

The presenter discusses many of these solutions and conditions. For large natural numbers n, even for some $n < 60$, progress (or lack of progress) is being made slowly. By the Pigeon Hole Principle, the maximum number of such points that can exist is $2n$. The problem of finding for which n this value is reached is known as the No-Three-In-Line Problem. Several conjectures exist. These conjectures and their motivations are discussed as well as some related problems. However, the No-Three-In-Line Problem is still an open problem.

The year 2019 is the centennial year of the honoree for which this lecture was named. The presenter will also discuss the life and contributions of David H. Blackwell.

Additionally, a light reception will follow the lecture to celebrate the National Association of Mathematicians's 100th anniversary.

SOCIAL EVENT

Estimathon!

4:00 P.M. - 5:45 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 232

They're called Fermi problems...
How heavy is the Eiffel Tower?
How many prime numbers have distinct digits?
How many calories would you be eating if you had "one of everything" at the Cheesecake Factory?

If you're looking for a mindbending mixture of math and trivia, look no further! Jane Street Capital presents The Estimathon contest: teams will have 30 minutes to work on 13 problems, ranging from totally trivial to positively Putnamesque. Can your team beat the all-time best score?? The top teams will receive prizes! As in past years, we will run 2 contests. Feel free to show up to either one!

(Please show up 15 minutes before the start time of the contest you want to join.)

CHRONOLOGICAL SCHEDULE

Our target schedule is as follows:
4:00 pm. Welcome, overview of rules and scoring.
4:15 pm. Estimathon contest #1
5:00 pm. Estimathon contest #2

Organizer:
Andy Niedermaier, *Jane Street Capital*

OTHER MATHEMATICAL SESSION
SCUDEM Gathering and Information Session

4:30 P.M. - 6:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 236
SCUDEM-SIMIODE Challenge Using Differential Equations Modeling Gathering of interested colleagues interested in host site coordinator issues, team registration, coaching teams, etc. to learn about SCUDEM IV 2091 event to be held on 9 November 2019. See www.simiode.org/scudem for complete details.

Organizer:
Brian Winkel, *Director of SIMIODE (Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations)*

SOCIAL EVENT
Pi Mu Epsilon Banquet

FRIDAY, AUGUST 2, 6:00 P.M. - 7:45 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM B
All PME members and their supporters are welcome. See the registration form for more information on this ticketed event.

SIGMAA ACTIVITY
SIGMAA TASHM Business Meeting, Reception, Sliffe Award Winners Celebration, & Guest Lecture

Using History and Education Research to Shape the Calculus Curriculum
6:00 P.M. - 7:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238
David Bressoud, *Conference Board of the Mathematical Sciences*

This talk will explain how the historical development of calculus should be used to inform its instruction. The standard order of the four big ideas—limits then derivatives then integrals then series—is wrong both historically and pedagogically. In addition, the standard models for derivatives and integrals, slopes of tangents lines and areas under curves, erect obstacles in the path of many students. Drawing on history and recent research in undergraduate mathematics education, this talk will make the case for calculus introduced first as problems of accumulation (integration), then ratios of change (differentiation), then sequences of partial sums (series), and finally the algebra of inequalities (limits).

SIGMAA ACTIVITY
SIGMAA Sports Business Meeting, Reception, and Guest Panel

Undergraduate Research in Mathematics & Sports
6:00 P.M. - 7:30 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 263
We will discuss ways in which faculty have mentored undergraduate projects related to mathematics and sports. Faculty will describe the various types of student research that was conducted, including interdisciplinary work, applied mathematics, sports analytics, and mathematics education. We hope that this will serve as a springboard for ideas on future work that can be conducted regarding mathematics and sports. We welcome all faculty and students to share their experiences and contribute to our discussion.

Panelists:
Daniel Dobbs, *Trine University*
R. Drew Pasteur, *College of Wooster*
Tetyana Berezovski, *St. Joseph's University*

Moderator:
Diana Cheng, *Towson University*

SOCIAL EVENT
Undergraduate Ice Cream Social

8:00 P.M. - 9:00 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM C
Besides cake and ice cream, we will recognize all students who gave talks in the MAA Student Paper Sessions, and award prizes for the best of them. All are invited.

Saturday, August 3

Registration & Information

8:00 A.M. - 3:00 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM LOBBY

OTHER MATHEMATICAL SESSION
PIC Math Showcase

Student Presentations
8:00 A.M. - 1:15 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM C
PIC Math prepares mathematical sciences students for industrial careers by engaging them in research problems that come directly from industry. In this session students who participated in PIC Math will give talks and poster presentations about their research, and mathematicians in industry will talk about what it is like to work in industry and what students need to do to succeed.

CHRONOLOGICAL SCHEDULE CONTINUED

Saturday, August 3 CONTINUED

8:00 a.m. - 10:00 a.m.	Eight students talks at 15-minute intervals
10:00 a.m. - 11:00 a.m.	Two mathematicians from industry speak in 30-minute intervals
11:00 a.m. - 12:00 p.m.	Break
12:00 p.m. - 1:15 p.m.	PIC Math student poster session

Sponsors:
PIC Math is an MAA program that is funded by the National Science Foundation (NSF grant DMS-1722275) and the National Security Agency (NSA).

OTHER MATHEMATICAL SESSION
MAA MathFest Mentoring Workshop for Women (MMWW)

8:30 A.M - 1:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201
A half-day workshop providing information for undergraduate women interested in advanced study in mathematics. Information will be provided on graduate study in mathematics, careers available to women with an advanced mathematics degree, and constructing a life as a mathematician.

Organizer:
Deanna Haunsperger, *Carleton College*

INVITED ADDRESS
MAA James R.C. Leitzel Lecture

What's at Stake in Rehumanizing Mathematics?
9:00 A.M. - 9:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Rochelle Gutiérrez, *University of Illinois*

Embracing an "equity" standpoint that has been poorly defined (Gutiérrez, 2002) or constantly shifting (NCTM, 2008) has led to a state of "tinkering" as opposed to real change within mathematics (Gutiérrez, 2017). That is, our progress has often focused on, and ended with, closing the achievement gap or recruiting more diverse students into the mathematical sciences, but not trying to radically reimagine a mathematics that supports students, teachers, and members of society to thrive, something I refer to as Rehumanizing Mathematics. This approach begins with 1) acknowledging some of the dehumanizing experiences in mathematics for students, teachers, and citizens and 2) designing ways for people to be provided with windows and mirrors onto the world and relating to each other with dignity through mathematics. This focus on Rehumanizing Mathematics allows us to think differently about student misconceptions, teachers as identity workers, the histories of mathematics, our bodies in relation to mathematics, and why it is not just that diverse people need mathematics but mathematics needs diverse people. In this talk, I explore "what's at stake" along two dimensions: 1) what it means for teachers, students, and society if we do not rehumanize mathematics and 2) what knowledge bases, sensibilities, and forms of risk taking it will require from us as mathematicians (and mathematics educators) if we commit deeply to rehumanizing mathematics.

INVITED PAPER SESSION
Commutative Algebra

9:00 A..M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 200
Commutative algebra is a central discipline at the intersection of algebraic geometry, number theory, combinatorics, and so on. Many of the foundations were laid by Emmy Noether. Modern commutative algebra combines techniques from computational symbolic algebra, combinatorics, graph theory, and homological and homotopical algebra. The session will cover many flavors with a broad appeal towards the subject's natural influence.

Organizers:
Irena Swanson, *Reed College*
Lance Miller, *University of Arkansas, Fayetteville*

Convergence of Rees Valuations
9:00 A.M. - 9:20 A.M.
Matthew Toeniskoetter, *Florida Atlantic University*

An Algebraic Condition that Allows Us to Do Intersection Theory
9:30 A.M. - 9:50 A.M.
Patricia Klein, *University of Kentucky*

On Flavors of Factorization in Commutative Rings with Zero Divisors
10:00 A.M. - 10:20 A.M.
Ranthony A.C. Edmonds, *Ohio State University*

Direct-sum Decompositions of Modules: The Good, the Bad, and the Ugly (aka Interesting)
10:30 A.M. - 10:50 A.M.
Nicholas Baeth, *Franklin and Marshall College*

Syzygy - When Submodules Align
11:00 A.M. - 11:20 A.M.
Courtney Gibbons, *Hamilton College*

CONTRIBUTED PAPER SESSION
Enhance Your Teaching through Best Practices That Align with the Instructional Practices Guide, Part B

9:00 A.M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 232

Organizers:
Carolyn A. Yackel, *Mercer University*
Mindy Capaldi, *Valparaiso University*

Sponsor:
Committee on the Teaching of Undergraduate Mathematics (CTUM)

CHRONOLOGICAL SCHEDULE

Saturday, August 3 CONTINUED

Writing to Promote Understanding in a First College Math Course
9:00 A.M. - 9:15 A.M.
Daniel Schultheis, *Smith College*

From Formative to Summative: Using a Proof Portfolio to Teach Proof-Writing
9:20 A.M. - 9:35 A.M.
Matt Boelkins, *Grand Valley State University*

An Interactive, Digital, Annotation Platform as a Mechanism for Out-of-Class Engagement, Community-Building, and Peer Instruction
9:40 A.M. - 9:55 A.M.
Abigail Higgins, *Sacramento State University*

Building Social, Teaching, and Cognitive Presence in the Face-to-face Classroom: Practices Borrowed from Online Instruction that Align with the MAA IP Guide
10:00 A.M. - 10:15 A.M.
Andrew George, *Penn State Erie*

Active Learning in Large Lecture Courses
10:20 A.M. - 10:35 A.M.
Bobby W. Ramsey, *The Ohio State University*

Fostering Student Engagement
10:40 A.M. - 10:55 A.M.
Lew Ludwig, *Denison University*

Developing Persistence and Growth Mindset through Formative Assessment
11:00 A.M. - 11:15 A.M.
Zoë Misiewicz, *SUNY Oneonta and SUNY Oswego*

Maintaining Instructional Best Practices in a Multi-Section Coordinated Course Environment
11:20 A.M. - 11:35 A.M.
Ryan Therkelsen, *University of Cincinnati*
Noel DeJarnette, *University of Cincinnati*

Teaching Linear Algebra with an Inquiry-Based Textbook and Applications
11:40 A.M. - 11:55 A.M.
Steven Schlicker, *Grand Valley State University*
Feryal Alayont, *Grand Valley State University*

CONTRIBUTED PAPER SESSION

Mathematics and Sports

9:00 A.M. - 12:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 206

The expanding availability of play-by-play statistics and video-based spatial data have led to innovative research using techniques from across the mathematical sciences, with impacts on strategy and player evaluation. Other areas of interest include ranking methods, predictive models, physics-based analysis, etc. Research presentations, expository talks, and contributions related to curriculum or pedagogy are all welcome. With a broad audience in mind, talks should be accessible to undergraduate mathematics majors, and projects involving undergrads are particularly encouraged for submission.

Organizer:
Drew Pasteur, *College of Wooster*

Sponsor:
SIGMAA on Mathematics and Sports (SIGMAA Sports)

Ranking Sports Teams with Perron-Frobenius Eigenvectors
9:00 A.M. - 9:15 A.M.
Nathaniel M. Iverson, *Siena Heights University*

Ranking Major League Pitchers and Batters Using the Oracle Method, an Update
9:20 A.M. - 9:35 A.M.
Tom Tegtmeyer, *Trinity University*

Predicted Performance Using Bayesian Inference
9:40 A.M. - 9:55 A.M.
Ollie Nanyes, *Bradley University*

Building and Using a Baseball Simulator to Analyze Batting Orders
10:00 A.M. - 10:15 A.M.
Paul von Dohlen, *William Paterson University*

Using Sports to Introduce Game Theory
10:20 A.M. - 10:35 A.M.
Daniel Shifflet, *Clarion University of Pennsylvania*

NFL Betting and Expected Value
10:40 A.M. - 10:55 A.M.
Jathan Austin, *Salisbury University*

Faster and Higher over Ice: Biomechanical Principles Used to Push the Boundaries in Figure Skating
11:00 A.M. - 11:15 A.M.
Diana Cheng, *Towson University*

Player Course Interactions on the PGA Tour
11:20 A.M. - 11:35 A.M.
Roland Minton, *Roanoke College*

CHRONOLOGICAL SCHEDULE CONTINUED

Saturday, August 3 CONTINUED

Envy-Free March Madness Bracketing
11:40 A.M. - 11:55 A.M.
R. Drew Pasteur, *College of Wooster*

CONTRIBUTED PAPER SESSION
Diversity, Equity, and Inclusion in Mathematics, Part C

9:00 A.M. - 11:00 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238

Organizers:
Joel Kilty, *Centre College*
Ranthony A.C. Edmonds, *The Ohio State University*
Alison Marr, *Southwestern University*
Alex M. McAllister, *Centre College*

The Limit Does Not Exist: The Value of Math Education in Prison
9:00 A.M. - 9:15 A.M.
Simone Sisneros-Thiry, *University of Illinois at Urbana-Champaign*
M. Sean Lawless, *University of Illinois at Urbana-Champaign*
Mario Rubio, *University of Illinois at Urbana-Champaign*
Joshua Jeishing Wen, *University of Illinois at Urbana-Champaign*

Exploring Equity in Co-Requisite First Year Mathematics and Statistics
9:20 A.M. - 9:35 A.M.
Jennifer Elyse Clinkenbeard, *California State University Monterey Bay*
Alison Lynch, *California State University Monterey Bay*
Peri Shereen, *California State University Monterey Bay*

Recruitment, Resilience, and Reaching Higher via Early Research Experiences
9:40 A.M. - 9:55 A.M.
Roberto Soto, *California State University, Fullerton*

The NREUP and Howard's Program
10:00 A.M. - 10:15 A.M.
Dennis Davenport, *Howard University*

Supporting the Transition to Undergraduate Mathematics: Collaborative Learning and Mentoring in Teams
10:20 A.M. - 10:35 A.M.
Nathan N. Alexander, *Morehouse College*

Conversations Across the Divide
10:40 A.M. - 10:55 A.M.
Linda Braddy, *Tarrant County College*

CONTRIBUTED PAPER SESSION
Building Teaching Teams: Professional Development in Departments

9:00 A.M. - 10:40 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 230 & 231
Research has shown that professional development programs play an important role in developing instructors who are more student-focused, but financial constraints, time limitations, and lack of buy-in often serve as barriers to offering these types of programs. This session will showcase a wide range of professional development programs situated within mathematics departments.

Organizers:
Sarah Mayes-Tang, *University of Toronto*
Jessica Deshler, *West Virginia University*

On Fire: FFLAME and the ECCP
9:00 A.M. - 9:15 A.M.
Jeffrey Kurtz, *Denison University*
May Mei, *Denison University*

Job Embedded Professional Development in an Introductory Statistics Course
9:20 A.M. - 9:35 A.M.
Sharona Krinsky, *California State University Los Angeles*

Providing Mentorship and Professional Development at a Metropolitan University
9:40 A.M. - 9:55 A.M.
Emily Hendryx, *University of Central Oklahoma*
Kristi Karber, *University of Central Oklahoma*

Starting a Calculus Community of Practice
10:00 A.M. - 10:15 A.M.
Sarah Mayes-Tang, *University of Toronto*
Mihai Nica, *University of Toronto*

Creating Overlapping Communities of Practice
10:20 A.M. - 10:35 A.M.
Elizabeth Miller, *The Ohio State University*
Jenny Sheldon, *The Ohio State University*

CONTRIBUTED PAPER SESSION
My Favorite Number Theory Proof

9:00 A.M. - 11:20 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 207 & 208
Presenters share favorite proofs suitable for introductory proofs or undergraduate number theory courses, giving the complete proof, discussing how the proof fits into the course, providing information regarding prerequisite topics, areas of difficulty, and making the proof accessible for students. Modifications to the proof over time, historical information, and explorations/demonstrations used to make related theorems/topics comprehensible for students are discussed.

CHRONOLOGICAL SCHEDULE

Saturday, August 3 CONTINUED

Organizers:
Sarah L. Mabrouk, *Framingham State University*

Divisibility, Modular Arithmetic, and Induction, Oh My!
9:00 A.M. - 9:15 A.M.
Martha H. Byrne, *Sonoma State University*

Various Teaching Strategies to Prove that a Certain Conjecture is Equivalent to Goldbach's Conjecture
9:20 A.M. - 9:35 A.M.
Kristi Karber, University of Central Oklahoma

Fermat's Bracelets and Wilson's Polygons: Seeing Two Foundational Theorems Geometrically
9:40 A.M. - 9:55 A.M.
Adam J. Hammett, *Cedarville University*

Euler's Criterion
10:00 A.M. - 10:15 A.M.
Scott Williams, *University of Central Oklahoma*

Seeding Polynomials for Quadratic Congruences Modulo Prime Powers
10:20 A.M. - 10:35 A.M.
Larry Lehman, *University of Mary Washington*

The Exact Power of p dividing n!
10:40 A.M. - 10:55 A.M.
Scott Zinzer, *Aurora University*

A Silver Version of Dirichlet's Bronze Approximation Theorem
11:00 A.M. - 11:15 A.M.
Andrew J. Simoson, *King University*

CONTRIBUTED PAPER SESSION

Math + X: Mathematics Courses, Curriculum, and Projects Serving Professional Disciplines, Part B

9:00 A.M. - 11:20 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 260, 261, &262

Organizers:
Francisco Savina, *Charles A. Dana Center, University of Texas at Austin*
Stuart Boersma, *Central Washington University*

Matrix Algebra and Multivariate Calculus Modules to Prepare Students for Data Science Graduate Programs
9:00 A.M. - 9:15 A.M.
Hong P. Liu, *Embry-Riddle Aeronautical University*
Keshav Acharya, *Embry-Riddle Aeronautical University*

Math+CEMA: Computational and Engineering Mathematics Concentration for Mathematics Majors at NC Central University
9:20 A.M. - 9:35 A.M.
Alade O. Tokuta, *NC Central University*
RN Uma, *NC Central University*
Gaolin Z. Milledge, *NC Central University*
Xinyu Huang, *NC Central University*

A Faculty Learning Community to Support Mathematics for Students in Nursing, Social Work, and Business
9:40 A.M. - 9:55 A.M.
Victor I. Piercey, *Ferris State University*
Rhonda Bishop, *Ferris State University (Nursing)*
Mischelle Stone, *Ferris State University (Social Work)*

Math for the Health Sciences
Magdalena Luca, *MCPHS University*

Intentional Course Design for Project-Based Courses
10:20 A.M. - 10:35 A. M.
Jessica Stewart Kelly, *Christopher Newport University*

BIG Problems in Mathematics
10:40 A.M. - 10:55 A.M.
Megan Sawyer, *Southern New Hampshire University*

How the Government Shutdown Derailed My Plans for a Series of Introduction to Statistics Projects and How I Got the Projects Back on Track
11:00 A.M. - 11:15 A.M.
John Noonan, *Mount Vernon Nazarene University*

CHRONOLOGICAL SCHEDULE CONTINUED

Saturday, August 3 CONTINUED

CONTRIBUTED PAPER SESSION

Recreational Mathematics: Puzzles, Card Tricks, Games, Gambling and Sports, Part C

9:00 A.M. - 11:40 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 233

Organizers:
Paul R. Coe, *Dominican University*
Sara B. Quinn, *Dominican University*
Kristen Schemmerhorn, *Concordia University Chicago*
Andrew Niedermaier, *Jane Street Capital*

Sponsor:
SIGMAA on Recreational Mathematics (Rec SIGMAA)

Equilibrium Patterns in the Candy-Sharing Circle
9:00 A.M. - 9:15 A.M.
Ryan Higginbottom, *Washington & Jefferson College*

Frogs + Puzzles = Algorithmic Thinking
9:20 A.M. - 9:35 A.M.
Edmund A. Lamagna, *University of Rhode Island*

Padovan, Pascal, and Proofs Without Words
9:40 A.M. - 9:55 A.M.
David Nacin, *William Paterson University*

Analyzing Playing Card Cryptosystems
10:00 A.M. - 10:15 A.M.
Eric Landquist, *Kutztown University*
Isaac Reiter, *Kutztown University*

KRYPTOS: A Cryptanalysis Contest for Undergraduates
10:20 A.M. - 10:35 A.M.
Stuart Boersma, *Central Washington University*
Cheryl Beaver, *Western Oregon University*

World's First 19-Sided Perfect Enneadecagon Construction
10:40 A.M. - 10:55 A.M.
Genghmun Eng

Fibonacci and Adaptive Strategies to Beat the Streak!
11:00 A.M. - 11:15 A.M.
Michael Nathanson, *Saint Mary's College of California*

Systematic Counting, Binomial Coefficients, Playoff Scenarios and the 150th Anniversary of The Cincinnati Reds
11:20 A.M. - 11:35 A.M.
Jay L. Schiffman, *Rowan University*

PANEL SESSION

Building a Community of Practice to Prepare Graduate Students to Teach Undergraduate Mathematics

9:00 A.M. - 10:20 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

CoMInDS is an NSF funded MAA project whose purpose is to support faculty who are preparing graduate students to teach undergraduate mathematics, including providing workshops, establishing a professional community of practice and developing an online resource suite of instructional materials. In this panel, we will show how CoMInDS is using MAA's new community platform to support this work.

Organizer:
Jack Bookman, *Duke University*

Panelists:
Doug Ensley, *Shippensburg University*
Teri J Murphy, *University of Cincinnati*
Jack Bookman, *Duke University*
Emily Braley, *Harvard University*

WORKSHOP

Get the Facts Out!

9:00 A.M. - 10:20 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Many math and science majors, despite an interest in teaching, do not pursue it as a career. Why? Research shows they (and their college faculty!) may hold beliefs such as: teacher pay is a lot less than other jobs, teachers can't retire, and teachers are unhappy. Get the Facts Out resources can help counter these myths with data from empirical studies. This workshop will share these resources as well as offer assistance in creating materials to use in your own location.

Get the Facts Out is an NSF-funded collaborative effort between the Mathematical Association of America, the Colorado School of Mines, the American Physical Society, the American Chemical Society, and others.

Organizers:
Judith Covington, *Louisiana State University*
Christina Eubanks-Turner, *Loyola Marymount University*
Ben Ford, *Sonoma State University*
Timothy Hendrix, *Meredith College*
Rose Zbiek, *Pennsylvania State University*

CHRONOLOGICAL SCHEDULE

Saturday, August 3 CONTINUED

GRADUATE STUDENT PAPER SESSION

Great Talks for a General Audience: Coached Presentations by Graduate Students

9:00 A.M. - 1:00 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM D AND ROOM 211

While graduate students gain experience speaking about their research to experts in their field, many do not have the opportunity to present their research to non-experts. This session gives graduate students the chance to give a research talk, aimed at sophomore mathematics majors. Participants work with session organizers throughout the creation of their talks.

Organizers:
Jim H. Freeman, *Cornell College*
May Mei, *Denison University*
Ranjan Rohatgi, *Saint Mary's College*
Aliza Steurer, *Dominican University*

Sponsor:
MAA Committee on Graduate Students

SESSION FOR UNDERGRADUATE STUDENTS

USA Problem Solving Competition

9:00 A.M. - 10:30 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 264

This event is the finals of The Problem Solving Competition. Universities and colleges that participate monthly on their own campuses by holding problem solving contests are invited to send a contestant. Each contestant will be required to solve a series of mathematical problems. Based upon the outcome, a champion along with second through sixth place winners will be named.

Organizer:
Richard Neal, *The American Society for Mathematics (ASFM)*

INVITED ADDRESS

Earle Raymond Hedrick Lecture Series

Complex Dynamics and Elliptic Curves, Lecture III
10:00 A.M. - 10:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Laura DeMarco, *Northwestern University*

OTHER MATHEMATICAL SESSION

Julia Robinson Mathematics Festival

10:00 A.M. - 12:00 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM B

The Julia Robinson Mathematics Festival (JRMF) consists of interactive and varied mathematical games, puzzles, problems, and activities. Participants choose which activity to engage in and for how long. Facilitators guide but don't demonstrate or teach so participants can discover, explore, and enjoy mathematics. The event provides an opportunity for faculty and teachers to learn how they could host a JRMF locally.

Organizers:
Japheth Wood, *Bard College*
Thomas Clark, *Dordt College*

CONTRIBUTED PAPER SESSION

Encouraging Effective Teaching Innovation, Part D

10:30 A.M. - 12:10 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Organizers:
Susan Crook, *Loras College*
David Failing, *Lewis University*
Russ Goodman, *Central College*
Mami Wentworth, *Wentworth Institute of Technology*
Mel Henriksen, *Wentworth Institute of Technology*

Introduction to Proof Techniques in a Geometry Course
10:30 A.M. - 10:45 A.M.
Carol Bell, *Northern Michigan University*

Project-Based Learning in Analysis
10:50 A.M. - 11:05 A.M.
Kevin Gerstle, *Hillsdale College*

An Alternate Method for Project Presentation in a Math Course
11:10 A.M. - 11:25 A.M.
Abigail Bishop, *Iona College*

Quantitative Consulting: An Interdisciplinary PIC Math Course
11:30 A.M. - 11:45 A.M.
Catie Patterson, *Austin College*

Building Course Embedded Undergraduate Research Experience (CURE) in a Mathematics Major Pathway
11:50 A.M. - 12:10 P.M.
Lipika Deka, *California State University Monterey Bay*
Jeffrey Wand, *California State University Monterey Bay*
Peri Shereen, *California State University Monterey Bay*

PANEL SESSION

Graduate School in Mathematics: What's it Like, and How Do You Get In?

10:30 A.M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, ROOM 263

This panel is for undergraduates considering graduate school in the mathematical sciences. Graduate students in mathematics must take courses, pass qualifying exams, write a thesis, and serve as a Teaching Assistant. We discuss how these may vary from school to school and then focus on the application process: What do you need to apply? What does it take to get in? How many schools should you apply to? When will you hear? etc. Panelists will include several graduate chairs and current graduate students.

CHRONOLOGICAL SCHEDULE CONTINUED

Saturday, August 3 CONTINUED

Organizer:
Ruth Haas, *University of Hawaii*

Panelists:
Michael Goldberg, *University of Cincinnati*
Richard McGehee, *University of Minnesota*
Laura Wells, *Notre Dame*
Craig Zirbel, *Bowling Green State University*

INVITED ADDRESS
MAA Invited Address

A Vision of Multivariable Calculus
11:00 A.M. - 11:50 A.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Robert Ghrist, *University of Pennsylvania*

This talk will address certain challenges in teaching multivariable calculus. Classical texts emphasize calculus in dimensions two or three, based on 19th and 20th century applications to physics. At present, many of our students are more motivated by data and systems in higher dimensions. How can a calculus course best adapt to these needs, without overwhelming students (or professors)? This talk will outline a plan for increasing both the dimension and sophistication of multivariable calculus instruction with the use of video. Topics covered will include the use of visualization, matrix algebra, and differential forms.

SIGMAA ACTIVITY
UR SIGMAA Guest Panel and Lunch

11:30 A.M. - 1:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 237 & 238
Choosing research problems to work on with undergraduate students is an art. What are some good qualities to look for in a research problem for students? A panel of successful undergraduate research mentors will share their experiences to begin a broader conversation on this topic that can continue over food and drinks, provided by the Undergraduate Research SIGMAA.

COMMITTEE MEETING
MAA Business Meeting

1:15 P.M. - 1:45 P.M., DUKE ENERGY CONVENTION CENTER, JUNIOR BALLROOM D
The meeting is organized by MAA Secretary James Sellers, *Penn State University*, and is chaired by MAA President Michael Dorff, *Brigham Young University.*

Martin Gardner Lecture

Recreational Mathematics and Computer Science: Martin Gardner's Influence on Research
2:00 P.M. - 2:50 P.M., DUKE ENERGY CONVENTION CENTER, GRAND BALLROOM A
Erik Demaine, *Massachusetts Institute of Technology*

Martin Gardner's beautiful writing about fascinating mathematics, puzzles, and magic tricks has attracted and inspired many people to become mathematicians. At an even deeper level, Martin's writings highlighted exciting research directions and posed open problems which directly influenced mathematical research. Much of my own research was deeply influenced by Martin Gardner, in both recreational mathematics and a branch I call "recreational computer science". While most of this research may have started out recreational, many of the results also have practical applications. I will give a tour of many examples of Gardner's writings and how it inspired new research, from paper folding to mazes to penny puzzles to polyomino packing to magic. I encourage you all to read more Martin Gardner and look for more unsolved research questions and directions.

WORKSHOP
Origami Boxes full of Mathematics

3:00 P.M. - 4:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 201
Origami can be described as mathematics in action! In this workshop we will construct an origami box from a rectangular sheet of paper and explore the relationship between the dimensions of the sheet and the dimensions of the constructed box. The mathematics involved with this activity draws upon several of branches of mathematics such as algebra, geometry and calculus.

Organizer:
Arsalan Wares, *Valdosta State University*

MINICOURSE
Minicourse 1. Beyond Traditional Grading Schemes, Part B

3:00 P.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOMS 202 & 203

Organizers:
Jessica O'Shaughnessy, *Shenandoah University*
Jeb Collins, *Mary Washington University*
Amanda Harsey, *Lewis University*
Alyssa Hoofnagle, *Wittenberg University*
Mike Jansen, *Dordt College*

Sponsor:
MAA Committee on Assessment

INVITED ADDRESS

CHRONOLOGICAL SCHEDULE CONTINUED

Saturday, August 3 CONTINUED

MINICOURSE

Minicourse 2. Creating a Purposeful Student Learning Experience, Part B

3:00 P.M. - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 204

Organizers:
Dan Callon, *Franklin College*
John Boardman, *Franklin College*
Paul Fonstad, *Franklin College*
Justin Gash, *Franklin College*
Stacy Hoehn, *Franklin College*
Angie Walls, *Franklin College*

OTHER MATHEMATICAL SESSION

Backgammon

3:00 P.M - 5:00 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 264

Learn to play backgammon from expert players. It's a fun and exciting game where players with a good mathematics background have a decisive advantage. Boards and free lessons will be provided by members of the US Backgammon Federation. Stop by anytime!.

Organizers:
Art Benjamin, *Harvey Mudd College*

CONTRIBUTED PAPER SESSION

Encouraging Effective Teaching Innovation, Part E

3:30 P.M. - 5:20 P.M., DUKE ENERGY CONVENTION CENTER, ROOM 205

Organizers:
Susan Crook, *Loras College*
David Failing, *Lewis University*
Russ Goodman, *Central College*
Mami Wentworth, *Wentworth Institute of Technology*
Mel Henriksen, *Wentworth Institute of Technology*

A Calculus Study: Class Preparation Worksheets
3:00 P.M. - 3:15 P.M.
Sarah Ann Fleming, *Belmont University*

Manipulative Calculus: Active Learning with 3D Models
3:20 P.M. - 3:35 P.M.
Stepan Paul, *Harvard University*
Janet Chen, *Harvard University*

The Transformation of a Luddite: Using Technology Outside of the Classroom Setting
3:40 P.M. - 3:55 P.M.
John Prather, *Ohio University*

Full Speed Ahead: A Day 1 Calculus Activity
4:00 P.M. - 4:15 P.M.
Benjamin Wilson, *Stevenson University*

The Challenges — and Successes — of Remediation in Calculus
4:20 P.M. - 4:35 P.M.
Paul N. Runnion, *Missouri S&T*

Collaborative Calculation (CoCalc) in the Classroom
4:40 P.M. - 4:55 P.M.
Michelle L. Isenhour, *Naval Postgraduate School*

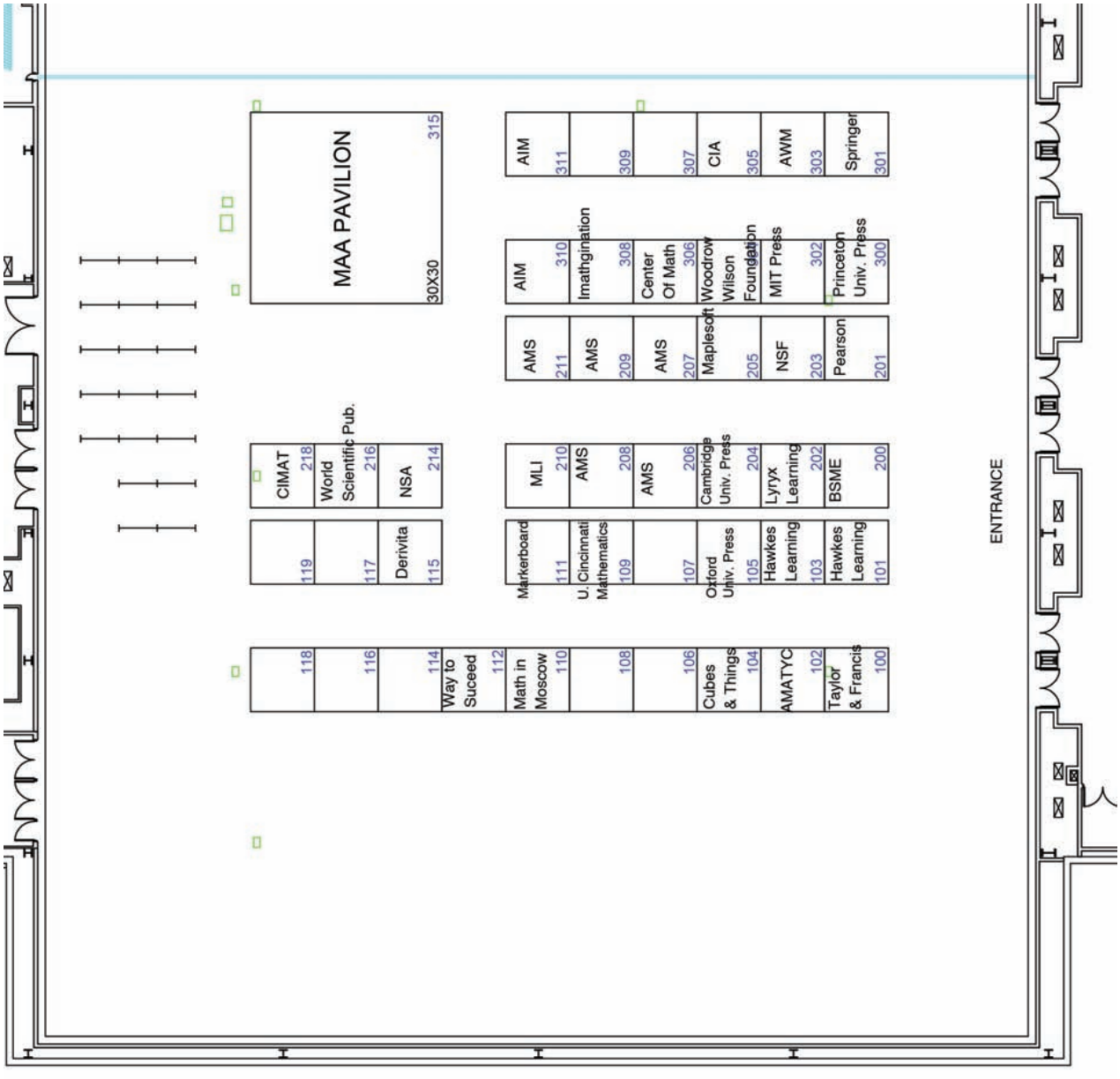
Interacting with Partial Derivatives
5:00 P.M. - 5:15 P.M.
Tevian Dray, *Oregon State University*
David Roundy, *Oregon State University*
Aaron Wangberg, *Winona State University*

EXHIBITORS

DUKE ENERGY CONVENTION CENTER SECOND FLOOR – MEETING ROOM LEVEL

DUKE ENERGY CONVENTION CENTER THIRD FLOOR - BALLROOM LEVEL

DUKE ENERGY CONVENTION CENTER - MAA EXHIBIT HALL, GRAND BALLROOM B



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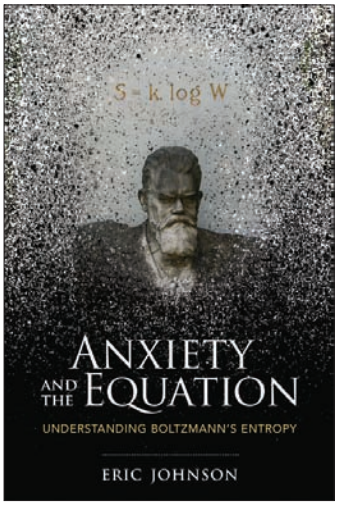

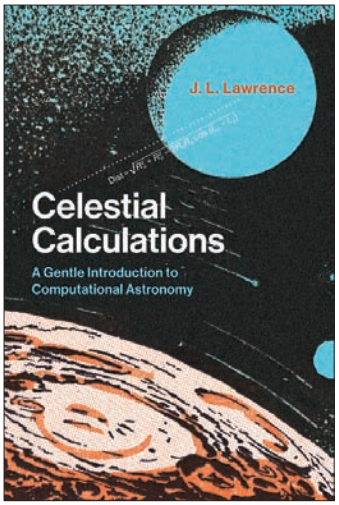

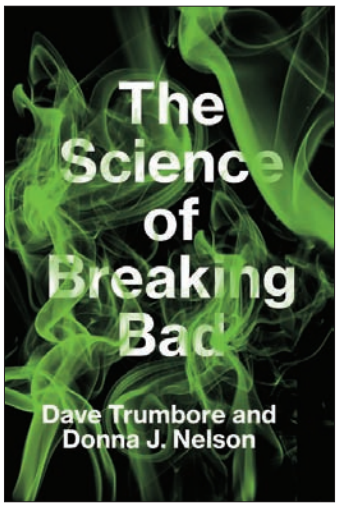

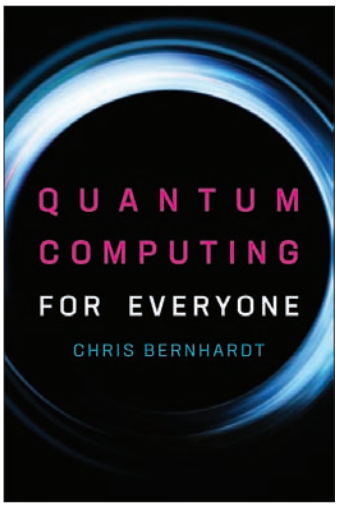

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