The Michigan Section of the Mathematical Association of America and MichMATYC 93rd Annual Meeting

FERRIS STATE UNIVERSITY

Big Rapids, Michigan

March 31 - April 1, 2017

Michigan Section of the Mathematical Association of America

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2017 Annual Meeting of the
Michigan Section of the MAA & MichMATYC

The 2017 Annual Meeting of the Michigan Section of the Mathematical Association of America and the Michigan Mathematical Association of Two-Year Colleges is being held on Friday and Saturday, March 31 and April 1, on the campus of Ferris State University in Big Rapids, Michigan. The registration desk and exhibits are in the University Center, outside of 202 AB, with registration beginning at 1:15 p.m. on Friday. Talks are in the University Center, Rooms 202 AB, 203, 209, 211, 213, and 217. A map of campus is available in the registration materials provided with this program, or on-line at
`https://www.ferris.edu/HTMLS/ferrisfaq/maps/Campus_Map_Color.pdf`.

Program Notes: Pages 4-6 give the timetable for this year's program, and pages 7–21 provide abstracts. Talks by undergraduates are denoted with an asterisk "∗," and the talks by graduate students are denoted with a double dagger "‡." Pages 22-25 provide lined note paper if you wish to take notes during any of the presentations.

Meals: *(Advance registration is required. Contact Erin Militzer with questions:* `<militze@ferris.edu>`*.)*

- **Friday dinner (University Center, Room 202 AB)**: Chicken piccata, wild rice garden blend, candied carrots, cloverleaf rolls, tossed salad, sheet cake. $10
- **Saturday breakfast (University Center, Room 202 AB)**: Continental breakfast. Included in registration.
- **Saturday lunch (University Center, Room 202 AB)**: Festiva chips, beef and chicken fajitas, fajita toppings, refried beans, fiesta rice, assorted cookies. $10
- **Saturday student lunch (University Center, Room 217)**: Pizza lunch. Included in registration for undergraduate students.
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has generously sponsored our coffee breaks.

Parking: You may park without a permit in Lots 1 & 13 on Friday 3/31 after 12:00 PM and all day on Saturday 4/1.

Lodging: The following hotels are recommended:

- Holiday Inn Big Rapids (1005 Perry Ave.; 231-796-4400)
- Quality Inn & Suites (1705 S. State St.; 231-592-5150)
- Country Inn & Suites, Big Rapids (15344 Waldron Way; 231-527-9000)
- Super 8 Big Rapids (845 Water Tower Rd.; 231-796-1588)

Student Activities: The Ron Mosier Memorial Award will be presented at the closing awards session to the student(s) with the most outstanding talk. Saturday there will be a pizza lunch for the MUMC at 12pm in University Center 217.

Internet Access: The University Center has public wifi. Any issues with connecting to the internet should be brought to the registration table.

Optional Free Tours:

- Jim Crow Museum (FLITE library, basement, across the quad from the University Center). **Guided Tours: Friday: 9:30 a.m. to 11 a.m. and 3:30 p.m. to 5 p.m; Saturday: 2:00 p.m. to 3:30 p.m.** Walk-in Hours: Friday and Saturday, 12 p.m. to 5 p.m
- Museum of Sexist Objects (STARR 314, across the street from the University Center). **Guided Tours: Friday: 11 a.m. to 12:00 p.m. and 4:00 p.m. to 5 :00 p.m.; Saturday: 11:00 a.m. to 12:00 p.m. and 3:30 p.m. to 4:30 p.m.**
- The Card Wildlife Education Center is a 5,000 square foot facility located on the ground floor of the Arts and Sciences Commons building (Room 011) on the Ferris State University Campus in Big Rapids, Michigan. The primary function of the Card Wildlife Education Center and Wildlife Museum is to serve as an educational resource for Ferris State University college students, K-12 school children, and members of the Michigan Community. Hours of operation: Friday, 9:00 a.m. - 5:00 p.m; Saturday, 10:00 a.m. - 3:00 p.m.

Saturday Panel Discussion: The Ferris State University Quantitative Reasoning Project: Student Voices

On Saturday from 9:30-10:35 a.m. in University Center 217, a panel of students will share their experiences, moderated by faculty from the Mathematics and English departments, regarding inquiry-based, hybrid quantitative reasoning and algebra courses developed by the mathematics faculty at Ferris State University, in partnership with faculty from partner disciplines. *No advanced registration is required to attend this panel discussion.*

Student Panelists

- Pachience Booker
- Rashawnda Brooks
- Justin Daro
- Justine Hibbard
- Brett Hoeft
- Rebecca McCarty

Faculty Moderators

- Roxanne Cullen, Ferris State University, English
- Erin Militzer, Ferris State University, Math
- Victor Piercey, Ferris State University, Math
- Melissa Smith, Ferris State University, English
- Anil Venkatesh, Ferris State University, Math

2017 Joint MAA/MichMATYC Meeting, Ferris State University

Friday, March 31, 2017

1:15-2:15	Registration (University Center - Outside of 202 AB)		
2:15-3:20	University Center 202 AB Welcome- Dr. Kristi L. Haik, Dean of the College of Arts and Sciences, Ferris State University Opening Plenary- JP Cossey, University of Akron *An Algebraist Tries to Do Combinatorics with Undergrads, and Occasionally Doesn't Completely Fail*		
3:30-4:10	Local Invited Lecture (University Center 217) Dawn Archey, University of Detroit Mercy *The Boy who Cried Wolf and the Mathematicians Who Said Math Was Really Useful*		Local Invited Lecture (University Center 203) David Murphy, Hillsdale College *It Takes a Community*
	University Center 209	**University Center 211**	**University Center 213**
4:15-4:35	Tanweer Shapla and Khairul Islam (EMU) *Communicate Large Sample Concepts in Statistical Education Using Simulation*	Gerry Cox (Lake Michigan College) *Using an Introductory Calculus Text to Teach a PreCalculus Algebra/Trig. Class*	*Jeff Ford and Leighann McReynolds (Ferris State U) *Strategies for Smokestack: A Statistical Analysis of Card Game Algorithms*
4:40-5:00	Anil Venkatesh (Ferris State U) *Mastery-Based Assessment: An Implementation with Reflective Writing*	Arlo Caine (Cal State Poly U Pomona) *Text Recognition with Computational Topology and Geometry*	ǂ Sarah Hayes (CMU) *Mathematics of Needlework: An Introduction to Knit and Crochet*
5:10-5:40	Business Meeting (University Center 203)		
5:30-6:30	Refreshments (University Center 202 AB)		
6:30-9:00	Banquet and Plenary Lecture (University Center 202 AB) Timothy Chartier, MAA Section Visitor, Davidson College *Mathematical Celebrity Look-Alikes*		

Saturday, April 1, 2017				
8:00-12:00	Registration (University Center - Outside of 202 AB)			
8:00-12:00	Continential Breakfast (University Center 202 AB) *(served until food is gone or lunch begins)*			
8:45-9:40	Plenary Lecture (University Center 202 AB) Matthew Wyneken, MI-AMTE President, University of Michigan-Flint *The Association of Mathematics Teacher Educators (AMTE) - Celebrating 25 Years*			
	Michigan Undergraduate Math Conference	**Contributed Papers**		
	University Center 209	**University Center 211**	**University Center 213**	**University Center 217**
9:50-10:10	* Jon Wilson (Ferris State U) *Entropy of Non-Rectangular LEGO™ Bricks*	Khairul Islam (EMU) *The Invariance of Chi-Squared Test under Various Probabilistic Models*	Jon Oaks (Macomb Community College) *Teaching Vocabulary in the Mathematics Classroom*	The Ferris State University Quantative Reasoning Project: Student Voices
10:15-10:35	* Rebecca Robinson (UM Flint) *A Markov Chain Model for the Viral Spread of Internet Memes*	* Huizhen Zhang, Hongli Zhang, and Marissa Mizwa (LTU) *An Optimized Modern Toll Plaza: An Application of Queuing Theory and the Poisson Distribution*	Feryal Alayont (GVSU) *Analyzing Student Work as a Way to Learn the Intracacies of Counting Techniques*	
10:40-11:20	**Break (University Center 202 AB)**			
11:20-11:55	Local Invited Lecture (University Center 217) Katrina Piatek-Jimenez, Central Michigan University *College Students' Stereotypes of Mathematicians*	Local Invited Lecture (University Center 203) Alan Lindsay, University of Notre Dame *Modeling Diffusion and Capture*		
12:00-12:45	MUMC Pizza Lunch (University Center 217)	Conference Luncheon (University Center 202 AB)		
12:55-1:50	Plenary Lecture - University Center 202AB Ronnie Pavlov, University of Denver *Nearest-Neighbor Tilings in One and Two Dimensions*			

	University Center 209	University Center 211	University Center 213	University Center 217
2:00-2:20	* Daniela Goetz (UM Flint) *Mathematical Identity and the Impact of Stereotype Threat*	* Suzy McTaggart (EMU) *On Predicting Successful Family Medicine Residents Using the Characteristics of Medical Students Accepted to University of Michigan Family Medicine Residency Program*	Matthew Wyneken (UM Flint) *An Introduction to General Orthogonal Polynomials*	
2:25-2:45	* Meiqi Song (Oakland U) *Fast Statistical Approximations of Computationally Intensive Numerical Solvers for Evolution Problems*	* Ben Savoie (UM Flint) *Mixing Time for the Generalized Rook's Walk*	P. Gavin LaRose (UM) *Increasing Student Engagement in a Large-Enrollment Differential Equations Course: Effect and Effectiveness*	
2:50-3:10	* Justin Wisby (UM Flint) *3D Rendering and Printing Fractals and Lindenmayer Constructions*	ǂ Layla Potts (EMU) *The Effects of Gender and Ethnicity on Students' Perceptions of Small-Group Learning in Collegiate Mathematics Courses*	Alexander Israetel (Davenport U) *Statistical Analysis of Select Biometric Life History Variables in Primates*	
3:15-3:35	* Alec Ward (SVSU) *How a Parabola can be a Source of Difference Equations?*	Khairul Islam (EMU) *Teaching and Research Using Statistical Software R*	Peter Brown (Lake Michigan College) *You Cannot Add Cats and Dogs*	*Stephanie Loewen and Vasily Zadorozhnyy (GVSU) *A New Triangle Generation of Generalized Genocchi Numbers Using Rook Placements on Genocchi Boards*
3:35-4:00	Break			
4:00-5:15	Closing and Student Awards (University Center 202 AB) Plenary Lecture Chris Rasmussen, Wesleyan University *Solving S-Unit Equations*			

2017 Annual Meeting of the Michigan MAA and MichMATYC
Speaker and Abstract List

INVITED PLENARY LECTURES

JP Cossey, University of Akron
Opening Plenary University Center 202 AB
An Algebraist Tries to Do Combinatorics with Undergrads, and Occasionally Doesn't Completely Fail.

As someone who researches representations of finite groups, there's only so much I can do in that field with even the most talented and ambitious undergraduates. However, I've managed to find a couple of distinct (semi-related) classes of problems that are interesting, accessible, and virtually limitless, and one of them has all sorts of applications to representations of finite groups. In this talk I'll discuss both of these at a somewhat introductory level, in the hopes that others can work with them and improve them. I will discuss generalizations of Catalan numbers, and partition problems motivated by representations of the symmetric group.

Timothy Chartier, MAA Section Visitor, Davidson College
Friday Banquet Plenary University Center 202 AB
Mathematical Celebrity Look-Alikes

Who is your celebrity look alike? LeBron James? Jackie Chan? Adele? Rihanna? Vectors norms enable us to discern what celebrity looks most like a selected individual. Linear algebra allows us to explore what linear combination of celebrity photos best approximates a selected photo. Would you describe yourself as a cross between Ben Stiller and Hugh Jackman or possibly Marilyn Monroe and Jennifer Aniston? In this talk, we learn how to answer this question using linear algebra and on the way get a sense of how math aids in facial recognition.

Matthew Wyneken, MI-AMTE President, University of Michigan-Flint
Saturday Morning Plenary University Center 202 AB
The Association of Mathematics Teacher Educators (AMTE) Celebrating 25 Years

AMTE is the largest professional organization devoted to the improvement of mathematics teacher education. Professional teacher educators and mathematicians both have key roles in preparing teachers of mathematics for all grade levels. In particular, I will discuss AMTE's just released "Standards for Preparing Teachers of Mathematics."

Ronnie Pavlov, University of Denver
Saturday Lunch Plenary University Center 202 AB
Nearest-neighbor Tilings in One and Two Dimensions

In this talk, I'll introduce some basic ideas from one- and two- dimensional symbolic dynamics. Our setting is simple; we start with a finite set. A of unit square tiles and set F of forbidden adjacent pairs of tiles, and define the associated nearest-neighbor tiling system X(A,F) as the set of all bi-infinite sequences (in one dimension) or bi-infinite arrays (in two dimensions) of tiles from A which do not contain the forbidden adjacencies from F.

In one dimension, nearest-neighbor tiling systems are somewhat simple objects; questions about them are often solvable via techniques from linear algebra and/or graph theory, and many of their properties have simple characterizations via definitions from those areas. However, in two (and more) dimensions, nearest-neighbor tiling systems suddenly exhibit incredibly complicated behavior, and their study unavoidably leads to surprising areas such as Turing machines and computability theory. In this talk, I'll describe the contrast between these two worlds and explain how some of these surprising connections arise.

Chris Rasmussen, Wesleyan University
Closing Plenary University Center 202 AB
Solving S-Unit Equations

The unit equation in its simplest form asks for all the solutions within a ring R to the equation $x + y = 1$, where both x and y are required to be units. In many natural contexts, the unit equation is known to have only finitely many solutions, and a common tactic in enumerative number theory problems (such as finding all integral solutions to a Diophantine equation, or finding all number fields with prescribed discriminant) is to reduce the enumeration problem to solving a related unit equation. However, solving unit equations is extremely computationally expensive in practice.

In this talk, we explore the connection between the S-unit equation and other problems in number theory, and discuss some of the effective strategies for solving the equation. We will also describe an effort by several mathematicians to bring S-unit equation solving techniques to the masses through the open source computer algebra program Sage.

LOCAL INVITED TALKS

Dawn Archey, University of Detroit Mercy
Friday March 31, 3:30–4:10 University Center 217
The Boy Who Cried Wolf and the Mathematicians Who Said Math Was Really Useful

For their whole lives, students have heard that math is useful, but they don't really believe it. This is largely due to the fact that when math teachers/professors are asked to show how the material will be used, we often provide story problems which are extremely artificial. Unfortunately, traditional story problems are hard without being meaningful. Students, justifiably, complain about this. Meanwhile, employers want to hire people who can take an ambiguously stated problem, decide what mathematical techniques to apply, and present their conclusion in a clear and convincing fashion.* Traditional story problems do not really help students develop these in demand skills. One solution to both the students' complaint and employers' desire is to create and use Authentic Applied Problems. For example, a traditional story problem might ask students to compute the percent change in volume of a snowball for a given change in diameter. In contrast, an Authentic Applied Problem might ask students to compute the percent change in the volume estimate of Pluto based on the more accurate measurement of the diameter of Pluto obtained by the New Horizon's space craft in its fly-by. The snowball problem and the Pluto problem use the same mathematical content, but students recognize the Pluto problem as more authentic. The Pluto problem also gives students a chance to practice the skills employers want like using math to solve real world problems. For additional examples of Authentic Applied Problems see `http://sites.udmercy.edu/archeyde/`

*Based on interviews with employers at a University Career fair.

David Murphy, 2016 Distinguished Teaching Award Winner, Hillsdale College

Friday, March 31, 3:30–4:10 University Center 203

It Takes a Community

Professional development programs provide important opportunities for all faculty, both new and "experienced," to grow as teachers and improve how we relate with our students. Whether it is a network in which we can ask questions and receive feedback from peers, a workshop where we are challenged to learn new things, or a program in which we interact with people at different stages of their careers, we need the give and take of such interactions to continue our lifelong learning that is essential to a lifetime of teaching. I have benefited directly from several, including Project NExT and PCMI's Undergraduate Faculty Program. In this talk, I will share some of the lessons I have learned and how these have contributed to my growth as a mathematician and a teacher. Audience contributions will be encouraged as we seek to share still more opportunities with one another and encourage each other in this ongoing endeavor.

Katrina Piatek-Jimenez, Central Michigan University

Saturday, April 1, 11:20–11:55 University Center 217

College Students' Stereotypes of Mathematicians

Stereotypes about mathematicians can affect how individuals view those who enjoy mathematics and those who enter mathematical careers. These stereotypes can also influence certain students mathematics performance, perseverance, and career choice in the field. It is likely that negative stereotypes more greatly affect women and certain minorities, who are already underrepresented in the field of mathematics. During this talk, I will discuss some of my work in this area of study. In particular, I will focus on my most recent study in which we asked 179 college students to Draw a Mathematician. We then conducted four focus group interviews with a total of 12 participants to explore their beliefs more deeply. During the focus group interviews, we asked the participants to view 16 photos of individual people and asked them to determine whether they believed each person was a mathematician or not and to explain their reasoning. Through our analysis of the data, we have found that many college students do have specific stereotypes about mathematicians, however, some of their beliefs are different than those found in previous studies with younger children.

Alan Lindsay, University of Notre Dame
Saturday, April 1, 11:20–11:55 University Center 203
Modeling Diffusion and Capture

Diffusion is a fundamental transport mechanism whereby spatial paths are determined from probabilistic distributions. In examples such as the pollination of a flower or immune response to infection, the arrival of a single particle can initiate a cascade of events. The movement of these particles is driven by random motions, yet these systems function in an ordered and predictable way. The first passage time (FPT) is the random variable describing the duration of a particles search for a target and gives key insight into such processes.

In this talk I will discuss the problem of determining the distribution of arrival times for a random walker to reach an absorbing set. In applications related to microscopic capture problems, the absorbing set has a large number of very small sites. I will present a new homogenized theory which replaces the heterogeneous configuration of boundary conditions with a uniform Robin type condition. This limit is numerically verified with a novel spectral boundary element method for the exterior mixed Neumann-Dirichlet boundary value problem for the harmonic measure. Real life systems feature thousands of absorbing sites and our numerical method can rapidly resolve this realistic limit to high accuracy.

CONTRIBUTED TALKS - FRIDAY SCHEDULE

Tanweer Shapla and Khairul Islam, Eastern Michigan University
Friday, March 31, 4:15–4:35 University Center 209
Communicate large sample concepts in statistical education using simulation

Large sample properties are very difficult to communicate theoretically with students at lower level statistics class. Given the students' background and mathematical skills, the general tendency is to address these properties superficially. However, large sample concepts in statistical education such as law of large number, central limit theorem, and asymptotic probability distribution, etc. can be presented easily using the simulation approach. In this presentation, we explore the capability and significant features of R in conveying large sample properties while teaching.

Gerry Cox, Lake Michigan College
Friday, March 31, 4:15–4:35 University Center 211
Using an Introductory Calculus Text to teach a Precalculus Algebra/Trig. Class.

Many students are now entering my Preacalculus Alg./Trig. course after having this same course or higher in High School. This has caused me to change my approach in teaching this course. I'm currently using: Ron Larson's, CALCULUS An Applied Approach. This seems to be working well. I'm using the concepts of limits and derivatives to teach the Precalculus Alg./Trig along with regular exponential function, log function, trig. functions, inverses, and skills warm-up sections in the text. Perhaps some of the young writers we have in mathematics would be interested in this approach.

∗ **Jeff Ford and Leighann McReynolds, Ferris State University**
Friday, March 31, 4:15–4:35 University Center 213
Strategies for Smokestack: A Statistical Analysis of Card Game Algorithms

Smokestack is a modern card-based strategy game for three players. Compared to traditional games such as Poker and Blackjack, Smokestack depends much less on the random flip of a card; instead, uncertainty in Smokestack is derived from extreme volatility of player actions. The main goal of this project is to write computer algorithms that outperform human players in Smokestack. To accomplish this goal, we used a blend of scripting and statistics to create and fine-tune strong algorithms. In this talk, we present results from our ongoing work.

Anil Venkatesh, Ferris State University
Friday, March 31, 4:40–5:00 University Center 209
Mastery-Based Assessment: An Implementation with Reflective Writing

Mastery-based assessment has been shown to improve student confidence and achievement. However, promoting mastery by allowing revision of graded work can result in untenable instructor workload in larger classes. In this talk, we share results from a semester-long study of mastery-based assessment in mid-size sections of intermediate algebra, calculus, and linear algebra (enrollment approximately 30). We present on the practical implementation of the study, including sample assignments and assessment techniques. We also offer quantitative and qualitative evidence of student success in mastering course content and building reflective learning practices. We conclude with a discussion of the obstacles encountered in the study and propose measures to address these obstacles.

Arlo Caine, California State Polytechnic University Pomona
Friday, March 31, 4:40–5:00 University Center 211
Text Recognition with Computational Topology and Geometry

How does the human brain learn to distinguish letters from one another in preparation for learning to read? What are the characteristic features of shape that one needs to identify in order to distinguish an A from a B from an S from a C, for example? Text recognition, the problem of designing algorithms to extract text from images, is a hard problem in computer science which drives much research in digital image processing, computer vision, and artificial intelligence. While machine learning has made significant advances in recent years, we attack this problem from a data mining perspective using computational topology and geometry. Flood-fill algorithms from computer science can be used to compute the number of connected components and cycles of glyphs (characters to be recognized). We developed an algorithm CORE which reduces a glyph G to a figure resembling a planar graph while preserving topology (like a deformation retraction) and overall shape. We prove that it is possible to decompose the output CORE(G) into features and segments which align with human descriptions. The proof involves a wonderful mix of continuous algebraic topology, discrete geometry, and finite mathematics. The types of features and segments detected can be used for distinguishing characters from one another. We hope this could improve machine learning techniques by narrowing the focus of investigation to such characteristic features.

‡ **Sarah Hayes, Central Michigan University**
Friday, March 31, 4:40–5:00 University Center 213
Mathematics of Needlework: An Introduction to Knit and Crochet

Mathematics and art are beautiful subjects, but together they make extraordinary creations. Math has always been part of art, whether the artist was aware or not. Segmented straight edges and compasses are some of the earliest tools to create artwork. From determining the middle of a painting to using their thumbs to measure proportions, artists have been using math since art began.

More specifically, mathematics plays a substantial role in needlework, or fiber art. There are many papers about the mathematic masterpieces that needlework can create, but people often forget to look at the math involved in creating the individual stitches. This presentation looks at the mathematical elements of each stitch and the different ways we can put stitches together. We will create several definitions and proofs to discover their geometrical and topological implications. We will also answer a few questions including: "What happens when a stitch is skipped?", "What shapes can be created?", "How can we create two similar or congruent fabrics using different methods?", "Are there any similarities or differences between knit and crochet?", and many more. Knowledge of needlework is not required to enjoy this dive into the Mathematics of Needlework: An Introduction to Knit and Crochet.

CONTRIBUTED TALKS - SATURDAY SCHEDULE

∗ **Jonathon Wilson, Ferris State University**
Saturday, April 1, 9:50–10:10 University Center 209
Entropy of non-rectangular LEGO^{TM} bricks

Let $T(n)$ be the number of ways to connect n LEGO bricks together. Then the entropy of such a brick is $h = \lim_{n\to\infty} \frac{1}{n} \log T(n)$. In a paper published recently by Durhuus and Eilers, the authors showed that the entropy of a rectangular LEGO brick is finite, and gave upper and lower bounds of the entropy for a 2×4 rectangular brick. In this talk, we describe upper and lower bounds of the entropy of non-rectangular LEGO bricks shaped like the letter L.

Khairul Islam, Eastern Michigan University
Saturday, April 1, 9:50–10:10 University Center 211
The Invariance of Chi-squared Test under Various Probabilistic Models

Using a contingency table is a very popular way of determining the association of a factor with an outcome (e.g. disease) in the fields of applied statistics and natural sciences. Given a contingency table, the general purpose is to test if the factor is associated with the outcome by means of a chi-squared test. In this presentation, we explore the invariance of the chi-squared test under various probabilistic models in reference to the association of a factor and outcome for a 2×2 contingency table, along with examples and applications.

Jon Oaks, Macomb Community College
Saturday, April 1, 9:50–10:10 University Center 213
Teaching Vocabulary in the Mathematics Classroom

In this talk, the presenter will discuss some strategies that he has used to increase students' use of proper mathematical vocabulary, including using the Internet in the classroom, having students read and write more in class, and holding optional workshops for students on the weekends.

The Ferris State University Quantative Reasoning Project
Saturday, April 1, 9:50–10:35 University Center 217
Student Voices Panel Discussion

* **Rebecca Robinson, University of Michigan-Flint**
Saturday, April 1, 10:15–10:35 University Center 209
A Markov Chain Model of the Viral Spread of Internet Memes

With the rising use and popularity of the Internet, it is much easier to spread content from person to person. Content in the form of humorous images known as memes is often shared among peers. We aim to model the rise and fall of Internet memes by using methods normally used to model infectious diseases. We first provide a Markov chain version of an SIR model, and then using data from Google Trends, create a function that models the spread of a meme. With this, we hope to predict future trends in Internet culture.

* **Huizhen Zhang, Hongli Zhang, and Marissa Mizwa, Lawrence Technological University**
Saturday, April 1, 10:15–10:35 University Center 211
An Optimized Modern Toll Plaza: An Application of Queuing Theory and the Poisson Distribution

To find the optimal shape, size, and merging patterns of a toll plaza, we create a model to represent traffic flow. We employ queuing theory to estimate the waiting time for cars driving from four lane highways into toll booths, and use this to model traffic intensity. We consider the risk analysis involved with accident prevention modeled by using the Poisson distribution. We also study the effect of traffic backups and how the introduction of autonomous vehicles would cut the crash rates in half.

Feryal Alayont, Grand Valley State University
Saturday, April 1, 10:15–10:35 University Center 213
Analyzing Student Work as a Way to Learn the Intricacies of Counting Techniques

The topic of counting techniques in Discrete Mathematics provides a fertile ground for both multiple solution methods and difficult to identify issues in problem solutions. This presentation will focus on the use of analyzing and comparing previous student work samples in assignments as an instruction method to improve student understanding of counting methods and flexibility in using these methods. Examples of topics and sample student work will be shared.

* **Daniela Goetz, University of Michigan-Flint**
Saturday, April 1, 2:00–2:20 University Center 209
Mathematical Identity and the Impact of Stereotype Threat

In this talk, I will discuss how math educators shape students' math identities through teaching practices, and how they can inadvertently introduce stereotype threat. We will examine the idea of culturally mindful classrooms as they relate to math identity, and how stereotype threat can also impact students' learning. More specifically, we will discuss what students can do to help them become better math learners, and how to recognize stereotype threat in their own lives.

* **Suzy McTaggart, Eastern Michigan University (Undergraduate)** and **Kairul Islam, Eastern University (Faculty)**
Saturday, April 1, 2:00–2:20 University Center 211
On Predicting Successful Family Medicine Residents Using the Characteristics of Medical Students Accepted to University of Michigan Family Medicine Residency Program

Family Medicine residency programs look into various characteristics reported on medical student applications to distinguish desirable candidates in a high stakes recruitment paradigm. Many programs develop complex processes by combining test scores with other attributes and interviews. In this presentation, we consider a statistical analysis of various characteristics of the residency applications of University of Michigan Family Medicine residents from 2010-2014. We also employ a logistic regression analysis to determine which reported characteristics predict success in residency.

Matthew Wyneken, University of Michigan-Flint
Saturday, April 1, 2:00–2:20 University Center 213
An Introduction to General Orthogonal Polynomials

Orthogonal polynomials with respect to different weight functions have been studied for 300 years. During the past 50 years there has been a study of polynomials orthogonal with respect to general weight measures using potential theory. We present an introduction to this modern theory.

* **Meiqi Song, Oakland University**
Saturday, April 1, 2:25–2:45 University Center 209
Fast statistical approximations of computationally intensive numerical solvers for evolution problems

Partial differential equations are the cornerstone of modeling in modern science and engineering. Finding their solutions often requires using computationally intensive numerical solvers that may take an extensive amount of time to output a highly accurate answer. We employ statistical methods to speed up the computation of numerical solutions of partial differential equations with space and time components while maintaining the accuracy. A two-dimensional linear parabolic partial differential equation that models the diffusion of a chemical contaminant in porous media with unknown permeability parameters is used to demonstrate our fast approximation methodology. The contaminant concentration is approximated numerically using finite elements in space and finite differences in time. Based on the space-time output data at a small sample of permeability parameters, Kriging methods from geostatistics are extended to obtain a fast approximation for the numerical solver. In turn, this is used to accelerate the investigation of the relationship between the permeability parameters and the contaminant concentration. Future work includes increasing the sample size sequentially to assess the quality of the resulting statistical approximation.

* **Ben Savoie, University of Michigan-Flint**
Saturday, April 1, 2:25–2:45 University Center 211
Mixing Times for the Generalized Rook's Walk

In my talk, I will show how I used path coupling, a powerful probabilistic tool, to find bounds on the mixing times of a class of Markov chains. The mixing time of a Markov chain measures the rate of convergence to its stationary distribution. This mixing time is of interest for sampling and simulations of random processes. The Markov chains we are investigating are restrictions on the random rook's walk on a d dimensional chessboard, which can also be considered random walks on the Cartesian powers of certain groups of circulant graphs. We prove bounds on the mixing times of these Markov chains, extending and generalizing previous results for the unrestricted case of the rook's walk.

P. Gavin LaRose, University of Michigan
Saturday, April 1, 2:25–2:45 University Center 213
Increasing Student Engagement in a Large-Enrollment Differential Equations Course: Effect and Effectiveness

It is now almost a closed case that to improve student learning in mathematics courses we must increase student engagement and collaboration. Left is the question of how to do this, especially in the context of large-enrollment courses taught in a traditional lecture format. In this talk we discuss the revision of our large-enrollment, primarily engineering, differential equations course to increase its conceptual focus and student engagement, primarily by rewriting the computer laboratory component of the course. We describe the goals for and effect of the curricular changes, some of the difficulties and successes we experienced, and how the project is continuing.

* **Justin Wisby, University of Michigan-Flint**
Saturday, April 1, 2:50–3:10 University Center 209
3D Rendering and Printing Fractals and Lindenmayer Constructions

3D printing has become quite popular in recent years, giving access to advanced visualization a white board just can't deliver. This increase in usability has brought mathematical visualization to a whole dimension. Objects like Sierpinki's tetrahedron, plots of two variables, and Klein bottles are the pioneers of the opportunities at our disposal. The problem arises in the development of such objects. Designing the objects can be completed using procedural algorithms called Lindenmayer System. Modern applications, when manipulated correctly, can be used with modern 3D printers to bring complex mathematics to the hand-held variety

‡ **Layla Potts, Eastern Michigan University**
Saturday, April 1, 2:50–3:10 University Center 211
The Effects of Gender and Ethnicity on Students' Perceptions of Small-Group Learning in Collegiate Mathematics Courses

Group or team settings will play signicant roles in college students' future professions, as will their ability to work eectively in group settings. Unfortunately, doing so can be quite challenging, especially when groups or teams consist of people of varying genders and ethnicities. As collegiate educators, we need to properly prepare our students for success in their careers. Thus, it is quintessential to examine the roles that factors, such as gender and ethnicity, play within group dynamics in the collegiate setting.

The aim of this research project is to conduct a qualitative analysis on how students' perceptions of small-group learning environments dier across

gender and ethnicity. Given the important role that mathematics plays in students success in science, technology, engineering and mathematics (STEM) elds, we will examine the perceptions of women and minority students on their small-group learning experiences in collegiate mathematics courses. The perceptions of women and minorities will then be compared and contrasted against the perceptions of their non-minority male counterparts.

Conducting a qualitative survey of Eastern Michigan University undergraduate students who are enrolled in mathematics courses ranging from Pre-College Math: Arithmetic to Calculus II allows us to assess the roles gender and ethnicity play in how students feel about their experiences in small-group learning environments. In addition, we can assess the factors that shape these perceptions, and the resulting impacts on students' perceived ability to understand the material in their mathematics courses.

Alexander Israetel, Davenport University
Saturday, April 1, 2:50–3:10 University Center 213
Statistical Analysis of Select Biometric Life History Variables in Primates

Statistical analysis on correlation and linear regression was performed for a large sample of the biggest primates. The following biometric variables were used: gestation, life expectancy, weight, and brain size to construct the best simple and multiple linear regression models. Fitted line plots, regression equations, explained and unexplained variations, correlation and determination coefficients, p-values for the test of significance have been computed using Minitab software. ANOVA Tables have been generated for both the best simple and multiple linear regression models. The results demonstrate interesting patterns and are discussed.

* **Alec Ward, Saginaw Valley State University**
Saturday, April 1, 3:15–3:35 University Center 209
How a Parabola Can Be a Source of Difference Equations?

A function has complete control over its own tangent lines. But the question is how much influence those tangent lines might have on its own function? To find an answer to this question, we turn our attention first to the parabola and explore how it can be a source of difference equations. A difference equation, often referred to as a recurrence relation, relates a term of a sequence to previous terms in the sequence. We start with an arbitrary tangent line of a parabola and construct a special sequence of lines to build up a number of difference equations which have applications to real world situations.

Khairul Islam, Eastern Michigan University
Saturday, April 1, 3:15–3:35 University Center 211
Teaching and Research Using Statistical Software R

R is an open source (free to download) complete programming language that provides an environment to perform statistical analysis and graphs. In this presentation, I would like to share my teaching experience with introductory statistics education and research using R. A particular attention is given to basic statistical analysis and programming issues that can be implemented easily for any level of statistical education and research.

Peter Brown, Lake Michigan College
Saturday, April 1, 3:15–3:35 University Center 213
You Cannot Add Cats and Dogs

This short presentation will describe a new approach that provides a one semester developmental math alternative for students needing a solid foundation before placing into a college level math class like Quantitative Reasoning. This is a preview of the work being done by the presenter and Eric Gaze who directs the Quantitative Reasoning (QR) program at Bowdoin College. The project, entitled *Thinking Numerically* uses a ground up approach by developing the interconnectedness of topics under the broad umbrella of proportional reasoning. Developing number sense is a focus, seeking to build mathematical maturity through rich visual examples (number lines with units) and sound reasoning all grounded in context. This encourages students to unlearn their preconceived notion that mathematics is simply a set of rules and procedures to be memorized.

* **Stephanie Loewen and Vasily Zadorozhnyy, Grand Valley State University**
Saturday, April 1, 3:15–3:35 University Center 217
A New Triangle Generation of Generalized Genocchi Numbers Using Rook Placements on Genocchi Boards

The two-dimensional rook theory can be generalized to three and higher dimensions by assuming that rooks attack along hyperplanes. Using this generalization, Alayont and Krzywonos defined two families of boards in any dimension generalizing the triangular boards of two dimensions whose rook numbers correspond to Stirling numbers of the second kind. One of these families of boards is the family of Genocchi boards whose rook numbers are the Genocchi numbers. This combinatorial interpretation of the Genocchi numbers provides a new triangle generation of the Genocchi numbers. In our project, we investigate whether such a similar triangle generation exists for the generalized Genocchi numbers in four and five dimensions.

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