Program of Activities
For the 99th Annual Meeting of the

Mathematical Association of America

Ohio Section

Spring 2015
Marshall University
Huntington, WV
March 27-28, 2015

Spring Meeting Program

The Contributed Talk will take place in Corbly Hall, while the rest of the activities will take place in the Memorial Student Center (MSC), which houses the Don Morris Room (MSC 2E18), the John Marshall Room and the John Spotts Room (MSC 2E37).

Friday, March 27

12:00-4:00	Registration	Don Morris Foyer
12:00-1:20	Leo Schneider Student Team Competition	MSC BE5
12:00-1:00	Committee Meetings:	
	Centennial Committee	MSC 2W9
	CONCUR (Curriculum)	MSC 2W10
	CONSACT (Section Activities)	MSC 2E10
	CONTEAL (Teacher Education & Licensure)	John Spotts Room
1:00-4:00	Vendor & Book Exhibits	Don Morris Room
1:30-1:45	Welcome and Announcements	Don Morris Room
1:45-2:45	Invited Address: **"The Marshall Differential Analyzer Project: Solutions of Dynamic Equations Using Mechanical Integration"** Bonita Lawrence, Alex Amorim, and Chad Lott	Don Morris Room
2:45-3:05	Break	Don Morris Room
3:05-3:15	Centennial Minute	Don Morris Room
3:15-4:15	Invited Address: **"The Many Facets of Polyhedra"** Carl Lee	Don Morris Room
4:25-5:25	Executive Committee Meeting (Part 1)	John Spotts Room
4:30-6:25	**Contributed Paper Session**	Corbly 236, 241, 243, 244
6:25-6:45	Social Time	John Marshall Room
6:30-8:00	Student Pizza Party	Marco's (MSC BE38)
6:45-8:00	Banquet	John Marshall Room
8:10-9:10	After dinner talk: **"Math and Art: The Good, The Bad, and the Pretty"** Annalisa Crannell	Don Morris Room
9:10	Business Meeting	Don Morris Room

Saturday, March 28

8:00-10:00	Registration	Don Morris Foyer
8:00-10:00	Book Vendors and Exhibits	Don Morris Room
8:00-9:15	Coffee and Pastries	Don Morris Room
8:00-9:00	Executive Committee Meeting (Part 2)	John Spotts Room
8:35-9:10	Committee on Local Arrangements	MSC 2E10
9:10-9:20	Welcome and Announcements; Student Competition Results	Don Morris Room
9:20-10:20	Invited Address: **"*In the Shadow of Desargues*"** Annalisa Crannell	Don Morris Room
10:20-10:35	Break	Don Morris Room
10:35-11:50	**Contributed Paper Session**	Corbly 236, 241 243
12:00-1:00	Retiring President's Address: **"Taking Other People's Ideas to Extremes"** John Prather	Don Morris Room
1:00-1:10	Closing Remarks	Don Morris Room

Abstracts of Invited Addresses

Friday

The Marshall Differential Analyzer Project: Solutions of Dynamic Equations Using Mechanical Integration

Bonita Lawrence
Marshall University

Abstract: Marshall University currently houses the largest publicly accessible differential analyzer in the USA. The machine (fondly known as Art in honor of Dr. Arthur Porter, the first to build a differential analyzer in England) solves up to fourth order differential equations using mechanical integration, a physical process that was first effectively implemented in the late 1920's by Dr. Vannevar Bush at MIT. The Marshall Differential Analyzer Team is a collection of undergraduate and graduate students who have worked together in the construction, maintenance and continuing development of this machine and two smaller more portable two-integrator machines. These machines are currently being used i) as teaching tools, offering a physical interpretation of how the derivatives of a function can be used to determine the structure of the function itself, and ii) as a research tool to study qualitative properties of nonlinear equations (without closed form solutions) as well as to investigate topics in dynamic equations on time scales.

Students of differential equations and calculus are given the opportunity, as part of their courses, to program the machine, run it and study the behavior of solutions. The perspective the machine offers bright mathematical minds lends credence to the idea that physical models can and do spark the imagination.

In this presentation we will give an overview of the history of the machine and the Marshall DA Project, discuss the mechanics that the machine (and the operator) uses to model mathematics, and discuss future plans for the Marshall DA Project. For the big finale you will see a live feed from the Marshall Differential Analyzer Lab (just across campus from the site of this talk) where my graduate students, Ms. Alex Amorim and Mr. Chad Lott, will demonstrate how to use the machine to solve dynamic equations. Anyone who is interested in visiting DA Lab during their visit to the Marshall University campus is welcome!

The Many Facets of Polyhedra

Carl Lee
University of Kentucky

Abstract: The area of polyhedral geometry has simply exploded over the last 50 years. I will offer some samplings of topics in polyhedral geometry that lend themselves to potential early encounters and exploration by students. I will draw from such examples as: counting faces beyond Euler's relation, symmetry, using new construction and visualization tools, dealing with linear inequalities instead of linear equations, and peering into the fourth dimension.

Math and Art: The Good, the Bad, and the Pretty

Annalisa Crannell
Franklin & Marshall University

Abstract: How do we fit a three-dimensional world onto a two-dimensional canvas? Answering this question will change the way you look at the world, literally: we'll learn where to stand as we view a painting so it pops off that two-dimensional canvas seemingly out into our three-dimensional space. In this talk, we'll explore the mathematics behind perspective paintings, which starts with simple rules and will lead us into really lovely, really tricky puzzles. Why do artists use vanishing points? What's the difference between 1-point and 3-point perspective? Why don't your vacation pictures look as good as the mountains you photographed? Dust off those old similar triangles, and get ready to put them to new use in looking at art!

Saturday

In the Shadow of Desargues

Annalisa Crannell
Franklin & Marshall University

Abstract: Those of us who teach projective geometry often nod to perspective art as the spark from which projective geometry caught fire and grew. This talk looks directly at projective geometry as a tool to illuminate the workings of perspective artists. We will particularly shine the light at Desargues' triangle theorem (which says that any pair of triangles that is perspective from a point is perspective from a line), together with an even simpler theorem (you have to see it to believe it!). Given any convoluted, complicated polygonal object, these theorems allow us to draw that object together with something that is related to it--- its shadow, reflection, or other rigid symmetries---and we'll show how this works. (If you enjoy doodling or sketching, bring your pencil, a good eraser, and a straightedge.)

Taking Other People's Ideas to Extremes

John Prather
Ohio University Eastern

Abstract: Attending conferences and talking to colleagues over the years, I have had the privilege of hearing a number of really good ideas to improve the classroom environment and student learning. Of course, not every idea can be easily implemented in my classes. There are almost always differences between my colleagues' situations and my own. We might serve different student populations, teach different classes, or have different teaching styles. While the title of this talk might be a bit extreme, I hope to discuss how I have modified a number of different ideas to suit my students' needs and my personality. Hopefully you will find an idea or two to adapt to your classes.

Brief Biographies of Invited Speakers

Bonita Lawrence, Marshall University

Inspired by her high school mathematics teacher, Dr. Bonita Lawrence began her formal mathematics training at Cameron University in Lawton, Oklahoma. After a short career as a classroom teacher, she returned to the university to continue her education, earning a Master's degree at Auburn University and a Ph. D. at the University of Texas at Arlington. Her Ph. D. dissertation was written in the area of Stochastic Differential Equations. Intrigued by studies of the similarities and differences between the differential and difference equations, her research studies now focus on results in the area of Dynamic Equations on Time Scales. Dr. Lawrence is a Professor of Mathematics at Marshall University and is the Lead Researcher for the Marshall University Differential Analyzer Lab. Her lab houses the only publicly accessible differential analyzer of its size in the USA (and beyond). She is the recipient of several College and University teaching and research awards and was named the 2009 – 2010 West Virginia Professor of the Year. Dr. Lawrence is married to Dr. Clayton Brooks, also a Professor of Mathematics at Marshall University.

Carl Lee, University of Kentucky

Carl Lee grew up in an extended family of academics. One of his earliest memories of his love of mathematics was in second grade when his mother taught him how to multiply with a slide rule. As he grew older he devoured his father's recreational math books, encountering flexagons, polyhedra, stitchings of conic sections, and many more lifelong friends. Gardner, Steinhaus, Ball and Coxeter, and Cundy and Rollett were his silent mentors who complemented his wonderful public school teachers in Baltimore County. He couldn't find the polyhedra in college (Yale), but learned where they were lurking in graduate school (Cornell, 1981, Applied Mathematics), and now he surrounds himself (sometimes physically) with higher dimensional ones. He was welcomed by the Department of Mathematics at the University of Kentucky in 1980, where he has found a supportive environment for his interests in discovering, teaching, learning, and playing with mathematics. He was an IBM Postdoctoral Research Fellow and an Alexander von Humboldt Fellow. He received the 2005 Mathematics Education Service and Achievement Award from the Kentucky Council of Teachers of Mathematics, the 2012 Kentucky MAA Outstanding Teaching Award, and one of the 2014 Deborah and Franklin Tepper Haimo Awards for Distinguished University Teaching from the MAA. He continues investigations into polyhedral and discrete geometry, while engaged in mathematics education and outreach projects.

Annalisa Crannell, Franklin & Marshall University

Annalisa Crannell is a Professor of Mathematics at Franklin & Marshall College and recipient, in 2008, of the MAA's most prestigious teaching award (the Deborah and Franklin Tepper Haimo Award). Her early research was in topological dynamical systems (also known as "Chaos Theory"), but she has become active in working with mathematicians and artists on Projective Geometry applied to Perspective Art. Together with mathematician/artist Marc Frantz, she is the author of *Viewpoints: Mathematical Perspective and Fractal Geometry in Art*. She especially enjoys talking to non-mathematicians who haven't (yet) learned where the most beautiful aspects of the subject lie.

John Prather, Ohio University Eastern

John Prather received his Ph.D. from the University of Kentucky in Complex Analysis in 1997. He also holds a J.D. from Vanderbilt University (1991), but he really didn't want to do that for the rest of his life. In his preferred career he is in his 18th year at Ohio University's Eastern Campus, where he is an Associate Professor of Mathematics and Faculty Chair of the campus. He was a National Project NExT fellow in 1998-1999 and an Ohio NExT fellow from 1999-2001. In the Ohio Section, John is currently section President. He also served as a member and chair of CONTEAL for many years and served as Co-Coordinator of Ohio NExT from 2007-2013.

Contributed Paper Sessions

(* denotes undergraduate student)

Friday, March 27

Time	**Session A** Room: Corbly 236 Session Chair: Susan Thompson	**Session B** Room: Corbly 241 Session Chair: Matt Lucas
4:30-4:45	***A Drunkard's Walk in Las Vegas*** Abstract 1 Matthew McMullen Otterbein University	***Inflated Geometric Distribution*** Abstract 2 Joshi Ram Marshall University
4:50-5:05	***Population Structure Affects the Speed of Genetic Change*** Abstract 5 Yulia Dementieva Emmanuel College	***Why not Substitute? A Simulation Study of Left Censored Data: Part I*** Abstract 6 D.J. Bays* Marshall University
5:10-5:25	***Properties of the first Hurwitz Equation*** Abstract 9 Josiah Banks* Youngstown State University	***Why not Substitute? A Simulation Study of Left-Censored Data: Part II*** Abstract 10 Tyler Bonnett* and Paige Yankey* Marshall University
5:30-5:45	***On a Local-Global Property of Quadratic Residues*** Abstract 13 Jenna Wise* Youngstown State University	***The Elements of Special Relativity*** Abstract 14 Amanda Maxwell* The University of Findlay
5:50-6:05	***Optimizing Delivery of Relief Items*** Abstract 16 Emily Hoopes* and Ashely Orr* Youngstown State University	***Constant Speed or Constant Effort: Which is the More Efficient Way to Run?*** Abstract 17 Joseph Glorioso* Ashland University
6:10-6:25	***Riemann's Foundations for a General Theory of Functions of a Complex Variable*** Abstract 19 Phil Blau Shawnee State University	***The Enigma Machine*** Abstract 20 Hannah Sedely* Baldwin Wallace University

Time	**Session C** Room: Corbly 243 Session Chair: Carl Mummert	**Session D** Room: Corbly 244 Session Chair: Alexei Davydov
4:30-4:45	***Planting Epsilons*** Abstract 3 David Cusick Marshall University	***Chinese Mathematics in 16th and 17th Centuries*** Abstract 4 Weiping Li Walsh University
4:50-5:05	***Linear Algebra for Everyone Else*** Abstract 7 Clayton Brooks Marshall University	***Age-Specific Variations in Cancer Mortality Rates: A Functional Data Approach*** Abstract 8 Keshav Pokhrel Mercyhurst University
5:10-5:25	***Best Practices with Online Assessment Tools*** Abstract 11 Michael Lafreniere Ohio University - Chillicothe	***Sieve Bootstrap-Based Prediction Intervals for GARCH Processes*** Abstract 12 Garrett Tresch* Ashland University
5:30-5:45	***Learning: Anytime, Anywhere*** Abstract 15 Kristin Marley Hawkes Learning	
5:50-6:05	***Spatial Modeling Techniques for Lattice Data*** Abstract 18 Mitra Devkota Shawnee State University	
6:10-6:25	***Mathematical Exploration of Card Tricks*** Abstract 21 Timothy Weeks* John Carroll University	

Contributed Paper Sessions

(* denotes undergraduate student)

Saturday, March 28

Time	**Session E** Room: Corbly 236 Session Chair: Glen Lobo	**Session F** Room: Corbly 241 Session Chair: erica Whitaker	**Session G** Room: Corbly 243 Session Chair: Clayton Brooks
10:35-10:50	***Predicting the Draft and Career Success of Quarterbacks in the NFL*** Abstract 22 Kristen Hauser* and Justin Eitner* The University of Findlay	***Modeling the Dynamics of Forest Fires*** Abstract 23 Caitlin Snyder* Xavier University	***Fluid Queues with Time-Varying Transitions*** Abstract 24 Barbara Margolius Cleveland State University
10:55–11:10	***Text Message Decryption Methods*** Abstract 25 Erica Langmeyer* The University of Findlay	***Modelling the Spread and Movement of a Zombie Attack*** Abstract 26 Austin Fry* Xavier University	***Prisoner's Light Switch Problem: Probabilistic Connotation*** Abstract 27 M B Rao University of Cincinnati
11:15-11:30	***To Infinity & Beyond: A Study of 3-D Kaleidoscopes*** Abstract 28 Bethany Nye* The University of Findlay	***Eradicating Ebola*** Abstract 29 Annie McClellan* Xavier University	***A Local Lagged Adapted Generalized Method of Moments and Applications*** Abstract 30 Olusegun Otunuga Marshall University
11:35-11:50	***Sierpiński Triangular Numbers*** Abstract 31 Justin Eitner* The University of Findlay	***The Effect of the Incidence Function on the Existence of Backwards Bifurcation*** Abstract 32 Philip Drew* Xavier University	***The Triangle Inequality: Algebraic or Geometric?*** Abstract 33 Daniel Otero Xavier University

Abstracts of Contributed Papers

(* denotes undergraduate student)

Friday 4:30 – 4:45

A Drunkard's Walk in Las Vegas

Matthew McMullen
Otterbein University

Abstract 1: We relate the true story of how a trip to Las Vegas led to a study of random (or drunken) walks. Along the way, we discuss Catalan numbers, discrete probability distributions, and, of course, gambling. Fans of combinatorics, number theory, and/or statistics are encouraged to attend.

Inflated Geometric Distribution

Joshi Ram
Marshall University

Abstract 2: A count data that have excess number of zeros, ones, twos or threes are commonplace in experimental studies. But these inflated observations lead to higher dispersion resulting difficulty in data analysis. So, to get the appropriate result from such data, we need to analyze the data by means of suitable distribution method to overcome the possible anomalies in the estimation of parameters. In this thesis, we have considered a Swedish fertility dataset with inflated values at 0, 1, 2 and 3. Generally, Poisson or Negative Binomial distribution are the most common methods of analyzing such data. Geometric distribution can be thought of as a special case of Negative Binomial distribution. And, we have used a special type of geometric distribution, which we call Generalized Inflated Geometric distribution to analyze such data with inflated points. The dataset is analyzed, tested and compared using various tests and techniques to ensure the better performance of multi-point inflated Geometric distribution over the standard Geometric/Negative binomial distribution. The various tests and techniques used include comparing the parameters obtained through method of moment estimators and maximum likelihood estimators. The two types of estimations- obtained from Method of moment estimators and Maximum likelihood estimators method, were compared using simulation study, and it is found after the analysis that the maximum likelihood estimators performs better. For the validation of the results obtained, Chi Square Goodness of Fit Test is used over the geometric distribution for various parameters. Another tests conducted were the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) on geometric distributions with different parameters. The results of the various tests and techniques showed that a multipoint inflated geometric distribution provides a better fit and model as compared to the standard geometric distribution. Keywords and Phrases: Method of moment estimators, maximum likelihood estimators, Chi-Square Goodness of fit test, AIC, BIC.

Planting Epsilons

David Cusick
Marshall University

Abstract 3: Calculus differs from algebra by studying limits. But in the 3-semester sequence epsilons and deltas seem relegated to the end of a chapter or to an appendix. In September, 1962, my professor said to us, "We will be happy if you understand the limit definition by June!" Sow the ideas early in the term and give them time to grow. Plant efficiently and do some minimal cultivation. There is time to get it done.

Chinese Mathematics in 16th and 17th Centuries

Weiping Li
Walsh University

Abstract 4: Western mathematics was first introduced systematically into China during the 16th and 17th centuries by Jesuit missionaries, which posed a great challenge to the development of traditional Chinese mathematics. We will review the state of Chinese mathematics at that time in this context.

Friday 4:50 – 5:05

Population Structure Affects the Speed of Genetic Change

Yulia Dementieva
Emmanuel College

Abstract 5: Evolution is driven by genetic mutations. While some mutations affect an organism's ability to survive and reproduce, most are neutral and have no effect. For almost 50 years, neutral mutations have been used as a "molecular clock" to estimate the timing of evolutionary events. We introduce a mathematical model to study how the rates of these molecular clocks are affected by the spatial arrangement of a population in its habitat. This graph-theoretic model can be applied to a variety of population structures. In one example, we investigate the accumulation of genetic mutations in the small intestine. In another application, we analyze Twitter networks to study the effect of network topology on the rate at which new ideas replace old ones.

Why not Substitute? A Simulation Study of Left Censored Data: Part I

D.J. Bays*
Marshall University

Abstract 6: It is common for environmental scientists to report collected data as "non-detect," which means a value is known only to be below a certain detection limit of the measuring device. In mainstream statistics, this type of data is known as left-censored data. In this talk, we use a variety of substitution methods, along with maximum likelihood estimation (MLE) and the Kaplan-Meier method to estimate summary statistics (primarily the mean) of left-censored data, and rank their effectiveness. Simulations are performed using R.

Linear Algebra for Everyone Else

Clayton Brooks
Marshall University

Abstract 7: Are you considering a section of Linear Algebra for non-Math majors? The presenter will highlight his 10 years of experience with the justification, creation, and implementation of such a course. Discussion from the audience is encouraged.

Age-Specific Variations in Cancer Mortality Rates: A Functional Data Approach

Keshav Pokhrel
Mercyhurst University

Abstract 8: Incidence and mortality rates are considered as a guideline in developing public health strategies and allocating resources. I will present some applications of functional data analysis techniques to model age-specific brain cancer mortality rates and forecast entire age-specific functions using exponential smoothing state-space models. The age-specific mortality curves are decomposed using principal component analysis and fit functional time series model with basis functions. Nonparametric smoothing methods are used to mitigate the existing randomness in the observed data. Functional time series models are used to model age-specific brain cancer mortality rates and forecast mortality curves with prediction intervals using exponential smoothing state-space model. In addition, I will also present a disparity of brain cancer mortality rates between different age groups. The data were obtained, from the Surveillance, Epidemiology and End Results (SEER) program of the United States. The brain cancer mortality rates, classified under International Classification Disease code ICD-O-3, were obtained from the National Center for Health Sciences (NCHS) available on SEER*stat database.

Friday 5:10 – 5:25

Properties of the first Hurwitz Equation

Josiah Banks*
Youngstown State University

Abstract 9: A Hurwitz Equation is a diophantine equation of the form

$$x_1^2 + x_2^2 + x_3^2 + \cdots + x_n^2 = ax_1x_2x_3 \cdots x_n$$

where a and x_i are positive integers for each i=1, 2, ⋯, n. This equation has been studied by many great mathematicians. In this talk we present original research on the Hurwitz Equation with a = 1, and discuss divisibility properties as well as operations to generate an infinite number of solutions. Other aspects looked at include: the solution space forming an infinite group and fixed divisors of the orbits of the group. Lastly, we will present unproven conjectures formed in the process of research.

Why not Substitute? A Simulation Study of Left-Censored Data: Part II

Tyler Bonnett* and Paige Yankey*
Marshall University

Abstract 10: This talk is a continuation of the previous talk on methods for determining summary statistics of left-censored data. In this part of the talk we analyze multiple detection limit scenarios, in which data is collected in two or more ways or with different devices such that the data contain values censored at different levels. Via simulations in R, we examine the performance of substitution methods, maximum likelihood estimation, and Kaplan-Meier estimation.

Best Practices with Online Assessment Tools

Michael Lafreniere
Ohio University - Chillicothe

Abstract 11: This session will highlight the best practices for helping students learn developmental mathematics and college algebra with online assessment tools such as EWA. Examples of how such tools are used with traditional, blended, and online instruction are highlighted. Mathematical examples will show how students engage with proper math syntax, graphical input, video lectures, and mathematical simulation.

Sieve Bootstrap-Based Prediction Intervals for GARCH Processes

Garrett Tresch*
Ashland University

Abstract 12: Time Series deals with observing a variable—interest rates, exchange rates, rainfall, etc.—at regular intervals of time. The main objectives of Time Series analysis are to understand the underlying processes and effects of external variables in order to predict future values. Time Series methodologies have wide applications in the fields of business in which mathematics is necessary. The Generalized Autoregressive Conditional Heteroscedasic (GARCH) models are extensively used in finance and econometrics to model empirical time series in which the current variation, known as volatility, of an observation is depending upon the past observations and past variations. Some of the drawbacks of the existing methods for obtaining prediction intervals include the assumption that the orders associated with the GARCH process are known and the heavy computational time involved in fitting numerous GARCH processes. This paper proposes a novel and computationally efficient method using the Sieve Bootstrap, a promising procedure for Autoregressive Moving Average (ARMA) processes, for computing prediction intervals for the returns as well as the volatilities of GARCH processes while also avoiding extensive computations. Our Monte Carlo simulation study shows that the proposed method works very well under normal, exponential and t-distributed errors.

Friday 5:30 – 5:45

On a Local-Global Property of Quadratic Residues

Jenna Wise*
Youngstown State University

Abstract 13: It is well known that not every property that holds in local fields (such as $\mathbb{Z}_p$) translates to be true in a global field. For example, the congruence

$$(x^2 - 2)(x^2 - 3)(x^2 - 6) \equiv 0 \ (mod\ p)$$

has a solution in $\mathbb{Z}_p$, but the corresponding diophantine equation

$$(x^2 - 2)(x^2 - 3)(x^2 - 6) = 0$$

has no solutions in $\mathbb{Q}$.

In this talk we will discuss whether an integer being a square residue for "many" primes must necessarily be a square of an integer. We will give a positive answer for this question. We will also present an application of this to generate a "well" separated arithmetic progression from a sequence of sequences.

The Elements of Special Relativity

Amanda Maxwell*
The University of Findlay

Abstract 14: Einstein's Special Theory of Relativity is founded upon the curious fact that the speed of light as measured by an observer is independent of that observer's relative motion to the source of the light. In this talk we will discuss some of the surprising and counterintuitive predictions of this theory, in particular the prediction that different observers can, and often do, measure different time intervals between the exact same two events.

Learning: Anytime, Anywhere

Kristin Marley
Hawkes Learning

Abstract 15: Hawkes Learning believes in offering affordable and accessible materials. Their comprehensive learning system is built and based on the principle of mastery learning to ensure that each student develops a solid foundation and deep understanding of the curriculum. This competency-based approach adapts to each student's individual needs and has a proven track record of increasing student success. Learn about the new tablet-friendly platform that requires no installation or plug-ins. All attendees will be entered to win a $50 amazon giftcard!

Friday 5:50 – 6:05

Optimizing Delivery of Relief Items

Emily Hoopes* and Ashely Orr*
Youngstown State University

Abstract 16: Motivated by the recent COMAP Mathematical Contest in Modeling problem on Eradicating Ebola we explore a network problem for the delivery of a relief item to specific locations of aid. Beyond a transportation problem, we discuss transshipment problems which allow points of demand to act as also points of supply. With a network made up of road travel times in minutes our initial goal is to find the shortest path and thus the quickest delivery. We will discuss our use of Floyd's shortest path algorithm, the solution we found, and its weaknesses. We will then conclude with a multi-objective transshipment problem approach to minimize costs of travel and unmet demand.

Constant Speed or Constant Effort: Which is the More Efficient Way to Run?

Joseph Glorioso*
Ashland University

Abstract 17: The problem examined was whether it is more beneficial to run 5000 meters at constant speed or at constant effort while minimizing the time. In order to determine this, a model was developed to calculate the oxygen used (VO2) due to running itself, to varying winds, and to varying inclines for an average sized runner. The model, based on human data from literature, takes an input of runner's speed, wind speed, and incline and gives an output of volume of oxygen consumed. Starting with a baseline VO2 target at each of several wind speeds, comparing the runner's time while running at constant effort and constant speed led to the conclusion that energy can be used more efficiently running at constant effort.

Spatial Modeling Techniques for Lattice Data

Mitra Devkota
Shawnee State University

Abstract 18: In this research work, Spatial Modeling Techniques for Lattice Data were discussed. In addition to Ordinary Least Squares, a conventional method of modeling spatial data; various types of spatial regression techniques, such as Simultaneous Autoregressive (SAR), Conditional Autoregressive (CAR), Generalized Least Squares (GLS), Linear Mixed Effects (LME), and Geographically Weighted Regression (GWR) were discussed. Comparative studies of these modeling techniques were carried out using a real world dataset and an artificially generated spatial dataset. The results showed that GWR was more suitable for the purpose of incorporating spatial autocorrelation of the data and assessing the local parameter estimates of the model.

Friday 6:10 – 6:25

Riemann's Foundations for a General Theory of Functions of a Complex Variable

Phil Blau
Shawnee State University

Abstract 19: Riemann's inaugural dissertation, published in 1851, is a classic among classic mathematical papers. We will give an overview of this seminal work.

The Enigma Machine

Hannah Sedely*
Baldwin Wallace University

Abstract 20: In this presentation we will discuss the complexity of the Enigma machine, which produced a code that many people believed to be unbreakable. We will discuss the strengths and weaknesses of the Enigma and the mathematics that was ultimately used to crack the code. Furthermore, we will explore the consequences of cracking the Enigma and make suggestions for possible improvements in security. (This was a joint project with Christine Austin, Matt Switlyk and Victoria Switlyk.)

Mathematical Exploration of Card Tricks

Timothy Weeks*
John Carroll University

Abstract 21: In this talk, we demonstrate several card tricks and discuss the mathematical basis for their success.

Saturday 10:35 – 10:50

Predicting the Draft and Career Success of Quarterbacks in the NFL

Kristen Hauser* and Justin Eitner*
The University of Findlay

Abstract 22: Each year professional football teams struggle trying to determine which college athlete will be the most successful in the NFL. By evaluating pre-selected college statistics of 2015 draft prospects, we predicted the success or failure of quarterbacks going into the NFL. This was completed by examining college and NFL statistics for quarterbacks previously drafted.

Modeling the Dynamics of Forest Fires

Caitlin Snyder*
Xavier University

Abstract 23: Forest fires are among the unique set of disasters that are both man-made and natural that devastate land and homes in many areas. I will replicate the movement of forest fires through a cellular automata model. Exploring the structure behind a forest fire provides an understanding of them that allows for more accurate predictions of their length and severity. Many factors go into the spread of a forest fire including wind speed, temperature and space between fuels. This cellular automata incorporates two factors: the susceptibility of fuel types and the slope of the land.

Fluid Queues with Time-Varying Transitions

Barbara Margolius
Cleveland State University

Abstract 24: Queues with a high volume of customers and short service relative to the number of customers can be modeled as fluid queues. Customers flow in and out of the system much as fluid flows into a reservoir and is released by a dam. We consider a stochastic process $\{X(t),J(t)\}$ where $X(t)$ represents the level of the fluid and $J(t)$ the state of a background Markov chain that modulates the state of the system. The background chain may be thought of as opening and closing pipes that allow fluid to flow into and out of the reservoir. We consider a Markov modulating chain with transition rates that vary in a periodic and deterministic way, so that, for example, early in the period the reservoir may be more likely to fill and later in the period it may be more likely to empty.

Saturday 10:55 – 11:10

Text Message Decryption Methods

Erica Langmeyer*
The University of Findlay

Abstract 25: The focus of my research was to see what it would be like decrypting text messages, since words would be missing numerous vowels. To explore this idea, I encrypted and decrypted text messages that included abbreviated words and phrases. After deciphering the messages, the object of my research was to investigate the amount of time it took to decrypt text messages compared to normal text. I also compared encryption methods to decide if certain methods work better than others with text messages.

Modelling the Spread & Movement of a Zombie Attack

Austin Fry*
Xavier University

Abstract 26: In recent years, there has been increased worry of a zombie apocalypse whether that be from recent movies or television shows like The Walking Dead. The model is a cellular automata, stochastic model involving the idea of the spread of zombies within the happiest place on earth, Disney World. The model has four cases where the zombies are placed, and the analysis shows how to survive the longest amount of time possible.

Prisoner's Light Switch Problem: Probabilistic Connotation

M B Rao
University of Cincinnati

Abstract 27: There are 100 prisoners completely isolated in their own cells with no way of communicating with each other. The warden offers a way out of jail for all of them.

1. Every day he selects one prisoner at random (with replacement) and brings him over to one special room in the jail.
2. There is a switch controlling a light bulb in the room. To begin with the switch is in off position. The prisoner has three options: a. if the switch is in the off position he can push it to the on position; b. if the switch is in the on position he can push it to the off position; c. Do nothing.
3. If on any particular day the selected prisoner feels that every prisoner made a visit to the room at least once he can say so to the warden. If the prisoner is right all will be released. Otherwise all will be executed.

Before the random selection begins, all prisoners can huddle together once and formulate a strategy of making sure that everyone visited the room.

- Question 1: Is there a strategy that assures prisoners' freedom?
- Question 2: If there is one, what is the distribution of total number of visits for the fulfillment of the strategy?

There are strategies the prisoners can adopt to secure their freedom. The main focus is on the distribution.

Saturday 11:15 – 11:30

To Infinity & Beyond: A Study of 3-D Kaleidoscopes

Bethany Nye*
The University of Findlay

Abstract 28: In this talk we examine some of the mathematics behind two dimensional and three dimensional kaleidoscopes. Graphics from kaleidoscopes as well as a model of a three dimensional kaleidoscope will be presented.

Eradicating Ebola

Annie McClellan*
Xavier University

Abstract 29: We approached the challenge to create a sensible model that considers the spread of the Ebola, quantity of medicine needed, possible delivery systems, locations of those deliveries, and the manufacturing of the vaccine. In order to begin to attack this problem, we decided to optimize the eradication of Ebola by distributing a vaccine to Sierra Leone, Liberia, and Guinea, which are the three western African countries most affected by the epidemic. Numerically, they made up 99.8% of the total suspected, documented, and confirmed cases of Ebola in the world during this most recent outbreak of the disease starting in March of 2014.

Our model is divided up into five subsections: the spread of Ebola, quantity of vaccines needed, allocating the vaccines, delivery method and destination, and finally manufacturing speed of the drug. We first examined the spread of the disease in light of the three distinct countries. By using an infectious disease model, we were able to determine how many people one infected citizen infects. With this value we were then able to determine the quantity of vaccinations that should be allocated to each country. From there, we developed three different distribution ideas in regards to the "who" of the delivery subsection of our model. We next established specific hospitals that each set of vaccines should be allocated to throughout the country. And finally, we discussed the implications of the speed of the manufacturing of the vaccine, in terms of real vaccines currently being developed.

A Local Lagged Adapted Generalized Method of Moments and Applications.

Olusegun Otunuga
Marshall University

Abstract 30: In this work, an attempt is made for developing an interconnected discrete-time dynamic system of local sample mean and variance processes. This development is motivated by a parameter estimation problem of continuous time nonlinear stochastic dynamic model of energy commodity markets. The byproduct of this work initiates alternative innovative approach for state and parameter estimation problems for continuous time stochastic dynamic models. Moreover, the presented Local Lagged adapted Generalized Method of Moments (LLGMM) exhibits the balance between model specification and model prescription of continuous time dynamic processes in biological, chemical, engineering, financial, medical, physical and social sciences. The usefulness of the approach is illustrated by applying it to four energy commodity data sets, the U. S. Treasury Bill Yield Interest Rate and U.S. Eurocurrency Exchange Rate data sets for state and parameter estimation problems. Moreover, the forecasting and confidence-interval problems are also investigated.

Saturday 11:35 – 11:50

Sierpiński Triangular Numbers

Justin Eitner*
The University of Findlay

Abstract 31: With collaborators across the country, we showed the existence of an intersection between triangular numbers, Sierpiński numbers, and Riesel numbers. In recent work, the aim is to show that each integer within the representative Sierpiński and Riesel number sequences have at least two distinct prime divisors. Furthermore, we wish to prove that there exists infinitely many triangular numbers that cannot be written as the sum or difference of two prime powers.

The Effect of the Incidence Function on the Existence of Backwards Bifurcation

Philip Drew*
Xavier University

Abstract 32: In the use of differential equations in mathematical epidemiology, the form of the incidence function that is utilized lies in the hands of the modeler. We examined to see if this choice is significant in the propagation of the existence of subcritical equilibria, a phenomenon known as backwards bifurcation. Through our examination of two hallmark papers on the phenomenon, as well as our own original model, we have found that the mass action version of the incidence function restricts BB as opposed to the standard incidence form.

The Triangle Inequality: Algebraic or Geometric?

Daniel Otero
Xavier University

Abstract 33: Results in plane geometry often live dual lives, with synthetic proofs that make no explicit recourse to quantities like distance, and with algebraic proofs which convert geometric objects to numerical measures and suppress the underlying geometric objects. This talk examines the ubiquitous triangle inequality as a case study of this duality.

Save these Dates!

MathFest
Washington, DC
August 5-8, 2015

2015 Fall Ohio Section MAA Meeting
Capital University
October 23-24, 2015

100th Annual Meeting of the Mathematical Association of America
Ohio Section
Ohio Northern University
April 8-9, 2016

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