2013 PME Conference Schedule

9:00–9:40: Registration & Breakfast - Third Floor, Room 3427/3422

9:40–9:50: Welcome & Introduction - Third Floor, Room 3422

	Room 2202	**Room 2203**	**Room 2204**	**Room 2205**	**Room 2221 COMAP**
10:00-10:15	Carissa Mason	Tyler Ewing	Rachel Jeswald	Michael Baker	Matthew Wozniak and Nick Cercone
10:20-10:35	Christina Erceg	Clayton Schuman	Robert Wyant	Joseph Cochran	Jordan Awan and Michael Bauer
10:40-10:55	James Munyon and Drew Saluga	Shane Bradford	Emily Hickman	Domenic Neely	COMAP MCM
11:00-11:15	Ryan Lopez	Stephanie Gelik	John Griebel	Blain Patterson	COMAP MCM
11:20-11:35	Mark Beckwith	Jarrett Scacchetti	Morgan Swartz	Sarah Ritchey	COMAP MCM
11:40-11:55	Megan Chambers	Lisa Kaylor	Julie Seitz	Jessi Smurphat	COMAP MCM

11:55–12:50: Lunch - Third Floor, Room 3422

	Room 2202	**Room 2203**	**Room 2204**	**Room 2205**	**Room 2221**
12:50-1:05	Shawn Pelc	Emily Walther	Kim Do	Mark Drombowski	Ashlee Dawson
1:10-1:25	Nico Mancuso	Daniel Rutkowski	Matthew Pierson	Michael Goldthwait	**Math Majors Panel**
1:30-1:45	Andrew Kieffer	Gabe Kramer	Shawn Doyle	Eric Shehadi	Ryan Culp, Chris Jones and Randi Yazvac
1:50-2:05	Daniel Catello	Adam Bryan	Frederick Sommers	Bethany Ekimoff	

2:10: Closing Remarks - Third Floor, Room 3422

Morning Session 10:00-10:15

10:00-10:15 **Carissa Mason** **Room 2202**

Goursat's Theorem

Edinboro University of Pennsylvania
Advised by: Dr. Richard White

Let G and H be groups. Then there is a bijection between the set S of subgroups of $G \times H$ and the set T of all triples $(A/B, C/D, f)$ where A/B is a quotient in G, C/D is a quotient in H, and $f : A/B \mapsto C/D$ is an isomorphism.

10:00-10:15 **Tyler Ewing** **Room 2203**

A Complete Characterization of the Sheffer B-Type k Orthogonal Sets

Penn State Erie
Advised by: Dr. Daniel J. Galiffa

J. Meixner (1934) and I.M. Sheffer (1939) determined all of the orthogonal polynomial sequences that satisfy, what Sheffer entitled, the *B-Type 0* generating function. These sets are often simply referred to as the Sheffer Sequences, which are now known to be the well-studied Laguerre, Hermite, Charlier, Meixner, Meixner-Pollaczek and Krawtchouk polynomials. Additionally, Sheffer extended the aforesaid generating function to the case of *B-Type k*. To date, no results have been put forth regarding the specific problem of determining all of the *B-Type k* orthogonal sets and it has recently been conjectured that such sets exist if and only if $k = 0$. In this paper, we prove this conjecture.

10:00-10:15 **Rachel Jeswald** **Room 2204**

Project Math Minds

Poland Seminary High School
Advised by: Miss Sarah Gerberry and Dr. Thomas Wakefield

We were given the problem to mathematically model one's college choice, given a particular major and future earnings potential. Using math skills, knowledge of actuarial science, and research, we solved the problem. We researched the cost of a college education from three universities and any additional expenses. Our results are based off my research and allowed us to determine which university would be most beneficial given the career choice.

Morning Session 10:00-10:15 (Continued)

10:00-10:15 **Room 2205**

Michael Baker
Modeling of Electromagnetic Radiation through Tri-layered Photonic Crystals
Youngstown State University
Advised by: Dr. Michael Crescimanno

In this presentation, we shall examine transformations of electric and magnetic fields traversing layers of photonic crystals via methods developed through linear algebra. Traditionally, these photonic crystals are made of two materials, A and B, that are layered n times, denoted $(AB)^n$. Such layers are nearly parity invariant with materials $(BA)^n$. However, with the addition of a third layer C, there are striking differences in reflection between $(ABC)^n$ and $(CBA)^n$. Using matrix multiplication, we shall explore such $(ABC)^n$ materials that break this parity.

10:00-10:15 **Room 2221**

Matthew Wozniak and Nick Cercone
Perfecting the Brownie Pan Using Statistical Optimization Techniques
Slippery Rock University
Advised by: Dr. Richard Marchand

The process by which heat is transferred from an oven heat source, into a pan, and dispersed throughout a contiguous mass of brownie batter is computationally modeled using a unique C program. The computer model extracts temperature data and heat diffusion rates for any x,y location within a 2–dimensional pan. The plausibility of the computational methods is verified by mathematically modeling the same scenario using the thermal diffusion equation with appropriate boundary conditions. Additionally, shape packing is studied for circles and squares inside of a square to model packing efficiency of pans within an oven. This research explores the effect that different sizes and shapes of baking pans have on this specific process. The final model presents a statistical method that attempts to optimize the quality and productivity of the baking system by finding an ideal shape, size, and quantity of pans for baking brownies in a square oven.

Morning Session 10:20-10:35

10:20-10:35 **Room 2202**

Christina Erceg
Backgammon End Game Doubling Strategies in Money Play and Match Play
Westminster College
Advised by: Dr. David Offner

This presentation focuses on Backgammon end game doubling strategies in money play and match play games. Money play is a single game to determine the winner and match play is a series of matches played to a certain point total. Doubling multiplies the value of the game and is important since it plays a large part in determining the winner. By calculating money equity and match equity in late game situations a player can determine whether or not he should double the stakes of the game. In money play a player should double if his probability of winning in a last move situation is greater than .5. Meanwhile, in match play the doubling point is determined by how many points away a player is from winning the match. We find players' end game positions where these doubling decisions differ between money play and match play.

10:20-10:35 **Room 2203**

Clayton Schuman
Multi-Dimensional Predator-Prey Models
Penn State Erie
Advised by: Dr. Antonio Mastroberardino

The Lokta-Volterra predator-prey system is one of the classical models of mathematical biology. This simple model describes the populations of a predator and prey specie within an ecosystem, and can be adapted to fit more biologically relevant situations; frequently, the two species model is expanded through the introduction of additional species. In this study, we analyze higher order Lokta-Volterra systems of a particular form, and use this analysis to generalize the behavior of such systems. Then, we use this generalization to derive conditions on system stability for arbitrarily large ecosystems.

10:20-10:35 **Room 2204**

Robert Wyant
A Solution to an Inner Product Space Problem
Youngstown State University
Advised by: Dr. Thomas Smotzer

A *Mathematical Monthly* problem will be proven that was proposed by Cezar Lupu and Dan Schwarz. The problem consists of two inequalities about vectors from an inner product space.

Morning Session 10:20-10:35 (continued)

10:20-10:35 **Room 2205**

Joseph Cochran
The Google PageRank Algorithm Applied to Sports Rankings
Youngstown State University
Advised by: Dr. Padraic Taylor

Since the late 1990's, Google has become a household name. Daily, it conducts over four billion searches. How often do we stop to think about the results that appear after we enter a query? In this talk we will explore the Google PageRank algorithm and discuss how it can be applied to ranking sports teams.

10:20-10:35 **Room 2221**

Jordan Awan and Michael Bauer
Superellipses: Shaping the Future of Brownies
Clarion University
Advised by: Dr. Duane Farnsworth

We are presenting our solution to the 2013 COMAP MCM question A. We use superellipses to describe the shapes of the pans and model the distribution of heat across the brownie as a function of the distance from the center of the pan to a given point. The quality of brownies cooked in a given pan is related to the standard deviation of the heat along the edge of the pan. We then developed a simple algorithm to determine an optimal pan given a consumer's preferences. From our model, it was determined that the optimal pan, should one only consider quality, is a circle, and that the optimal pan for packing is a rectangle with dimensions related to those of the oven.

Morning Session 10:40-10:55

10:40-10:55 **Room 2202**

James Munyon & Drew Saluga
Ranking the 2012 NFL Teams
Youngstown State University
Advised by: Dr. Thomas Wakefield

We utilized methods from the book "Who's #1?" to rank the teams of the National Football League during the 17 weeks of this past regular season. We used several methods including the Colley and Keener methods. We then compared the rankings we got between the different methods, and also compared them with the final standings listed by NFL.

10:40-10:55 **Room 2203**

Shane Bradford
An Arithmetic Metric
Edinboro University of Pennsylvania
Advised by: Dr. Richard White

An arithmetic metric is defined on the integers, by using the Fundamental Theorem Of Arithmetic to find the distance between two natural numbers. Specific examples are constructed using I-12, the integers from 1-12.

10:40-10:55 **Room 2204**

Emily Hickman
A Solution to a Function Problem
Youngstown State University
Advised by: Dr. Thomas Smotzer

We present a solution to a function problem proposed by Peter Linnell. The problem consists of proving that an arbitrary function satisfying a certain property satisfies two inequalities.

10:40-10:55 **Room 2205**

Domenic Neely
Quarantine for an Infectious Disease
Westminster College
Advised by: Dr. Carolyn Cuff

In this presentation we adapt the classic SIR model of an epidemic to include quarantines of the Susceptibles and/or the Infected. The model developed can be used to predict the best time to impose the quarantine. This will help us determine how to make an epidemic more manageable which will result in lower death rates.

10:40-10:55 **COMAP Modeling Discussion** **Room 2221**

All are welcome to discuss this year's COMAP problems and potential solutions to both the discrete and continuous problems. This informal session is meant to share ideas and strategies for the approach to the problems, which are provided on Page 16 of this abstract book.

Morning Session 11:00-11:15

11:00-11:15 **Ryan Lopez** **Room 2202**
Weather Derivatives and an Application with Modeling
Youngstown State University
Advised by: Dr. Thomas Wakefield

This project involves the exploration of the mathematics behind weather derivatives and how they work. The goal is to give an understanding of the concept of derivatives and provide an example analysis of data relating to Youngstown, Ohio.

11:00-11:15 **Stephanie Gelik** **Room 2203**
N-gons of a Different Color
Edinboro University of Pennsylvania
Advised by: Dr. Douglas Puharic

This project will explore the results of folding regular pentagons and regular n-gons. We will examine the polygons formed by the folding and the underlying geometry behind the patterns of these polygons.

11:00-11:15 **John Griebel** **Room 2204**
A Fibonacci Sequence with Probability
Westminster College
Advised by: Dr. Carolyn Cuff

We analyze a standard problem studied in discrete mathematics. Consider the discrete math problem of parking small cars which require one space and large cars which require two spaces. The solution yields a Fibonacci sequence. We then investigate the implications of introducing probability to the problem. Our solution includes Fibonacci like recurrence relations, as well as an explicit solution of the recurrence relation.

11:00-11:15 **Blain Patterson** **Room 2205**
Converse to Lagrange's Theorem Groups
Youngstown State University
Advised by: Dr. Neil Flowers

We will be discussing converse to Lagrange's theorem groups, or CLT groups. This includes defining what it is to be a CLT group, examples of groups that are CLT groups and not CLT groups, as well as finding wide classes of CLT groups.

11:00-11:15 **COMAP Modeling Discussion** **Room 2221**

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Morning Session 11:20-11:35

11:20-11:35 **Room 2202**

Mark Beckwith
Spooky Spokes and the Path Partition Conjecture
Slippery Rock University
Advised by: Dr. Shelly Bouchat

The Path Partition Conjecture is an open problem first posed by Lovász and Mihók in 1981. This talk will focus on the Path Partition Conjecture for three types of graphs: cycles, wheels, and web graphs.

11:20-11:35 **Room 2203**

Jarrett Scacchetti
Rubik's Cube Android App: Solve Your First Rubik's Cube Today!
Youngstown State University
Advised by: Dr. Nathan Ritchey

The Rubik's Cube is a household common puzzle invented in 1974 by Ernō Rubik–a Hungarian sculptor and professor of architecture. It is a puzzle that became popular in the 1980's to kids of all ages, and even more so in the field of mathematical group theory. Throughout the years the optimal solution has been proven down to a present day twenty moves thanks to research by Tomas Rokicki and Google, proved by God's number. This Rubik's Cube Android App takes pictures of a $3 \times 3 \times 3$ cube, and will generate a solution with twenty-two or less moves with less than a second of computation time on the phone. The solution is created by the implementation of a color recognition algorithm that changes the RGB values to a Hue-Saturation value, which maps the $3 \times 3 \times 3$ cube and passes it into Kociemba's Two-Phase Cube Solving Algorithm, outputting the result to a text friendly interface for the user to understand. Come and watch the presentation and live demonstration where members of the audience will have the chance to solve a $3 \times 3 \times 3$ Rubik's Cube without any prior knowledge! Credit for this app goes to the team of Aaron Bishop, Michael Sammartino, and Jarrett Scacchetti.

11:20-11:35 **Room 2204**

Morgan Swartz
Statistical Analysis of an Analytical Chemistry Experiment: Applications of Partial Least Squares Regression to Biodiesel Blends and Frackwater Samples
Westminster College
Advised by: Dr. Carolyn Cuff

Natural gas is an important resource in the world. Recently, the United States has begun drilling for natural gas in the Marcellus Shale formation located across Pennsylvania, Ohio, and surrounding states. We need to understand the chemical composition of the frackwater from this form of drilling. In this project, we create a technique for analyzing the chemical compositions of our samples. We began with a pilot study involving blends of biodiesel and conventional diesel. We used known blends of biodiesel and conventional diesel to determine if our technique produced the results we were expecting. We use a linear regression statistical model to analyze data collected from an Analytical Chemistry experiment using gas chromatography-mass spectrometry and chemometrics to predict biodiesel blend percent composition. This experiment is being studied and will serve as a reference for a similar experiment to be conducted in the future dealing with Marcellus Shale fracturing, or fracking.

Morning Session 11:20-11:35 (continued)

11:20-11:35 **Sarah Ritchey** **Room 2205**
Prime Time Algorithms: Constructing a Prime Number Generator
Youngstown State University
Advised by: Dr. Nathan Ritchey

Over the years, many things have been discovered about primes. For example, one can easily prove that there are infinitely many primes or easily determine if a number is prime. On the other hand, it is not trivial to find a formula to generate all the primes or even one that generates only primes. This presentation will examine the accuracy of different prime generating algorithms like polynomial generators, the Fermat primality test, and the W. H. Mills equation. It will also take a closer look at the precision and brute computational power needed to make make these algorithms work.

11:20-11:35 **COMAP Modeling Discussion** **Room 2221**

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Morning Session 11:40-11:55

11:40-11:55 **Room 2202**

Megan Chambers
The "Bigger Half": Examining Fair Division
Youngstown State University
Advised by: Dr. Nathan Ritchey

The Fair Division Dilemma, also known as the Cake-Cutting Problem, is a method of resource allocation used to ensure that each party sharing the resource believes that they have received at least a fair share. It is a problem that has been studied extensively by mathematicians for years and has been the topic of many mathematical papers and books. In my presentation, I examine this problem's different variations, various algorithms that can be executed to solve the problem, and an impossibility proof regarding the algorithms. The potential uses for the problem are abundant, and the mathematics behind it are beautiful, not to mention delicious!

11:40-11:55 **Room 2203**

Lisa Kaylor
Matrices over Z (mod p) with Eigenvalues in the Same Field
Westminster College
Advised by: Dr. David Offner

In this presentation, we present a method to count the number of matrices in Z (mod p) whose eigenvalues also lie in Z (mod p). After providing a count of the invertible matrices with entries in Z (mod p), we present a condensed version of Olsavsky's solution for 2 by 2 matrices. These ideas are then extended to both the 3 by 3 and 4 by 4 cases. With the resulting counts from each case, we conjecture and prove a theorem stating that the number of matrices sharing this property for some n by n matrix has a limiting value if $1/n!$ as the prime p becomes large.

11:40-11:55 **Room 2204**

Julie Seitz
Tilings and Tessellations
Youngstown State University
Advised by: Dr. Angela Spalsbury

Tilings of shapes are commonly seen in both natural and man-made settings. In this presentation, we will explore the mathematical basis of some tilings. We will focus first on polygons and the properties that allow them to tile a plane. We will then discuss how it is possible to create tilings with other images using geometric transformations.

11:40-11:55 **Room 2205**

Jessi Smurphat
Mathematical Magic
Edinboro University of Pennsylvania
Advised by: Dr. Douglas Puharic

I will demonstrate a mystifying card trick for your amusement. After which, we will investigate the mathematics behind the card trick and demystify the card trick with simple algebra.

11:40-11:55 **COMAP Modeling Discussion** **Room 2221**

All are welcome to discuss this year's COMAP problems and potential solutions to both the discrete and continuous problems. This informal session is meant to share ideas and strategies for the approach to the problems, which are provided on Page 16 of this abstract book.

Afternoon Session 12:50-1:05

12:50-1:05 **Room 2202**

Shawn Pelc
Chance Music: Using Probability to Compose Bugle Calls
Edinboro University of Pennsylvania
Advised by: Dr. Emily Sprague

We will present an illustration of a technique for determining bugle calls by constructing and applying transition matrices. We will explain the underlying mathematics, discuss some conclusions, and suggest some amplifications.

12:50-1:05 **Room 2203**

Emily Walther
Variations of Lollipops and Their Pebbling Numbers
Westminster College
Advised by: Dr. Jeffery Boerner, Dr. Natacha Fontes-Merz, Mr. James Anthony

A pebbling move on a graph comprises of taking two pebbles off of on vertex in order to move a pebble to an adjacent vertex. The pebbling number of a graph is defined as the lowest number of pebbles you need to place on a graph to guarantee that you will be able to place at least one pebble on any vertex after a series of pebbling moves. This mathematical game was originally introduced in 1989 by F. R. K. Chung and is a topic studied in graph theory and related to number theory. This talk will first focus on understanding the fundamental concepts of pebbling and the pebbling number of common graphs such as paths, complete graphs, and cycles will be discussed. The pebbling number of an even cycle lollipop will be introduced and we will explore the pebbling number of an odd cycle lollipop.

12:50-1:05 **Room 2204**

Kim Do
An Introduction to Combinatorial Games on Directed Graphs
Youngstown State University
Advised by: Dr. David Pollack

We introduce the basic theory of impartial combinatorial games on directed graphs. The structure of directed graphs with no cycles is used to find winning strategies for games. The Sprague-Grundy function is defined and used to study games with multiple boards.

12:50-1:05 **Room 2205**

Mark Drombowski
Determining Quantized Orthogonal Polynomial Solutions to a Difference Equation
Penn State Erie
Advised by: Dr. Daniel Galiffa

Orthogonal Polynomials follow two equations that help to classify their properties. Using the methodology behind finding specific solutions for Orthogonal Polynomials, we can obtain new solutions using new difference equations. A difference equation that has yet to be used is the Askey Wilson Difference Operator. This operator was used for the first case and the results followed.

12:50-1:05 **Room 2221**

Ashlee Dawson
An Original Proof of the Pythagorean Theorem
Youngstown State University
Advised by: Dr. Padraic Taylor

The Pythagorean Theorem is a famous mathematical finding dating back to before 250 B.C. The theorem states that in a right triangle, the sum of the squares of the lengths of the two legs equals the square of the length of the hypotenuse. Hundreds of proofs of this theorem can be found today in texts and on the internet. This presentation uses a diagram like that used by the Chinese in 250 B.C. but quickly takes a different path as an original, and possibly new, proof of the Pythagorean Theorem is discovered using geometric series.

Afternoon Session 1:10-1:25

1:10-1:25 **Room 2202**

Nico Mancuso
Proof for the Nine-Point Circle and the Euler Line
Youngstown State University
Advised by: Dr. Richard Goldthwait

The Nine-Point Circle, as the name suggests, is a circle for which nine points on the circumference are known. It is constructed from any given triangle. A proof for this Circle will be presented. Additionally, the orthocenter, centroid, and circumcenter of any given triangle are collinear. The line segment connecting them is commonly referred to as the Euler Line, and a proof for it will also be presented.

1:10-1:25 **Room 2203**

Daniel Rutkowski
An Exploration in Cover Pebbling
Westminster College
Advised by: Dr. Natacha Fontes-Merz and Mr. James Anthony

Graph pebbling is a recent development in graph theory in which pebbles are placed on the vertices of a graph G. Pebbles are moved from vertex to vertex by a process known as a pebbling move. In this talk, we will explore a variation of graph pebbling known as cover pebbling. Specifically, we will explore the cover pebbling number of a graph, the Stacking Theorem and its uses, and, finally, the connections between cover pebbling and eccentricity.

1:10-1:25 **Room 2204**

Matthew Pierson
Mathematical Modeling of Selenium Metabolism in *S. maltophilia* ORO2
Youngstown State University
Advised by: Dr. George Yates

A system of differential equations was developed using a modified logistic growth equation coupled with Michaelis-Menten enzyme kinetics to model bacterial growth and selenite metabolism in *S. maltophilia* ORO2. The model tracks selenite as it enters the cells and is reduced to nontoxic selenium. Analysis and numerical computation of the model compare favorably to experimental data, and help explain this bacteria's resistance to selenite.

1:10-1:25 **Room 2205**

Michael Goldthwait
The Secretary Problem
Youngstown State University
Advised by: Dr. Nathan Ritchey

The Secretary Problem is a famous problem in discrete probability, which became a popular subject of discussion and research about halfway through the twentieth century. This talk will explore the solution to the problem as it was originally stated, and then discuss several variants of the original problem.

1:10-1:25 **Panel: Advice from Math Majors to Math Majors** **Room 2221**

Ryan Culp, Pricing Analyst, Nationwide Insurance
Chris Jones, VP Bank of NY Mellon
Randi Yazvac, STEM Teacher, Crestview Local Schools

The panel includes mathematics majors who have graduated and are now employed in schools and in the private sector. They are willing to share their experiences, offer advice to undergraduate mathematics majors, and answer questions about their positions. Their biographies are provided on Page 15 of this abstract book.

Afternoon Session 1:30-1:45

1:30-1:45 **Andrew Kieffer** **Room 2202**

Using a Markov Chain Model to Compare the 2012 MLB Playoff System to the 2011 System

Westminster College

Advised by: Dr. David Offner

The playoff system in Major League Baseball (MLB) has evolved over time as more teams and divisions were added to the league. The current form in the 2012 playoffs included an extra wild card team in each league. We want to investigate how much this difference in formats may change the outcome of the playoffs, i.e., what teams, if any, will benefit from, or get hurt by, this new format. To do this, we updated and added to a simulator that uses a Markov chain model to simulate baseball games, and then simulated the playoff scenarios. We took the same teams that made the 2012 playoffs and tested them in both the new and the old system. From these tests, we concluded that the number one seeds in each league have the overall advantage in the 2012 playoff format.

1:30-1:45 **Gabe Kramer** **Room 2203**

A Walk In the Woods

Penn State Erie

Advised by: Dr. Courtney Nagle

In Differential Calculus, students learn three useful rules: the power rule, the product rule, and the quotient rule, but rarely see a proof or derivation of any of the rules. This talk will provide proofs of the power, product, and quotient rules using only the properties and derivative of the Natural Logarithm function.

1:30-1:45 **Shawn Doyle** **Room 2204**

Newton's Series for π

Youngstown State University

Advised by: Dr. Angela Spalsbury

I will be discussing Newton's derivation of π using an infinite series.

1:30-1:45 **Eric Shehadi** **Room 2205**

Prioritizing Vacant Homes for Demolition in Youngstown, Ohio

Youngstown State University

Advised by: Dr. Thomas Wakefield

Home vacancy in Youngstown has been a significant issue since the economic and population decline beginning in the 1970s. A survey of the city from April 2012 identified roughly 4000 vacant structures in Youngstown. Through research, we attempt to identify vacant structures to prioritize for demolition. To achieve this goal, we use data compiled from various sources and include geographical and neighborhood information. Through this, we identify homes that, through their demolition, would offer the maximum impact to the surrounding neighborhood and community.

1:30-1:45 **Panel: Advice from Math Majors to Math Majors** **Room 2221**

Ryan Culp, Pricing Analyst, Nationwide Insurance
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Afternoon Session 1:50-2:05

1:50-2:05 **Room 2202**

Daniel Catello
Goursat's "Other" Theorem
Youngstown State University
Advised by: Dr. Thomas Wakefield

An elementary abstract algebra course teaches students many methods of constructing, analyzing, and dissecting groups. However, most texts and courses in this field exclude this intriguing theorem by Jean-Baptiste Goursat that fully characterizes the subgroups of a direct product. The theorem utilizes a surprising number of topics covered in a first Abstract course. Goursat's "other" theorem will be proven and dissected and an example given of this useful tool.

1:50-2:05 **Room 2203**

Adam Bryan
The Mathematics of Kicking Field Goals
Xavier University
Advised by: Dr. David Gerberry

I want to analyze the mathematics of kicking field goals in football. What creates the difficulty of a field goal? I will incorporate the angle at which the ball was kicked along with the probability that the kicker kicks the ball straight to get a better understanding of the mathematics during a field goal attempt.

1:50-2:05 **Room 2204**

Frederick Sommers
Probability of Triangle Heights
Youngstown State University
Advised by: Dr. Thomas Smotzer

Let the unit interval be broken at two randomly chosen points about its length. I will show how to find the probability that the lengths of the resulting three intervals are the heights of a triangle.

1:50-2:05 **Room 2205**

Bethany Ekimoff
An Examination of Checkerboard Surfaces on Knots
Westminster College
Advised by: Dr. Jeffrey Boerner

In this talk we will discuss properties of knots and their checkerboard surfaces. Specifically we will focus on whether a checkerboard surface of a knot is orientable or nonorientable in a minimal diagram. We examine the manipulation of these diagrams through the use of grid diagrams and planar graph representations. In particular, we discuss the twist knot family and identify patterns in the use of a Cromwell translation to change a checkerboard surface's orientability. Using these techniques, we are able to show that some knots do not have projections with a minimal number of crossings for an orientable checkerboard surface.

1:50-2:05 **Panel: Advice from Math Majors to Math Majors** **Room 2221**

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Biographies of Panelists

Ryan Culp

Ryan graduated from Champion High School in 2007. After high school graduation, he attended Westminster College in Pennsylvania. While attending Westminster, Ryan majored in mathematics, participated in extracurricular activities, and worked at the recreation facility in a work study program. After two years at Westminster, he transferred to continue his mathematics degree at Youngstown State University. While attending Youngstown State University, he majored in mathematics with a minor in actuarial science. He earned a bachelor of science in mathematics with a minor in actuarial science and learned skills that helped him establish and begin to achieve his career goals. He graduated with his bachelor's degree from YSU in 2011. The next semester he enrolled in graduate school at Youngstown State University. After one semester of graduate school, Ryan obtained a summer internship with Nationwide Insurance working in the field of actuarial science. After his summer internship, he was offered a full time position with Nationwide. He is now a pricing analyst with Nationwide Insurance. He hopes to continue to succeed as an employee at Nationwide and proceed to study and pass actuarial science exams.

Chris Jones

Chris Jones is a Vice President at the Bank Of New York Mellon and works in model risk analysis. Chris holds a Ph.D. in mathematics from the University of Pittsburgh and wrote his dissertation on the optimal exercise of the mortgage prepayment option and has been working in quantitative finance for the past 5 years. While at YSU, Chris participated in COMAP's Mathematical Competition in Modeling (MCM), earning a rank of Outstanding with teammates Sarah Grove and Joel Lepak in 2003.

Randi Yazvac

Randi Yazvac is currently a teacher at Crestview Local Schools in Columbiana, Ohio. After graduating from Boardman High School in 2008, she was offered the Leslie Cochran University Scholarship from Youngstown State University, making her selection of colleges quite easy. Upon arriving at Youngstown State University, she was uncertain of a major so began taking general education courses as a freshman. Randi then settled into Mathematics as a sophomore and realized she had found her calling. After completing a year of Mathematics classes, Randi decided to get a degree in Mathematics Education and graduated two years later. Upon graduation, Randi accepted a wonderful job teaching a new program, titled "STEM", which combines science, technology, engineering, and mathematics for grades 7–12 at Crestview Local Schools. Halfway through her first year of teaching, Randi is excited to come back to the Pi Mu Epsilon Regional Conference to share her experiences.

2013 MCM / ICM - COMAP Modeling Problems

Continuous Modeling (Problem A)
The Ultimate Brownie Pan

When baking in a rectangular pan heat is concentrated in the 4 corners and the product gets overcooked at the corners (and to a lesser extent at the edges). In a round pan the heat is distributed evenly over the entire outer edge and the product is not overcooked at the edges. However, since most ovens are rectangular in shape using round pans is not efficient with respect to using the space in an oven. Develop a model to show the distribution of heat across the outer edge of a pan for pans of different shapes–rectangular to circular and other shapes in between.

Assume

1. A width to length ratio of W/L for the oven which is rectangular in shape.
2. Each pan must have an area of A.
3. Initially two racks in the oven, evenly spaced.

Develop a model that can be used to select the best type of pan (shape) under the following conditions:

1. Maximize number of pans that can fit in the oven (N)
2. Maximize even distribution of heat (H) for the pan
3. Optimize a combination of conditions (1) and (2) where weights p and $(1-p)$ are assigned to illustrate how the results vary with different values of W/L and p.

In addition to your MCM formatted solution, prepare a one to two page advertising sheet for the new Brownie Gourmet Magazine highlighting your design and results.

Discrete Modeling (Problem B)
Water, Water Everywhere

Fresh water is the limiting constraint for development in much of the world. Build a mathematical model for determining an effective, feasible, and cost-efficient water strategy for 2013 to meet the projected water needs of (pick one country from the list below) in 2025, and identify the best water strategy. In particular, your mathematical model must address storage and movement; desalinization; and conservation. If possible, use your model to discuss the economic, physical, and environmental implications of your strategy. Provide a non-technical position paper to governmental leadership outlining your approach, its feasibility and costs, and why it is the "best water strategy choice."

Countries: United States, China, Russia, Egypt, or Saudi Arabia

2013 MCM-COMAP Participants from YSU:

Estee George Matt English Daniel Catello	Kim Do Christopher Karlic Michael Baker	Cory Merlo Kyle Shehadi Kyle Spickler	Christopher Poullas Samuel Rakocy Kayla Zitello
Camron Bagheri James Tancabel Ashley Orr	Jared Clark Austin Vestrand	Shawn Doyle Sebastian Haigler	

2013 PME National Meeting at MAA MathFest

Please join us at this year's meeting to be held July 31 through August 3, 2013, in Hartford, Connecticut. Students are invited to give fifteen minute talks on any mathematical topic or application in areas such as statistics, computing, or operations research. Topics including expository research, interesting applications, problems, etc. are also welcome. Transportation reimbursement is also available to those who qualify. Visit the National Pi Mu Epsilon website at `http://www.math-pme.org` for more details.

Ohio Section of MAA Spring Meeting at Denison University

The Ohio Section of the Mathematical Association of America will hold its annual spring meeting at Denison University on Friday, April 5 and Saturday, April 6, 2013. The meeting consists of talks by mathematics faculty, graduate students, and undergraduates from around the state. The Section especially welcomes talks and participation by undergraduate students. In addition to student talks, there is an undergraduate problem solving competition with cash prizes, and a pizza party. We encourage you to give a talk at the meeting or participate in the competition or pizza party.

If you are participating in the problem solving competition, we ask that you register at:

`http://constum.ohiomaa.org/`

If you have any questions, please do not hesitate to contact Tom Wakefield by phone `330-941-1395` or by email `tpwakefield@ysu.edu`.

A Warm Welcome to the Participating Schools:

- Boardman High School
- Bowling Green State University
- Butler County Community College
- Carnegie Mellon University
- Clarion University of Pennsylvania
- Cleveland State University
- D'Youville College
- Edinboro University of Pennsylvania
- Fairmont State University
- Franklin Area High School
- Georgia Southern University
- Grand Valley State University
- John Carroll University
- Kent State University
- Lake Erie College
- Lakeland Community College
- Lorain County Community College
- Miami University
- The Ohio State University
- Penn State Erie
- Poland High School
- Slippery Rock University
- St. Olaf College
- The University of Akron
- Walsh University
- West Liberty University
- West Point
- Westminster College
- Xavier University
- Youngstown State University

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Funding for this conference is provided by NSF grant DMS-0846477 through the MAA Regional Undergraduate Mathematics Conferences program `http://www.maa.org/RUMC/`.

Special thanks to the Department of Mathematics and Statistics and the Center for Undergraduate Research in Mathematics (CURMath) at Youngstown State University.