Youngstown State University

Regional Pi Mu Epsilon Conference

February 25, 2012

Make everything as simple as possible, but no simpler.
~ Albert Einstein

The moving power of mathematical invention is not reasoning, but imagination.
~ Augustus De Morgan

What science can there be more noble, more excellent, more useful for men, more admirably high and demonstrative than mathematics.
~ Benjamin Franklin

The value of a problem is not so much coming up with the answer as in the ideas and attempted ideas it forces on the would-be solver...
~ I. N. Herstein

Sponsored by NSF Grant DMS - 0846477

A Warm Welcome to the Participating Schools:

- Allegheny College
- Boardman High School
- Cleveland State University
- Duquesne University
- Edinboro University of Pennsylvania
- Fairmont State University
- John Carroll University
- Kent State University
- Lake Erie College
- Lakeland Community College
- Lorain County Community College
- Penn State Erie
- Slippery Rock University
- Warren G. Harding High School
- West Liberty University
- Westminster College
- Youngstown State University

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Dr. Angela Spalsbury

Dr. Thomas Wakefield

Dr. George Yates

Funding for this conference is provided by NSF grant DMS-0846477 through the MAA Regional Undergraduate Mathematics Conferences program `http://www.maa.org/RUMC/`. Support from NSF Grant DBI-0827205 is also acknowledged for sponsoring a talk in mathematical biology.

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

2012 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 2201	**Room 2203**	**Room 2204**	**Room 2212**
10:00-10:15	Nick Fischer	Greg Clark	Emma Stevens	Bradley Slabe
10:20-10:35	Sarah Ritchey	Kristi Yazvac	Chelsea Schrock	COMAP MCM-B
10:40-10:55	James Munyon and Drew Saluga	Rex Edmonds	Kelcie Herberger	COMAP MCM-B
11:00-11:15	Nivetha Ramasubramanian	Tara McCart	Randi Yazvac	COMAP MCM-A
11:20-11:35	Timothy Clos	Richard Ligo	Ben White	COMAP MCM-A
11:40-11:55	Glenn Sidle	Kathleen Sprague	Rachel Legg	COMAP MCM-A

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

	Room 2201	**Room 2203**	**Room 2204: High School**	**Room 2212**
12:50-1:05	Tanya Riston	Amanda Goodrick	Michael Sheridan	Mario Sracic
1:10-1:25	Ryan Ray	Daniel Catello	Muhammad Akbar and Katya Sracic	**Career and Graduate Opportunities Panel**
1:30-1:45	Andrew King	Coty Hainsey	Maddie Smotzer	Jim Banoczi, Leah Gold and Daniela Calvetti
1:50-2:05	Eric Shehadi	Elliot Blackstone	Michael Coates	
2:10-2:25	Robert Rhodes	Emily Dolsak	Michael Baker	

2:30: Closing Remarks - Third Floor, Room 3422

Morning Session 10:00-10:15

10:00-10:15 **Room 2201**

Nick Fischer
Finding the Dimension of Two Famous Fractals Using Self-Similarity
Lakeland Community College
Advised by: Dr. Carl Stitz

In this talk we will motivate what dimension means in terms of exponents and use this to find the fractal dimension of the Cantor Set and the Sierpinski Gasket.

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

Greg Clark
Famous Sequences and Euclidean Algorithm Step Sizes
Westminster College
Advised by: Dr. Natacha Fontes-Merz

We will prove that the maximum step size for the Euclidean Algorithm is achieved using Fibonacci numbers and Lucas numbers of odd index. In particular, we will use a formula that provides an upper bound on the number of steps needed when using the Euclidean Algorithm on two natural numbers a and b. Furthermore, we will show that the upper bound is achieved for certain values of b.

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

Emma Stevens
Music and Math
Lake Erie College
Advised by: Dr. Tabrina Smith

Teaching transformations of functions sometimes can be boring to students. They often ask why, when learning transformations and most of the time don't understand the concept of how transformations really work. This is a discovery activity that allows students to learn transformation of functions through music. This is an activity in which students treat a song like a function and apply changes to the input to analyze the output to gain an understanding of transformations.

10:00-10:15 **Room 2212**

Bradley Slabe
Mathematical Model of Acetone-Butanol-Ethanol Fermentation by Clostridium beijerinckii
Youngstown State University
Advised by: Dr. George Yates

Over this past summer I was part of a team researching the fermentation of Butanol by the bacteria Clostridium beijerinckii, as part of an alternative energy project. The metabolic pathways have been previously mapped out by others, and the model for the pathway consists of differential equations derived from Michaelis-Menten kinematics. Due to the complexity of the pathway, steady state solutions are not readily apparent. In this presentation, we examine the steady state solutions for simplified versions of the model.

Morning Session 10:20-10:35

10:20-10:35 **Room 2201**

Sarah Ritchey
Inscribed Equilateral Triangles:
Where Geometry and Number Theory Collide
Youngstown State University
Advised by: Dr. Jacek Fabrykowski

In this presentation, we will provide a solution to Fall 2011 PME Journal Problem Number 1245. This problem asks whether it is possible to construct a particular triangle that has distinct positive integer side lengths from an equilateral triangle that has been inscribed inside of a circle. We will show that there are infinitely many such triangles and then proceed to characterize all such solutions. A wonderful surprise occurs when the solution process reveals that the solution to this problem involves a problem from number theory that Euler studied many years ago.

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

Kristi Yazvac
Cauchy's Condensation Test
Youngstown State University
Advised by: Dr. Thomas Smotzer

We will prove the Cauchy Condensation Test, which is a test about the convergence of infinite series. We will then look at how this test is sometimes easier to apply than the popular Integral Test.

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

Chelsea Schrock
How To Hang With The High Rollers
Westminster College
Advised by: Dr. David Offner

My research focused on using the Monte Carlo Simulation to analyze games. I recreated a betting system made by Steven Skiena for the game Jai Alai using Java programming. This was done by using the Monte Carlo Simulation and the results closely resembled that of Steven Skiena in which the first two players of Jai Alai matches have the highest probability of winning. Once the creation of this betting system was understood, I made my own system for the game Knockout. The results confirmed that the last player in any Knockout game would have the highest probability of winning.

10:20-10:35 **COMAP Modeling Discussion** **Room 2212**

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 13 of this abstract book.

Morning Session 10:40-10:55

10:40-10:55 **Room 2201**

James Munyon & Drew Saluga
Using Markov Chains to Analyze Board Games
Youngstown State University
Advised by: Dr. Thomas Wakefield

We used discrete Markov Chains, an often used technique in the actuarial field, to analyze the pastime board game known as "Candyland." Viewing the game as a Markov Chain gave us information about the game such as the probability of being on a given space after a certain number of card draws, the average number of card draws in a single game, how to win in the least amount of moves, and much more.

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

Rex Edmonds
Numbers Constructible over the Rationals: A Characterization
Slippery Rock University
Advised by: Dr. Michael Detlefsen

In this talk we will consider numbers constructible over the rationals. By associating geometric constructions with algebraic representations, we will show that a number is constructible if and only if it is contained in a finite chain of quadratic extensions of the rational numbers.

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

Kelcie Herberger
The Calculus on Time Scales
Youngstown State University
Advised by: Dr. Paddy Taylor

The Calculus of Time Scales, introduced in 1988 by Stefan Hilger, serves as a bridge between the continuous would of differential equations and the discrete world of difference equations. We will give an informal introduction to the delta derivative and the Cauchy integral on time scales through a series of examples.

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Morning Session 11:00-11:15

11:00-11:15 **Room 2201**

Nivetha Ramasubramanian
Separability of Elements in Free Groups
Allegheny College
Advised by: Dr. Matt Clay

During the summer, we worked on groups and specifically free groups. Our main goal was to find out how likely it is that a word is separable, both using some code we wrote using the language C++ and also through analysis. We concluded that the longer the word, the less likely that the word will be separable.

11:00-11:15 **Room 2203**

Tara McCart
Ethnic Roles in Early Industrial Youngstown, Ohio:
A Statistical Analysis
Youngstown State University
Advised by: Dr. Thomas Wakefield

Youngstown is historically known as an immigrant city. Early industrial Youngstown was a haven to immigrants looking for work and permanent settlement. This presentation introduces the statistical and historical analysis of the different roles of different ethnic groups in early industrial Youngstown circa 1900-1930.

11:00-11:15 **Room 2204**

Randi Yazvac
A Jumping Monkey's Principle
Youngstown State University
Advised by: Dr. Jacek Fabrykowski

We studied the effects that discrete continuity has on a jumping monkey. Discrete continuity describes a discrete version of the intermediate value theorem. We use this concept to solve problems, including a monkey jumping from integer to integer, and explain why the proofs are true. Lastly, we discuss a Magic Sequence. Be amazed at how two unknown numbers can fit into the same sequence, using discrete continuity. Come and enjoy this fun talk!

11:00-11:15 **COMAP Modeling Discussion** **Room 2212**

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Morning Session 11:20-11:35

11:20-11:35 **Room 2201**

Timothy Clos
The Riemann Mapping Theorem
Cleveland State University
Advised by: Dr. Pratibha Ghatage

The Riemann mapping theorem guarantees the existence of an analytic bijection from open simply connected subsets of the complex plane onto the unit disk. The talk will present some of the basics of complex analysis required for understanding the proof of the Riemann mapping theorem, an outline of the actual proof, and an application to the proof of the isoperimetric inequality.

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

Richard Ligo
Diagonal Diagrams:
An Interesting Representation for a Specific Class of Links
Westminster College
Advised by: Dr. Jeffrey Boerner

In topology, a link L of m components is defined to be a subset of R^3 that consists of m disjoint, piecewise linear, simple closed curves. Every link can be represented by a grid diagram. We define a specific family of grid diagrams called diagonal diagrams. From this definition, we can prove that the number and type of components in a link represented by a diagonal diagram can be determined exactly by the size and layout of the diagonal diagram.

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

Ben White
Boxing a Sequence
Youngstown State University
Advised by: Dr. Thomas Smotzer

We will prove the Fibonacci sequence is eventually periodic modular a natural number. We will also generalize this result for any similar sequence.

11:20-11:35 **COMAP Modeling Discussion** **Room 2212**

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 13 of this abstract book.

Morning Session 11:40-11:55

11:40-11:55 **Room 2201**

Glenn Sidle
Image Fusion Using Gaussian Mixture Models
Duquesne University
Advised by: Dr. Stacey Levine

In recent years, many image processing tasks such as denoising, inpainting, and deblurring have been solved by finding optimal sparse image representations in a (possibly redundant) dictionary. Yu, Sapiro, and Mallat have shown that related representations can be found using Gaussian Mixture Models (GMMs). In this talk we demonstrate how the GMM approach can easily be applied to solve the image fusion problem, and compare some of its results to those using sparse and redundant image representations.

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

Kathleen Sprague
Spherical Triangles
Youngstown State University
Advised by: Dr. Thomas Smotzer

We will define what spherical triangles are and we shall prove an identity about right spherical triangles. Also, we will show how to find the area of a spherical triangle.

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

Rachel Legg
Can You Think Out of the Box?
Westminster College
Advised by: Dr. Natacha Fontes-Merz

Think-Tac-Toe is a single player game, similar to Minesweeper, in which the player uses given numeric clues to determine the location of X's and O's on a board. Although this game is normally played on a square board, in this talk we have adapted it to a triangular board. Our goal is to determine which triangular boards have unique solutions when given a set of clues.

11:40-11:55 **COMAP Modeling Discussion** **Room 2212**

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 13 of this abstract book.

Afternoon Session 12:50-1:05

12:50-1:05 **Room 2201**

Tanya Riston

On An Elementary Characterization of the Sheffer A-Type 0 Orthogonal Polynomial Sequences

Penn State Erie, The Behrend College
Advised by: Dr. Daniel J. Galiffa

In 1939, I.M. Sheffer published "Some properties of polynomial sets of type Zero," Duke Math J. **5**, 590–622, which has been regarded as an indispensable paper in the theory of orthogonal polynomials. Therein, Sheffer basically proved that every polynomial sequence can be classified as belonging to exactly one *Type*. In addition to various interesting and important characterizing theorems, one of Sheffer's most prominent results pertained to completely characterizing all of the polynomial sequences that were of the most basic type, entitled *A-Type 0*, and subsequently establishing which of these sets were also orthogonal. This yielded the very well-studied and applicable Laguerre, Hermite, Charlier, Meixner, Meixner-Pollaczek and Krawtchouk orthogonal polynomial sequences. However, Sheffer's elegant analysis relied heavily on various functional relationships and formal power series. In this talk, we demonstrate how all of the Sheffer *A-Type 0* orthogonal polynomial sequences can be characterized by using only the generating function that defines this class and a monic three-term recurrence relation.

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

Amanda Goodrick

Tilings of a Rectangle with Central Squares Removed

Slippery Rock University
Advised by: Dr. William Lindgren

This talk is motivated by the following problem posed by Donald E. Knuth in the April 2011 edition of *Mathematics Magazine*:

> Let $n \geq 2$ be an integer. Remove the central $(n-2)\times(n-2)$ squares from an $(n+2)\times(n+2)$ array of squares. In how many ways can the remaining squares be covered with $4n$ dominoes?

Here we determine the number of domino tilings of an $(n+2)\times(kn+2)$ board from which k $(n-2)\times(n-2)$ squares have been removed.

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

Michael Sheridan

The Game of Life

Boardman High School
Advised by: Dr. Thomas Wakefield

In today's talk we will go over the Game of Life which was created in 1970 by John Conway to simulate how life evolves in different circumstances over time. I will discuss the rules and history of the game as well as how it is applied to different subjects in every day life. I will also demonstrate how different patterns and objects form when the game begins with a certain number of cells.

12:50-1:05 **Room 2212**

Mario Sracic

Cryptology and Quantum Computing

Youngstown State University
Advised by: Dr. David Yetter

A brief introduction to the Sakalauskas, Tvarijonas and Raulynaitis Key Agreement Protocol (STR-KAP) will be presented which is the motivation for research into quantum computing. By decomposing matrix multiplication into simpler circuits of integer multiplication, row-column multiplication and row addition, an original circuit for matrix multiplication can be constructed.

Afternoon Session 1:10-1:25

1:10-1:25 **Room 2201**

Ryan Ray
Networking and Graph Theory
(An Application to Linear Algebra)
Kent State University
Advised by: Dr. Stephen Gagola

The use of linear algebra can be traced from matrix theory to numerical solution methods. I am going to talk about its application to graph theory and network analysis. Network analysis can be used to look at contexts ranging from traffic design to most efficient ways for electricity to travel. An easy survey may be conducted on network analysis through linear algebra to obtain very useful information in efficiency and 'walk' distances.

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

Daniel Catello
PME Journal Problem 1251
Youngstown State University
Advised by: Dr. Thomas Wakefield

Given the real numbers under a "strange" binary operation, an identity, inverse elements, commutativity, and associativity are shown through an abstract algebra approach. Investigation into generalizing this operation is shown by induction.

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

Muhammad Akbar & Katya Sracic
Card Counting
Boardman High School
Advised by: Dr. Nate Ritchey

We have a presentation on counting cards. There is a Prezi presentation on the probability of getting blackjack at any given time. We plan to pass out cards and do a hands-on demonstration of how to count and practice the equation.

1:10-1:25 **Room 2212**

Panel: Career and Graduate Opportunities for Undergraduate Mathematics Students

Jim Banoczi, National Security Agency
Daniela Calvetti, Case Western Reserve University
Leah Gold, Cleveland State University

The panel includes graduate coordinators from regional colleges and universities as well as a former YSU student who now works for the National Security Agency. They will discuss options available for undergraduate students upon graduation with a mathematics degree.

Afternoon Session 1:30-1:45

1:30-1:45 **Andrew King** **Room 2201**

The Euler Line

Youngstown State University

Advised by: Dr. Richard Goldthwait

My topic for the presentation will be a portion of my senior research project, The Euler Line. With the Euler Line comes a few key terms. These key terms are the Orthocenter, Circumcenter, and Centroid of a triangle. In my presentation I will define these three points and will explain how they are important. For example the Centroid creates a two to one ratio from the arbitrary triangle to its medial triangle. Next, in my presentation I will show a very simple proof that the circumcenter of a triangle is also the orthocenter of its medial triangle. This is a very big part of the proof of Euler's Line. Finally, I will construct a proof using triangle similarity on the board of Euler's Line. Euler's Line is a special line such that the Orthocenter, Circumcenter, and Centroid lie on this line. This will complete my presentation of The Euler Line.

1:30-1:45 **Coty Hainsey** **Room 2203**

A Look at Benford's Law

Westminster College

Advised by: Dr. David Offner

Benford's Law governs the first digit of many sets and sequences of numbers in nature. These sets of numbers are all around us. They include heights of buildings, areas of countries, populations, and many other natural occurrences. In fact, we know exactly what the probabilities for each digit appearing in these sets are. For $d \in \mathbb{N}$ and $1 \leq d \leq 9$ we have

$$\mathbb{P}(d \text{ is the first digit}) = \log_{10}(1 + \frac{1}{d}).$$

The questions of what follows Benford's Law and why these sets and sequences do follow Benford's Law are important ones that have been studied since Frank Benford published a paper on the law in 1938. The implication of the answers to these questions is the knowledge of how the first digits of sets of numbers should be distributed and, as a result, would give us insight into finding abnormalities in sets of numbers. I have explored sets and sequences that both follow and do not follow Benford's Law to try to find patterns in the data as well as search for real-world applications for Benford's Law. Through this research, I have been able to identify sets and sequences that follow Benford's Law, as well as sets and sequences that do not follow Benford's Law. I have also been able to find connections between sets and sequences that do not follow Benford's Law and the probability distribution of sets that do follow Benford's Law. These connections and findings give helpful insight into real world applications in fraud detection.

1:30-1:45 **Maddie Smotzer** **Room 2204**

Ceva's Theorem

Boardman High School

Advised by: Dr. Thomas Smotzer

We will prove Ceva's Theorem about the concurrency of cevians of a triangle. We will also provide a few examples using Ceva's Theorem.

1:30-1:45 **Panel: Career and Graduate Opportunities for Undergraduate Mathematics Students** **Room 2212**

Jim Banoczi, National Security Agency
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Afternoon Session 1:50-2:05

1:50-2:05 **Room 2201**

Eric Shehadi
Approximation of Pi
Youngstown State University
Advised by: Dr. Angela Spalsbury

In my talk I will go through several methods to approximate pi and offer some history of the special symbol.

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

Elliot Blackstone
Linear Generating Functions for the Charlier Polynomials
Penn State Erie, The Behrend College
Advised by: Dr. Daniel J. Galiffa

In this talk, we provide an interesting way to obtain the linear generating function for the classical (discrete) Charlier orthogonal polynomials by implementing what we entitle the "Inverse Method." The inverse method transforms a three-term recurrence relation into a differential equation. We apply the inverse method to the Charlier polynomials and then to a variation of the Laguerre polynomials, which shares a relationship with the Charlier polynomials. We then solve the differential equations, obtaining the desired generating functions.

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

Michael Coates
Weird Fractions
Warren G. Harding High School & Youngstown State University
Advised by: Dr. Nathan Ritchey

Weird fractions, the phenomenon by which one may perform a correct division by incorrectly "canceling" common digits in the numerator and denominator (such as $\frac{64}{16} = \frac{4}{1}$), are known to many. In this talk, the solution to a question of Fried and Goldberg is presented and the relationship and properties of the weird fractions equivalent to a given rational number are examined.

1:50-2:05 **Room 2212**

Panel: Career and Graduate Opportunities for Undergraduate Mathematics Students

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The panel includes graduate coordinators from regional colleges and universities as well as a former YSU student who now works for the National Security Agency. They will discuss options available for undergraduate students upon graduation with a mathematics degree.

Afternoon Session 2:10-2:25

2:10-2:25 **Robert Rhodes** **Room 2201**

A Markov Chain Model for Predicting Wins in Baseball

Westminster College

Advised by: Dr. David Offner & Dr. Jeffrey Boerner

For over a century, baseball statistics such as batting averages have been used to give players, owners, and fans the means to compare players and measure player production. In the past few decades, the growing popularity of sabermetrics (the study of baseball stats) has given rise to new statistics. In my research, I created a Markov chain simulator that estimates runs. Using this simulator I was able to investigate a few questions that use these newer statistics. For example, which players are more productive, power hitters or those that get on base consistently? How well do second order win percentages estimate future wins? And finally, were the St. Louis Cardinals lucky to have beaten the Texas Rangers in the 2011 World Series?

2:10-2:25 **Emily Dolsak** **Room 2203**

A Statistical Analysis of the Free Throw

Westminster College

Advised by: Dr. David Offner

In this talk, we discuss the statistical analysis of free throws shot by a NCAA Division III women's basketball team in order to determine the variables that contribute to a successful free throw. Analysis was performed on both the team as a whole and each individual shooter. Results indicate that knee bend, follow through, and time (a proxy for speed) contribute to a make in team analysis with very small explanation of variance. However, a combination of these and others appear to contribute in shooter analysis with higher explained variance.

2:10-2:25 **Michael Baker** **Room 2204**

Methods of Calculating Pythagorean Triples

Youngstown State University

Advised by: Dr. Angela Spalsbury

Many people are familiar with the Pythagorean Theorem. In this talk, we will explore the various methods one can use to calculate Pythagorean triples, positive integers which satisfy the Pythagorean Theorem.

2:10-2:25 **Panel: Career and Graduate Opportunities for Undergraduate Mathematics Students** **Room 2212**

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Daniela Calvetti, Case Western Reserve University
Leah Gold, Cleveland State University

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2012 MCM / ICM - COMAP Modeling Problems

Continuous Modeling (Problem A)
The Leaves of a Tree

"How much do the leaves on a tree weigh?" How might one estimate the actual weight of the leaves (or for that matter any other parts of the tree)? How might one classify leaves? Build a mathematical model to describe and classify leaves. Consider and answer the following:

- Why do leaves have the various shapes that they have?
- Do the shapes "minimize" overlapping individual shadows that are cast, so as to maximize exposure? Does the distribution of leaves within the "volume" of the tree and its branches effect the shape?
- Speaking of profiles, is leaf shape (general characteristics) related to tree profile/branching structure?
- How would you estimate the leaf mass of a tree? Is there a correlation between the leaf mass and the size characteristics of the tree (height, mass, volume defined by the profile)?

In addition to your one page summary sheet prepare a one page letter to an editor of a scientific journal outlining your key findings.

Discrete Modeling (Problem B)
Camping along the Big Long River

Visitors to the Big Long River (225 miles) can enjoy scenic views and exciting white water rapids. The river is inaccessible to hikers, so the only way to enjoy it is to take a river trip that requires several days of camping. River trips all start at First Launch and exit the river at Final Exit, 225 miles downstream. Passengers take either oar-powered rubber rafts, which travel on average 4 mph or motorized boats, which travel on average 8 mph. The trips range from 6 to 18 nights of camping on the river, start to finish. The government agency responsible for managing this river wants every trip to enjoy a wilderness experience, with minimal contact with other groups of boats on the river. Currently, X trips travel down the Big Long River each year during a six month period (the rest of the year it is too cold for river trips). There are Y camp sites on the Big Long River, distributed fairly uniformly throughout the river corridor. Given the rise in popularity of river rafting, the park managers have been asked to allow more trips to travel down the river. They want to determine how they might schedule an optimal mix of trips, of varying duration (measured in nights on the river) and propulsion (motor or oar) that will utilize the campsites in the best way possible. In other words, how many more boat trips could be added to the Big Long River's rafting season? The river managers have hired you to advise them on ways in which to develop the best schedule and on ways in which to determine the carrying capacity of the river, remembering that no two sets of campers can occupy the same site at the same time. In addition to your one page summary sheet, prepare a one page memo to the managers of the river describing your key findings.

2012 MCM-COMAP Participants from YSU:

Joseph Cochran	Sarah Ritchey	Megan J. Chambers	Nancy E. Conder
Michael J. Coates	Timothy R. Shaffer	Ruth E. Lin	Christopher P. DeChellis
Matthew C. Pierson	Eric A. Shehadi	James D. Munyon	Jon Michael Valantine
Mario Sracic	Drew A. Saluga	Ryan D. Lewis	Michael A. Baker
Bradley Slabe	Michael Slavens	Alexandra M. Lincoln	Adam W. Graff
Daniel P. Catello	Mark A. Calautti	Jason B. White	Ian E. Miller

2012 PME National Meeting at MAA MathFest

Please join us at this year's meeting to be held August 2 through August 4, 2012, in Madison, Wisconsin. 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 Xavier University

The Ohio Section of the Mathematical Association of America will hold its annual spring meeting at Xavier University on Friday, April 13 and Saturday, April 14, 2012. 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. This year's activity during the pizza party is an integration bee followed by a performance of "Calculus: The Musical". 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/`

and more information about registration and local arrangements are available at the site

`http://www.xavier.edu/ohiomaa/`

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