2006 Conference Schedule

9:00-10:00: Registration-Atrium

10:00-10:30: Breakfast and Introduction-Atrium

	Room 1106	**Room 1120**	**Room 1105**	**Room 1062: COMAP**
10:30-10:45	Brian Fadden	Sarah Yurco	Matt Sanders	CONTINUOUS
10:50-11:05	Lauren Beichner	Anne Rollick	Nicole Cunningham	CONTINUOUS
11:10-11:25	Christie Grewe	Tim Hanek	Katie Ritchey	INTERDISCIPLINARY
11:30-11:45	Thomas Deems	Sagita Bardulla	Carrie Davis	INTERDISCIPLINARY
11:50-12:05	Bianca Edwards	Renald Turnquest	David Gohlke & Josh Taylor	DISCRETE

12:05-1:00: Lunch-Atrium

	Room 1106	**Room 1120**	**Room 1105**	**Room 1062**
1:00-1:15	Melissa Rhode	David Hepler	Becky Grove	COMAP
1:20-1:35	Chelsey Kimble	Paul Havens	Matt Ward	Jean Luc Bori-Mekouangori
1:40-1:55	Tim Smith		David Martin	

2:00: Closing Remarks-Atrium

10:30-10:45 **Room 1106**

Brian Fadden
Major League Baseball's Rookies of the Year and the Sophomore Slump
Westminster College
Advised by: Dr. Barbara Faires

There is a myth that players who win the "Rookie of the Year" award in Major League Baseball have what is known as a sophomore slump. Is this really a valid thing to say? The talk will summarize an analysis to answer this question.

10:30-10:45 **Room 1120**

Sarah Yurco
Black Scholes
Youngstown State University
Advised by: Dr. J. Douglas Faires

This presentation involves understanding and deriving the Black-Scholes financial equation. First, options are explained to understand the use of the model. This introduction includes the use of options and the assumptions made when using the Black-Scholes formula. Secondly, the model is stated and explained. Then, the second-order-partial differential equation is derived and related to the diffusion equation.

10:30-10:45 **Room 1105**

Matthew Sanders
Instant Insanity
Youngstown State University
Advised by: Dr. Thomas Smotzer

In 1736 Euler proved that the Konigsberg bridge problem had no solution. The citizens of Konigsberg wanted to know if a person could cross each of the 7 bridges over the Pregal River exactly once, before returning where they started. We will also see how the Konigsberg bridge problem relates to the game instant insanity.

10:50-11:05 **Room 1106**

Lauren Beichner
Pyramid Yahtzee
Westminster College
Advised by: Dr. Barbara Faires

Yahtzee is a game chance overflowing with mathematical possibilities. Much research has been done with the original game, but other versions exist. Using the ideas of other researchers, the variation called Pyramid Yahtzee is explored. Using various ideas from Game Theory, the research always returns to one main question: "Given a game situation, what choice should a player make next?"

10:50-11:05 **Room 1120**

Anne Rollick
A Fractional Point
John Carroll University
Advised by: Dr. Leo Schneider

An exploration of the decimal expansion of $\frac{1}{p}$, where p is a prime, including relations between periods and primes.

10:50-11:05 **Room 1105**

Nicole Cunningham
The Fundamental Theorem of Riemann-Stieltjes Integrals
Youngstown State University
Advised by: Dr. John Buoni

The Riemann-Stieltjes integral is a generalization of the Riemann integral. We will be examining the Fundamental Theorem of Calculus applied to Riemann-Stieltjes integrals.

11:10-11:25 **Room 1106**

Christie Grewe
Best American Movie of All Time
Westminster College
Advised by: Dr. Barbara Faires

To determine the greatest American movie, all areas of films are evaluated, ranked according to importance, weighted, and tabulated. Categories assessed include revenue, awards, and critics choice.

11:10-11:25 **Room 1120**

Tim Hanek
Granger Causality Testing
Youngstown State University
Advised by: Dr. J. Douglas Faires

In this talk, future prices are used to determine rates of return, which in turn, are used to calculate variance. A Granger Causality test is performed to see if variance Granger causes volume and if volume Granger causes variance. It turns out the both cases are true: variance is useful in predicting volume and volume is useful in predicting variance.

11:10-11:25 **Room 1105**

Katie Ritchey
Error Correction Codes and Smart Telephones
Kennedy Catholic High School
Advised by: Dr. Nathan Ritchey

Imagine a telephone system that can detect and correct common errors that occur when dialing a number. Using dot products and modular arithmetic it is possible to construct such "smart" numbers. This presentation will give an introduction to the mathematics of error correction and discuss the advantages and disadvantages of forming a "smart" telephone system.

11:30-11:45 **Room 1106**

Thomas Deems, Jr.
Optimized Least-Squares Monte-Carlo for American Put Options
Slippery Rock University
Advised by: Dr. Richard Marchand

A stock option is a finanical tool which gives its holder the right but not the obligation to buy or sell stock in the future under specified terms. Fairly pricing this right is important to prevent certain parties from holding an absolute advantage called arbitrage. Given the complexities of American style put options which allow their holder to exercise at any time during the option's lifetime, standard pricing techniques cannot be used and numerical techniques must be relied upon. A newly devised technique credited to Longstaff and Schwartz uses least-squares regression along with Monte-Carlo simulation to find a 'fair' price. The aim of this research is to improve the Longstaff and Schwartz method by decreasing the necessary trade-off between reasonable computing time and desired accuracy of the result. Our technique combines the accuracy of the Longstaff and Schwartz "Least-Squares Monte-Carlo Approach" with various variance reduction techniques. To realize the theoretical improvement in the technique in the actual application of the technique, many styles of options and variance reduction techniques are explored. The results thus far show that the empirical variance between iterations as well as between simulation runs is hugely reduced, hence improving the accuracy of the 'fair' price and/or decreasing the time needed for computing such a price.

11:30-11:45 **Room 1120**

Sagita Bardulla
A Limit Formula for the n^{th} Derivative
Lakeland Community College
Advised by: Dr. Carl Stitz

I will present a limit formula for the n^{th} derivative and work some examples.

11:30-11:45 **Room 1105**

Carrie Davis
Power Indices
Youngstown State University
Advised by: Dr. Angela Spalsbury

How do weighted voting systems really work? This talk will explore the Banzhaf Power Index and the Shapley-Shubik Index to explain the power that each voter has in a weighted system.

11:50-12:05 **Room 1106**

Bianca Edwards
Investigating the Powers of Magic Matrices
College of Wooster
Advised by: Dr. James Hartman

A magic matrix is a matrix in which the sum of all of the columns, rows, diagonal and cross-diagonal sum to the same value, s. This research focuses on determining whether the n^{th} root of a magic square, where n is a positive integer, is also magic.

11:50-12:05 **Room 1120**

Renald Turnquest
The French Fry: "Small Beginnings, Large Potential"
The College of The Bahamas
Advised by: Joseph Ferguson

The French fry has been known as a staple dish for fast food connoisseurs. However, many people eat French fries without consciously thinking about how they eat them. Furthermore, if I were to ask the question how many bites did it take you, to eat that French fry? consumers would be baffled. The number of bites required to eat a French fry has been a question Ive pondered for quite some time. A simple survey of College students during their lunch hours would provide the data needed to determine the arithmetic mean of bites required to eat a French fry. Based on these observations we will make assumptions on the number of bites required to eat other food items.

11:50-12:05 **Room 1105**

Dave Gohlke and Josh Taylor
Tecmo Super Bowl
Youngstown State University
Advised by: Dr. Jay Kerns

Tecmo Super Bowl for the original Nintendo is arguably the greatest sports video game ever created. This was one of the first games to model its players after real athletes and have a complete season schedule. This presentation will determine how accurately the teams were modeled by comparing simulated seasons to different NFL seasons. In addition, this data will be used to objectively rank the 28 teams of Tecmo Super Bowl.

1:00-1:15 **Room 1106**

Melissa Rhode
Two Remarks on Integration by Parts
Kent State Tuscarawas Campus
Advised by: Dr. Jeff Osikiewicz

We present two techniques that can be used on difficult integrals that require the use of integration by parts.

1:00-1:15 **Room 1120**

David Hepler
A Mathematical Model to Predict the Most Valuable Player in Major League Baseball
Clarion University
Advised by: Dr. Michael McConnell

The presentation discusses the steps and procedures I used to develop the mathematical model. The model is a linear programming model. The project is based on the article, A Mathematical Model to Predict Award Winners, by Rebecca Sparks and David Abrahamson of Rhode Island College. The goal of the model is to predict the winner of the MVP award in Major League Baseball. The model uses the top three vote getters in each of the American and National Leagues over a ten year span. The aim of the model is to find weights for seven statistical categories so that the order of finish in each of the seasons and leagues is reproduced. The Simplex Method is used to find a optimal solution to the linear programming problem. In my project, no optimal solution was found. Several reasons for this are discussed.

1:00-1:15 **Room 1105**

Becky Grove
Applications of Vibrational Analysis
Youngstown State University
Advised by: Dr. Hazel Marie

In the industrial setting, vibrations occur as a result of machine imbalances and machine interaction. This presentation will derive a method using differential equations to analyze the vibrations present in such a setting.

1:20-1:35 **Room 1106**

Chelsey Kimble
Tabular Integration by Parts
Kent State Tuscarawas Campus
Advised by: Dr. Jeff Osikiewicz

We will present the technique of tabular integration by parts and illustrate the usefulness of this method of integration.

1:20-1:35 **Room 1120**

Paul Havens
Periodic Derivatives
Lakeland Community College
Advised by: Dr. Carl Stitz

This presentation will detail the derivation of a generalized equation for periodic functions, those functions whose n^{th} derivative is equivalent to the original function.

1:20-1:35 **Room 1105**

Matt Ward
Equivalent Norm Coefficients
Youngstown State University
Advised by: Dr. John Buoni

All norms defined on a finite dimensional vector space are equivalent. The proof for this can be quite tedious and involves a combination of techniques from Analysis to Topology. We can find coefficients of equivalent norms to significantly reduce the proof.

1:20-1:35 **Room 1062**

Jean-Luc Bori-Mekouangori
Use of the Gamma Function in the Evaluation of Special Integrals
Bethany College
Advised by: Dr. Joe Santmyer

The integral $\int_{-\infty}^{\infty} e^{-\frac{x^2}{2}} dx$ is commonly known as the "Error Function" or "Gaussian Distribution". The evaluation of this integral necessarily requires the use of one of the following techniques:

- The first technique deals with the polar coordinates where $x = r\cos\theta$ and $y = r\sin\theta$.
- The second technique involves the "Gamma Function" and enables the evaluation of more general forms of the above integral.

The exploration of this particular integral in its various and general forms leads to closed formulas that can be used to evaluate similar integrals by substitution.

1:40-1:55 **Room 1106**

Tim Smith
A Proof of the Kraft Inequality
Cleveland State University
Advised by: Dr. John Holcomb

Data compression is all around us, from shorthand, ZIP files and internet phones and CD, DVD, HDTV and MP3. This talk will present a proof of the Kraft Inequality, which provides a necessary and sufficient condition for the existence of a uniquely decodeable code; i.e., a code that can only be correctly interpreted in one way. Some historical background on compression will also given.

1:40-1:55 **Room 1105**

David Martin
Prime or not Prime: You be the Judge!
Youngstown State University
Advised by: Dr. Thomas Smotzer

Is the number 256128000000000000000000001 prime or composite? No calculators allowed, of course (proposed by Nick Hobson, London, England). Several means of attempting to factor such an intimidating integer will be explored.

2006 COMAP Modeling Problems

Continuous Modeling (Problem A)

The continuous problem this year dealt with the positioning and moving of a circular sprinkler system for irrigation of a rectangular field. The field was required to be uniformly watered, and the time for maintaining the system was to be minimized.

David Gohlke, Brian Hamilton, Josh Taylor: Youngstown State University

Becky Grove, David Martin, Matt Ward: Youngstown State University

Discrete Modeling (Problem B)

The discrete problem addressed the problem of providing wheel chairs to all passengers requesting them in an airport terminal. A detailed analysis of the scheduling, movement, storage and cost of maintaining wheel chairs and escorts for passengers was required.

Nicole Panza: Westminster College

Interdisciplinary Modeling (Problem C)

The interdisciplinary problem dealt with the management of available resources in the fight against HIV/AIDS. A model was to be constructed for the spread, introduction of drug resistant strains, and the allocation of financial resources used to treat HIV/AIDS patients.

Tyler Drombosky: Youngstown State University

Ryan Livingston: Youngstown State University

YSU Pi Mu Epsilon Officers

President: David Gohlke

Vice President: Nicole Cunningham

Secretary: Carrie Davis

Treasurer: David Martin

Historian: Becky Grove

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Special thanks also to the Department of Mathematics and Statistics at Youngstown State University.

A Warm Welcome to the Participating Schools:

- Baldwin Wallace
- Bethany College
- Capital University
- Case Western Reserve University
- Chatham College
- Clarion University
- Cleveland State University
- College of Wooster
- Edinboro University
- Fairmont State University
- John Carroll University
- Kennedy Catholic High School
- Kent State University
- Kent State University Tuscarawas Campus
- Lakeland Community College
- Lakeview High School
- Slippery Rock University
- The College of the Bahamas
- Westminster College
- Youngstown State University

2006 PME National Meeting at MAA MathFest

Please join us at this year's meeting to be held August 10 through August 12, 2006, in Knoxville, Tennessee. 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.