Program of Activities
For the 91st Annual Meeting of the

Mathematical Association of America

Ohio Section

Spring 2007
Shawnee State University
Portsmouth, Ohio
April 13-14, 2007

MAA Ohio Section
Program

Friday, April 13, 2007

Noon – 4:30	Registration	Library Rotunda/Lobby, Clark Memorial Library
1:00 – 4:30	Book Exhibits	Library Rotunda/Lobby, Clark Memorial Library
12:00 – 1:20	Student Competition	Flohr Lecture Hall, Clark Memorial Library (room 204)

12:15 – 1:15	Committee Meetings:
	   CONSTUM
	   CONCUR
	   CONTEAL
	   CONSACT
		212 Massie Hall
		213 Massie Hall
		214 Massie Hall
		215 Massie Hall

1:30 – 1:45	Welcome and Announcements	Flohr Lecture Hall, Clark Memorial Library (room 204)
1:45 – 2:45	Invited Address **"Preference Sets, Graphs, and Voting in Agreeable Societies"** Francis Edward Su, Harvey Mudd College	Flohr Lecture Hall, Clark Memorial Library
2:45 – 3:15	Break	Library Rotunda/Lobby, Clark Memorial Library
3:15 – 4:15	Invited Address **"Euler, Number Theorist"** Daniel E. Otero, Xavier University	Flohr Lecture Hall, Clark Memorial Library
4:25 – 6:20	**Contributed Papers**	Kricker Hall
4:25 – 6:20	Executive Committee Meeting	253 Kricker Hall
6:30 – 8:00	Student Pizza Party and Integration Bee	Micklethwaite Banquet Hall, University Center
6:20 – 6:45	Social Time	Grand Lobby, Vern Riffe Center of the Arts
6:45 – 8:00	Banquet	Grand Lobby, Vern Riffe Center of the Arts
8:10 – 8:50	After-Dinner Talk **"My Favorite Math Fun Facts"** Francis Edward Su, Harvey Mudd College	Flohr Lecture Hall, Clark Memorial Library
8:50	**Business Meeting and Presentation of Teaching Award**	Flohr Lecture Hall, Clark Memorial Library

Saturday, April 14, 2007

8:00 – 10:15	Registration and Book Exhibits	Library Rotunda/Lobby, Clark Memorial Library
8:00 – 8:50	Coffee and Donuts	Library Rotunda/Lobby, Clark Memorial Library
8:05 – 8:40	Liaisons' and Department Chairs' meeting	205 Clark Memorial Library
8:05 – 8:40	Executive Committee Meeting (if necessary)	207 Clark Memorial Library
8:50 – 8:55	Announcements	Flohr Lecture Hall, Clark Memorial Library
8:55 – 9:55	Invited Address **"Curious Curves"** Judith Palagallo, The University of Akron	Fhlor Lecture Hall, Clark Memorial Library
9:55 – 10:15	Break	Library Rotunda/Lobby Clark Memorial Library
10:25 – 11:40	**Contributed Papers**	Kricker Hall
11:50 – 12:50	Retiring President's Address **"A Tantalizing Trek Through Elementary Number Theory"** Thomas Dence, Ashland University	Flohr Lecture Hall, Clark Memorial Library
12:50	**Student Contest Results and Closing Remarks**	Flohr Lecture Hall, Clark Memorial Library

Abstracts of Invited Addresses

Friday

Speaker: Francis Edward Su
Title: *Preference Sets, Graphs, and Voting in Agreeable Societies*
Abstract: When mathematical objects have a social interpretation, the associated theorems have social applications. We give examples of situations where sets model preferences, and suggest extensions of classical theorems on convex sets (such as Helly's theorem) which have applications to the analysis of voting in "agreeable" societies. This talk features research with undergraduates.

Speaker: Daniel E. Otero
Title: *Euler, Number Theorist*
Abstract: In 1730, Leonhard Euler had been established at the St. Petersburg Academy of Sciences for less than a year when he started to receive correspondence from Christian Goldbach in Moscow, who was tutor to the young Russian Tsar Peter II. Goldbach made Euler aware of the number theoretic investigations of Pierre de Fermat, who was the first in more than 1000 years to systematically study the finding of solutions to algebraic problems in integers alone, but who had been dead already for some 50 years. Almost immediately, Euler followed up on Fermat's work, correcting his few mistakes, filling in gaps in his proofs, extending his conjectures, and probing in new directions. Through Euler's contributions the tenuous threads of the development of number theory that had been spun by Fermat now became sturdy ropes that linked Euler to later practitioners like Lagrange, Legendre and especially Gauss, thereby leading into the modern phase of the history of the subject. In this address, we celebrate the Euler Tricentennial with a look at Euler the number theorist.

Speaker: Francis Edward Su
 Title: *My Favorite Math Fun Facts*
For several years, I have been collecting "Math Fun Facts", which are juicy math tidbits that I have been using to start off my calculus classes, as a warm-up activity. Math Fun Facts can be from any area of mathematics (not just calculus), can be presented in less than 5 minutes, and are meant to arouse my students' curiosity and fascination with the subject and to give them a glimpse that mathematics is full of interesting ideas, patterns, and new modes of thinking. In this talk, I will present my favorite Math Fun Facts. They're definitely fun, but will they be YOUR favorites? You decide.

Saturday

Speaker: Judith Palagallo
Title: *Curious Curves*
Abstract: Self-similar curves date at least to Koch's work in 1904. They are also associated with names like Levy, Sierpinski, Gosper and Cesaro. These mathematicians referred to such curves as "curious" and "marvelous" because of the property that the curves consist of parts similar to the whole. Interest has not diminished over the years. Intriguing computer-generated drawings of such curves abound in the literature. I'll present two generalizations of the Koch curve and discuss some of their curious properties.

Speaker: Thomas Dence
Title: *A Tantalizing Trek Through Elementary Number Theory*
Abstract: During the course of roughly 2000 years we'll meet many of the luminaries from Number Theory, discuss some of their great contributions on such subjects as solving equations and congruences, the distribution of primes, and applications involving continued fractions and some special number theoretic functions. Several classic results will be shown along with some modern results, and some slick proofs.

Brief Biographies of Invited Speakers

Francis Edward Su, Harvey Mudd College
Francis Edward Su earned his undergraduate degree at the University of Texas, and his Ph.D. at Harvard University. He is now Professor of Mathematics at Harvey Mudd College, and he has also held visiting positions at Cornell and MSRI. His recent research is in topological and geometric combinatorics and applications to the social sciences, and he has co-authored more than a dozen papers with undergraduates. He has a passion for teaching and popularizing mathematics. From the MAA, he received the 2001 Merten M. Hasse Prize for expository writing and the 2004 Henry L. Alder Award for distinguished teaching. He is an MAA Project NExT "blue dot" and serves on editorial boards of the American Mathematical Monthly and Math Horizons. In his spare time he enjoys working on his "Math Fun Facts" website. He also enjoys songwriting, sports, and is active in a unique Christian community in LA known as Mosaic, where he can just be himself – passion not stifled by expectation, worth not derived from accomplishments.

Daniel E. Otero, Xavier University
Daniel E. Otero is an Associate Professor of Mathematics at Xavier University. His years as an undergraduate at Providence College taught him that mathematics was trustworthy knowledge, but ultimately meaningless unless one appreciated not only why it worked, but why one would be interested in such problems in the first place. This placed him on the road to the serious study of the history of mathematics. Trained in algebra and number theory, Danny received his PhD at Penn State University in 1987 and, after a postdoc at Syracuse University, came to Xavier in 1989. In 1998, after participating in the MAA Institute for the History of Mathematics and Its Uses in Teaching under V. Fred Rickey and Victor Katz, he became cofounder, with Daniel J. Curtin at Northern Kentucky University, of the ORESME (Ohio River Early Sources in Mathematical Exposition) Reading Group, a seminar that meets twice a year to read historically important works in the development of mathematics. Danny is a sometime chorister (baritone) and lover of early music, an avid bridge and Scrabble player, and a big fan of the new Sci-Fi series Battlestar Galactica.

Judith Palagallo, The University of Akron
Judith Palagallo received her Ph.D. from Colorado State University. She joined The University of Akron in 1978. Recently, she has been interested in fractal geometry and its basis in analysis and has directed several undergraduate research projects in this area. She is a participant in the Akron REU site "Algebra, Number Theory and Applications" which will run for its third year this summer. In the Ohio Section, Judy has been President, Program Chair, and chair of CONSTUM and is now Section Governor. She just completed two terms on the editorial board of the MAA series Classroom Resource Materials and is now on the editorial board for Classroom Notes. Judy is also involved in a mentoring program for teenage girls in Summit County. She retired from teaching at UA in August 2006. In the fall she and her husband Tom Price taught for 9 weeks in Austria at the Vienna Christian Center

Thomas Dence, Ashland University
Thomas Dence is a native of Toledo, Ohio. He attended Bowling Green State University, and then received a Masters degree from the University of Colorado. After 3 years of high school teaching, he returned to grad school and earned a Ph.D. in Analysis at Colorado State University. After a post-doc at New Mexico State University, Tom was hired at the Firelands branch campus of Bowling Green. Visiting positions at Southern Utah, Cal State/ Los Angeles, and the University of Georgia followed. Tom has now been at Ashland University for 23 years. His wife Kathe is a recruiter in the Human Resources Department at Firelands Hospital In Sandusky; oldest son Robert (a recent grad of University of Dayton) is now an engineer in Denver with Lockheed-Martin Aerospace; middle son Paul is a radiology technologist in Sandusky/Norwalk; and youngest son Dan is a sophomore business major at Ohio State. The dog, Euler, usually stays home and works on his problems/bones.

Contributed Paper Sessions
Friday, April 13
All sessions are in Kricker Hall

Time	Room Room 150 Session Chair Brian Shelburne	Room 153 Session Chair Charles McCracken	Room 154 Session Chair Angela Spalsbury
4:25-4:40	**The Math Behind the Magic** Jason R. Roush *College of Mount St. Joseph* FRI-1	**Primality Testing and Sequences** Gregory C. Cosimi *Cleveland State University* FRI-2	**The Cauchy-Riemann Equations and $\bar{z}$** Nick Haught *Youngstown State University* FRI-3
4:45-5:00	**Parking Functions** Tim A. Smith *Cleveland State University* FRI-7	**Patterns in Coin-Tossing** MB Rao *University of Cincinnati* FRI-8	**Representations of Groups** Jared M. Ruiz *Youngstown State University* FRI-9
5:05-5:20	**Can You Beat My Taxman?** Jennifer R. Picucci *Ashland University* FRI-13	**An Analysis of "Risk" Probabilities** Ryan Knobeloch *Mount Vernon Nazarene College* FRI-14	**A Solution to a Multi-Sport Race Using Differential Equations** Doug Wajda *Youngstown State University* FRI-15
5:25-5:40	**Statistical Comparison of Discrete Audio** Tyler W. Drombosky *Youngstown State University* FRI-19	**Cellular Automata** Rob Flax *Denison University* FRI-20	**The Differential Analyzer** Thomas J. Cuchta *Marshall University* FRI-21
5:45-6:00	**The Golden Section and Design** Megan V. Reese *Ohio Northern University* FRI-25	**Historical Notes Related to the Teaching of Elementary Statistics** Weiping Li *Walsh University* FRI-26	**Latte Hour** Mark K. Brauen *Mount Vernon Nazarene College* FRI-27
6:05-6:20	**Geometry in Rose Windows** Charise M. Kazmierczak *Ohio Northern University* FRI-31	**Checker Jumping in Three Dimensions** Bryan Ropp *Ashland University* SAT-4	

Contributed Paper Sessions
Friday, April 13
All sessions are in Kricker Hall

Time	Room 155 Session Chair John Whitaker	Room 250 Session Chair Cathy Stoffer	Room 255 Session Chair Bill Fuller
4:25-4:40	**Counting with Transfer Matrices** Gregory Back *Ohio Northern University* FRI-4	**Predicting the Prisoner's Dilemma** Matthew D. Williamson *Marietta College* FRI-5	**Infinitely Small Numbers** Robert Mendris *Shawnee State University* FRI-6
4:45-5:00	**p-Colorability for Knots Using Matrices** William W. Sears *Marietta College* FRI-10	**The Rubik's Cube** Mandy R. Glessner *Ashland University* FRI-11	**When Does a Complex Function Equal Its Own Derivative?** Leanna Cluff *Youngstown State University* FRI-12
5:05-5:20	**Banach Limits** Bau Qi Feng *Kent State University – Tuscarawas* FRI-16	**The Secret of Nim** Katie M. Miller *Ashland University* FRI-17	**The Cow and the Silo** Mark de Saint-Rat *Miami University – Middletown* FRI-18
5:25-5:40	**On the Representation of the Metric Projection** Jinlu Li *Shawnee State University* FRI-22	**TSRP: A Graph Theory Software Application** Timothy E. Bechmann *College of Mount Saint Joseph* FRI-23	**Keeping Your Cows Happy** Kelsie L. McCartney *Marietta College* FRI-24
5:45-6:00	**Congruential Extensions of Ducci Games** Mihai Caragiu *Ohio Northern University* FRI-28	**The Cayley Tree Formula** Matt Steinke *Denison University* FRI-29	**The Perfect Shuffle: An Analysis** Kerry McIver *John Carroll University* FRI-30
6:05-6:20	**Rational Equations with Extraneous Solutions** John J. Whitaker *Shawnee State University* FRI-32	**Links in Straight-Edge Embeddings of K_7** Pam Arbisi *Denison University* FRI-33	**Developmental Mathematics Labs** John T. Noonan *Mount Vernon Nazarene College* FRI-34

Contributed Paper Sessions
Saturday, April 14
All sessions are in Kricker Hall

Time	Room 150 **Session Chair** Jon Stadler	Room 153 **Session Chair** Wiebke Diestelkamp	Room 154 **Session Chair** Darren Wick
10:25-10:40	**The Expected Value of the Ohio Lottery** Rachel A. Bresson *Capital University* SAT-1	**Radical Extraneous Solutions** Matt Whitt *Shawnee State University* SAT-2	**Spheres on a Cayley Graph** Anne Rollick *John Carroll University* SAT-3
10:45-11:00	**Serious Sudoku** Erin M. Satterlee *Ashland University* SAT-7	**Funforms** Joel S. Steinberg *Case Western Reserve University* SAT-8	**An Outline of the Completeness Theorem** Andrew J. Homan *Ohio Northern University* SAT-9
11:05-11:20	**Speedsolving Rubik's Cube in Under 40 Moves** Morley A. Davidson *Kent State University – Kent* SAT-13	**Analysis of Password Strength** Steven L. Szente *Wright State University* SAT-14	**Dawn of the Logistic Function** John W. Hoffman *Youngstown State University* SAT-15
11:25-11:40	**The Spin Out Puzzle and Recurrence Relations** Jon D. Stadler *Capital University* SAT-19	**The Mayr-Meyer Example** Bessam Mehanni *Cleveland State University* SAT-20	**Can You Pick a Perfect Bracket?** Matthew M. Menzel *Marietta College* SAT-21

Contributed Paper Sessions
Saturday, April 14
All sessions are in Kricker Hall

Time	Room 155 Session Chair Barbara D'Ambrosia	Room 250 Session Chair Eric Wingler	Room 255 Session Chair Barbara Margolius
10:25-10:40		**Napoleon Triangles: A Brief Presentation** Jeffrey T. Cornfield *Youngstown State University* SAT-5	**Kroneker's Theorem and Linear Recurrences** John T. Holodnak *Ohio Northern University* SAT-6
10:45-11:00	**The Birthday Problem Extended** Matt Haase *Defiance College* SAT-10	**Virtual Reidemeister Moves** Emily N. List *Wittenberg University* SAT-11	**RSA-Cryptography** Heather M. Schramm *Cleveland State University* SAT-12
11:05-11:20	**The Decimal Expansion of $\frac{1}{2007}$** Scott R. Zimmerman *John Carroll University* SAT-16	**An Introduction to Fractals** Melissa A. Ciacchi *Ashland University* SAT-17	**An Introduction to Error-Correcting Codes** Frank A. Ballone *Youngstown State University* SAT-18
11:25-11:40	**Order from Chaos** Chris F. Buurma *Ashland University* SAT-22	**The Parallel Postulate and Neutral Geometry** Carrie Ebright *Otterbein College* SAT-23	**Representations of Complex Numbers** Tara Cruickshank *Youngstown State University* SAT-24

Abstracts of Contributed Papers

All sessions are in Kricker Hall.

Friday, April 13

FRI-1 | **The Math Behind the Magic**
Room 150 | Jason R. Roush, *College of Mount Saint Joseph*
4:25-4:40

Whether professional or amateur, "magicians" always bring amazement and curiosity to their crowds. The most basic of magic tricks are those that deal with a deck of cards. While many card tricks require the quickness of ones' hands, a special type of shuffle, or a predetermined order of cards, some can be explained with mathematics instead. In this talk we will discuss the mathematics behind a popular card trick known by many as "The Abracadabra Trick."

FRI-2 | **Primality Testing and Sequences**
Room 153 | Gregory C. Cosimi, *Cleveland State University*
4:25-4:40

In this presentation we will discuss two methods that utilize sequences to determine the primality of a number. First, we will look at a fast probabilistic primality test that is used in practice today. Then we will scrutinize the work of Marin Mersenne and use another test to prove some of his conjectures. Finally, we will make some conclusions about the usefulness of sequences in primality testing.

FRI-3 | **The Cauchy-Riemann Equations and $\bar{z}$**
Room 154 | Nick Haught, *Youngstown State University*
4:25-4:40

Using the Cauchy-Riemann Equations, we show that analytic functions are characterized by the fact that they respect the complex structure of z.

FRI-4 | **Counting with Transfer Matrices**
Room 155 | Gregory Back, *Ohio Northern University*
4:25-4:40

We provide a series of interesting examples of combinatorial problems which can be solved by using the technique of transfer matrices.

FRI-5 | **Predicting the Prisoner's Dilemma**
Room 250 | Matthew D. Williamson, *Marietta College*
4:25-4:40

Although the Prisoner's Dilemma, one of the more famous topics in game theory, is easy to play, it has more complexities than originally perceived. One of these complex areas involves how to predict your opponent's next move. We will discuss one method of accomplishing this task by using simple bookkeeping and probability.

FRI-6 **Infinitely Small Numbers**
Room 255 Robert Mendris, *Shawnee State University*
4:25-4:40

An introduction to infinitely small numbers. We will present their intuitively clear construction, some of their properties, and touch some related philosophical questions. (It is not based on non-standard analysis, but rather on a system with axioms different from Cantor set theory.)

FRI-7 **Parking Functions**
Room 150 Tim A. Smith, *Cleveland State University*
4:45-5:00

Parking functions are a well-known, well-studied combinatoric structure. This talk will present an introduction to parking functions and count them (this IS combinatorics, after all). We will then discuss a pair of functions Phi and Psi. Phi accepts a parking function of length N and produces an "allowable pair" of permutations of [N]. Psi takes the pair of permutations produced by Phi and gives back the original parking function. Finally, we will introduce a logical extension to parking functions called "valet functions" and very briefly show how Phi and Psi are affected. No math beyond a basic understanding of permutations is required to enjoy this talk.

FRI-8 **Patterns in Coin-Tossing and the Power of Recurrence**
Room 153 MB Rao, *University of Cincinnati*
4:45-5:00

You set any pattern of Heads and Tails, for example HTHTHTHT, say. Keep tossing a fair coin until you see this pattern. How many tosses X are required to achieve the objective? The entity X is a random variable. You would like to calculate E(X), the expected value of X, and Variance(X). The answers are known. A powerful martingale optional stopping theorem is used to get the answers. We use an elementary technique to get the answers. The technique is accessible to any undergraduate student.

FRI-9 **Representations of Groups**
Room 154 Jared M. Ruiz, *Youngstown State University*
4:45-5:00

Cayley's Theorem is one of the most important theorems regarding Group Theory. In proving Cayley's Theorem, an interesting technique arises. The property, known as the regular representation, is used to represent any element of any finite group in completely new and unique ways.

FRI-10   *p*-**Colorability for Knots Using Matrices**
Room 155   William W. Sears, *Marietta College*
4:45-5:00

In knot theory, there are many different techniques to determine if two potentially different knots are the same. One such technique is *p*-coloring. This presentation demonstrates one type of *p*-coloring technique, and its utility in determining for which prime numbers p a given knot is *p*-colorable. The technique presented uses matrices in contrast to other currently used techniques.

FRI-11   **The Rubik's Cube**
Room 250   Mandy R. Glessner, *Ashland University*
4:45-5:00

In this talk, I will be exploring different aspects of the Rubik's cube. I will also explore the different ways to find optimal solutions for solving a Rubik's cube and showing the Rubik's cube group.

FRI-12   **When Does a Complex Function Equal Its Own Derivative?**
Room 255   Leanna Cluff, *Youngstown State University*
4:45-5:00

In this talk, we present some unique properties of the complex exponential function.

FRI-13   **Can You Beat My Taxman?**
Room 150   Jennifer R. Picucci, *Ashland University*
5:05-5:20

The Taxman is a computer game where you chose numbers up to a maximum *n*, and the Taxman receives his numbers due to the specifications of the game. Originally the Taxman receives all the divisors of your number that are left in the set. I will look at the best choices to make in order to beat the Taxman and some patterns that begin to appear. I will also propose a new type of the Taxman game and look at whether or not the optimal choices for the original Taxman are still relevant.

FRI-14   **An Analysis of "Risk" Probabilities: Conquering the World with the Power**
Room 153   **of Math!**
5:05-5:20   Ryan Knobeloch, *Mount Vernon Nazarene College*

Risk is a board game of the ages. The game of world domination has inspired and frustrated generations of players. Its many variants have been widespread, and the more popular ones, like *Capital Risk*, are well known. Yet all the games focus on two elements: the strategy of the player and the luck of the dice roll. We will use recursion to develop a solid strategy for playing the game of *Risk* by answering this question: "What troop margin does the attacker need to guarantee success in battle beyond some level of confidence?"

FRI-15	**A Solution to a Multi-Sport Race Using Differential Equations: Baseball**
Room 154	**and Cars**
5:05-5:20	Doug Wajda, *Youngstown State University*

If a pitcher throws a ball and a car leaves the pitcher's mound at the same time, which one will get to home plate first?

FRI-16	**Banach Limits and Their Values on the Almost Convergent Sequences Space**
Room 155	Bau Qi Feng, *Kent State University – Tuscarawas*
5:05-5:20	

In this talk, we introduce the concepts of upper weight, lower weight and weight of sequences of natural numbers and we present the results that we have obtained and published in JMAA about Banach Limits. We also present some new and unpublished results that we obtained recently on the almost convergent sequences spaces and we will raise some open problems about Banach Limits.

FRI-17	**The Secret of Nim**
Room 250	Katie M. Miller, *Ashland University*
5:05-5:20	

In this seminar, we will investigate the age-old game of Nim starting with a brief history. From there, we will explore the basic mathematics and strategy behind winning the game along with various other versions of the game.

FRI-18	**Three Aspects of the Cow Tethered to the Silo Problem**
Room 255	Mark de Saint-Rat, *Miami University – Middletown*
5:05-5:20	

I will consider three ways to view the problem of finding the area which a bovine can graze. Assume the bovine is tethered to the base of a circular silo by a cord which permits grazing to the point at the base of the silo diametrically opposed to the point of tethering.

FRI-19	**Statistical Comparison of Discrete Audio**
Room 150	Tyler W. Drombosky, *Youngstown State University*
5:25-5:40	

It's easy for a person to tell if two samples of audio are similar or not, but how hard would it be to do mathematically? We take a look at comparing two real songs on a computer in a journey to find their similarity. Computer science, statistical programs, and moment sequences all play a critical role in finding the answer.

FRI-20   **Cellular Automata: Randomness from Deterministic Simplicity**
Room 153   Rob Flax, *Denison University*
5:25-5:40

This talk is an introductory-level talk on cellular automata, which are types of deterministic dynamical systems. I will describe some of the history behind one- and two-dimensional cellular automata, with focus on the famous example of Conway's Game of Life, as well as Stephen Wolfram's discoveries outlined in his book *A New Kind of Science*. Finally I will discuss applications of cellular automata, particularly their use in pseudo-random number generators and encryption, which is the subject of my research this coming summer.

FRI-21   **The Differential Analyzer**
Room 154   Thomas J. Cuchta, *Marshall University*
5:25-5:40

Have you ever wondered how the solutions of difficult non-linear differential equations were plotted before the advent of digital computation? It was done via a process called mechanical integration with a machine called a differential analyzer. This talk will encompass the history of mechanical integration and differential analyzers, why they are worth studying today, and the Marshall University differential analyzer.

FRI-22   **On the Representation of the Metric Projection**
Room 155   Jinlu Li, *Shawnee State University*
5:25-5:40

In this paper, we provide a representation of the metric projection operator P in a two dimensional Banach space and we give some application of this representation to solving variational inequalities in a two dimensional Banach space.

FRI-23   **TSRP: A Graph Theory Software Application**
Room 250   Timothy E. Bechmann, *College of Mount Saint Joseph*
5:25-5:40

The purpose of this project was to create a software application that allows a user to compute common and complex graph theory properties. This was accomplished by analyzing algorithms associated with graph theory; these algorithms include but are not limited to Fluery's Algorithm, Prim's Algorithm, and Pathing Algorithms. The software application allows users to create simple and complex graphs, directional graphs, and mixed graphs and apply my algorithms produced within the software application. One specific application I worked on was considering graphical sequences. I used my Graph Theory package to analyze the number of degree sequences of a certain number of vertices that are graphable. During the course of my research, I also developed a general equation to answer this question.

FRI-24   **Keeping Your Cows Happy**
Room 255   Kelsie L. McCartney, *Marietta College*
5:25-5:40

You have 1000 feet of fence and a square 100 foot barn, how will you construct your enclosure? What if you only have 500 feet of fence? What if your barn is 60 feet wide? Find these answers and more! Using only basic calculus techniques, I will design the optimal rectangular enclosure, maximizing area for any barn and amount of fence.

FRI-25   **The Golden Section and Design**
Room 150   Megan V. Reese, *Ohio Northern University*
5:45-6:00

We will be exploring the aesthetically pleasing golden ratio and its use in design. We will cover the construction of the golden ratio, the golden rectangle, the golden triangle, and the golden ellipse. There will be an analysis of works ranging from the Greek construction of the Parthenon to the design of the new Volkswagen Beetle.

FRI-26   **Historical Notes Related to the Teaching of Elementary Statistics: From**
Room 153   **John Graunt to Sir Ronald Fisher**
5:45-6:00   Weiping Li, *Walsh University*

Most of the textbooks of elementary statistics show little or no reference to the development of basic ideas taught in such a course. In the talk we will attempt to show the history of important ideas and techniques in elementary statistics and write about some important figures in the development.

FRI-27   **Latte Hour: Using Differential Equations to Make the Perfect Latte**
Room 154   Mark K. Brauen, *Mount Vernon Nazarene College*
5:45-6:00

During Latte hour at Mount Vernon Nazarene University, some students prefer their lattes made with more milk than others. In order to satisfy the varying tastes, we explore one solution that involves hooking up a series of vats, each containing either coffee or milk. We solve the resulting mixture problem for the concentration of milk in the resulting lattes.

FRI-28   **Congruential Extensions of Ducci Games**
Room 155   Mihai Caragiu, *Ohio Northern University*
5:45-6:00

We will see that a certain class of geometric sequences in cyclic algebras over rings of p-adic integers can be seen as congruential extensions of the classical Ducci game. In these algebras we have both a topology and a (probability) measure. We will address, in this context, a result due to Ciamberlini and Marengoni (*Su una interessante curiosita numerica*, Period. Mat. Ser. 4 (1937), 25-30).

FRI-29   **How Big Is Your Forest?: The Cayley Tree Formula**
Room 250   Matt Steinke, *Denison University*
5:45-6:00

Graph theory has many applications – network analysis (roads and transportation), internet-based applications, chemistry and physics, to name a few. A major component of this field is the study of trees. A classic result in this area is referred to as the Cayley Tree Formula, which states that the number of distinct trees of order *n* with a specified vertex set is n^{n-2}. This result is often stated in undergraduate texts, but the proof is "beyond the scope of this book." We present an elegant proof of this result that is accessible to a general audience.

FRI-30   **The Perfect Shuffle: An Analysis**
Room 255   Kerry McIver, *John Carroll University*
5:45-6:00

I will compare the number of riffles to obtain a perfect shuffle in a poker versus a pinochle deck. Also, I will compare two different methods of shuffling to see if the number of riffles changes.

FRI-31   **Geometry in Rose Windows**
Room 150   Charise M. Kazmierczak, *Ohio Northern University*
6:05-6:20

Rose windows, a main aspect in Gothic Architecture, originate from the Roman oculus and through architectural advances have become beautiful works of art. These windows are used in many churches to tell stories and represent ideas of faith. Rose windows are geometric wonders and although the individual components may not be difficult, when placed in intricate repetitious patterns, their beauty is transformed into a majestic wonder. Through Geometer's Sketchpad software, the re-creation of these windows becomes possible and imagination allows for limitless personal creations.

FRI-32   **Creating Equations Involving Rational Expressions Having Extraneous**
Room 155   **Solutions**
6:05-6:20   John J. Whitaker, *Shawnee State University*

We will give conditions that ensure the formation of equations involving rational expressions with integer coefficients that have an extraneous integer solution. Several examples will be given.

FRI-33   **Links in Straight-Edge Embeddings of K_7**
Room 250   Pam Arbisi, *Denison University*
6:05-6:20

In 1983 Conway and Gordon and Sachs proved that every embedding of the complete graph on six vertices, K_6, is intrinsically linked. That is, every embedding of K_6 contains at least one link. Colleen Hughes (Denison '06) determined and proved that all straight-edge embeddings of K_6 have either one or three linked triangle pairs. Following Hughes's work, we have extended her research to characterize the straight-edge embeddings of K_7 and determined the number of links in each embedding where a link could exist between two triangles or a triangle and a quadrilateral. This talk is intended for a general audience.

FRI-34   **Developmental Mathematics Labs**
Room 255   John T. Noonan, *Mount Vernon Nazarene College*
4:25-4:40

In an effort to help developmental mathematics students succeed at Mount Vernon Nazarene University, the mathematics department began requiring these students to attend a weekly one-hour lab staffed by well qualified student workers. The format of the labs will be presented along with preliminary assessment data gathered both before and after implementing the labs.

Saturday, April 14

SAT-1   **The Expected Value of the Ohio Lottery**
Room 150   Rachel A. Bresson, *Capital University*
10:25-10:40

Do you ever play the lottery? It is definitely a risk when you place that dollar bet, but is it ever beneficial to play? The Ohio Lottery is comprised of several different games, but we will look closely at the Super Lotto Plus and apply the same ideas to the Rolling Cash 5 and the Ohio portion of the Mega Millions. The main focus of the research is finding the expected value. We will compare calculated expected values and jackpots in each lottery and look at the highest in each game. Through the comparisons, we will see if the expected value ever exceeds the price of the ticket making it beneficial to play.

SAT-2   **Creating Radical Equations with Extraneous Solutions**
Room 153   Matt Whitt, *Shawnee State University*
10:25-10:40

In this talk we will examine results that ensure the formation of equations involving radicals with integer coefficients that have extraneous solutions. Examples will be included.

SAT-3 **Spheres on a Cayley Graph**
Room 154 Anne Rollick, *John Carroll University*
10:25-10:40

We will define free groups, Cayley graphs of free groups, and distance functions on those graphs. We will show results on the numbers of points on spheres under various representations. This work was done at an REU at Indiana University during Summer, 2006.

SAT-4 **Checker Jumping in Three Dimensions**
Room 155 Bryan Ropp, *Ashland University*
10:25-10:40

What if your checkerboard was an infinite plane? What if your checkerboard had infinite planes? The object of this game is not to defeat your opponent, but to see if you can arrange checkers below the fold (the middle of the checkerboard) in such a way to reach the highest level above the fold. Is there a limit for the level that can be attained in either dimension? Can you achieve infinite levels if you have infinite checkers? I will propose these problems and solutions and look to see if there is a limit to what levels can or cannot be attained.

SAT-5 **Napoleon Triangles: A Brief Presentation**
Room 250 Jeffrey T. Cornfield, *Youngstown State University*
10:25-10:40

Given any arbitrary triangle, construct equilateral triangles erected outwardly on the sides of our arbitrary triangle. The circumcenters of these equilateral triangles connect to form an equilateral triangle, namely, the Napoleon Triangle. Through this talk, we will look at a brief history of Napoleon Triangles, discuss a proof with Cyclic Intersection Points, and future research into Inner Napoleon Triangles and Fermat Points.

SAT-6 **Kronecker's Theorem and Linear Recurrences**
Room 255 John T. Holodnak, *Ohio Northern University*
10:25-10:40

While the sequences $\{\sin(n)\}$ and $\{\cos(n)\}$ satisfy linear homogeneous recurrence relations with constant coefficients, we show that this is not the case for sequences like $\{\tan(n)\}$ and $\{\cot(n)\}$. The proof is a nice application of Kronecker's uniform distribution theorem for the fractional parts of the integer multiples of an irrational number.

SAT-7 **Serious Sudoku: The Mathematics Behind a Modern Puzzle Fad**
Room 150 Erin M. Satterlee, *Ashland University*
10:45-11:00

Sudoku puzzles have been referred to by many as "the Rubik's cube of the 21st century." In this talk, I will address the investigation of the mathematics that lie at the foundation of this modern craze by recounting its mathematical foundations in Euler's Latin Squares. Through an investigation of the mathematics of Latin Squares, I will propose some interesting mathematical properties of Sudoku puzzles.

SAT-8   **Funforms: A New Math Learning System**
Room 153   Joel S. Steinberg, *Case Western Reserve University*
10:45-11:00

Words and symbols are the chief tools used in human thought. We do not yet know what effects, if any, learning new symbols and structures might have on our understandings of mathematics. Funforms is a place order, tally mark, binary system. The continuity between fractions and whole numbers is beautifully demonstrated in FF. Operations become much more transparent and follow simple easily learned rules. The glyphs/ciphers are iconic/ideographic. A power point presentation demonstrating each concept and each operation will be the mechanism by which this material is made clear to the listener/participant. The presentation is currently available, and will be forwarded to the reviewers on request. Counting, adding, subtraction, multiplication and division of whole numbers, fractions and mixed numbers will all be clearly demonstrated. Learning Funforms should produce benefits analogous to the benefits and advantages that learning a foreign language has on the understanding of one's native language.

SAT-9   **An Outline of the Completeness Theorem**
Room 154   Andrew J. Homan, *Ohio Northern University*
10:45-11:00

We outline a proof, following the ideas of L. Henkin, of the fundamental Theorem of Model Theory - Gödel's Completeness Theorem.

SAT-10   **How Much Impact Does Leap Year Have on the Birthday Problem?**
Room 155   Matt Haase, *Defiance College*
10:45-11:00

My presentation will explore the impact that the extra day provided by leap year has on the Birthday Problem. It will include a brief description of the traditional Birthday Problem, including visual representation. The impact of "leap day" will be explored in the actual numbers involved in the 4-year cycle, as well as in smaller samples, where the extra day will have a greater impact. I will also relate this to an example of a real-world application, based on research I have conducted with random samples.

SAT-11   **Dowker Notation Meets the Reidemeister Moves**
Room 250   Emily N. List, *Wittenberg University*
10:45-11:00

Knots are an exciting thing to look but sometimes the projections can be hard to work with. This talk will discuss how the classic Reidemeister moves can be performed on a knot just by manipulating its Dowker notation. Kurt Reidemeister proved that the Reidemeister moves exhaust the possibilities of changing a knot projection without changing the knot type. A virtual Reidemeister move allows one to change the Dowker notation without changing the knot type of the knot it represents.

SAT-12   **RSA-Cryptography**
Room 255   Heather M. Schramm, *Cleveland State University*
10:45-11:00

We explore a brief history of RSA Cryptography. The algorithm discovered by Rivest, Shamir, and Adleman is introduced. An application in which a coin can be "flipped" virtually implements the RSA algorithm in the format of double encryption and double decryption. The participants are incapable of cheating, and the coin can be tossed fairly when participants are not able to be physically together.

SAT-13   **Speedsolving Rubik's Cube in Under 40 Moves**
Room 150   Morley A. Davidson, *Kent State University – Kent*
11:05-11:20

Rubik's Cube speedsolving competitions are increasingly popular these days, with 15-second solutions a common occurrence. A separate competition category is that of solving for fewest moves, at the expense of up to an hour; top practitioners can shave about 20-25 moves from the roughly 55 moves required by speedsolvers. But is it possible to accomplish such savings quickly, say within 40 seconds (one widespread definition of speedcubing)? In this talk I describe joint work with J. Miller, where we used GAP to simulate and analyze various known and newly found solution algorithms. Our work shows that there are indeed solution systems with a median face-turn count around 35 moves and which require only a humanly-memorizable library of move sequences.

SAT-14   **Analysis of Password Strength While Under Brute Force Attack**
Room 153   Steven L. Szente, *Wright State University*
11:05-11:20

This project was based around creating a model which would replicate the attacks an electronic password could encounter under extreme conditions. The model presented was created to compare two possible common types of electronic passwords; each which was generated randomly. The model focused on comparing each password's level of security, which could be concluded by subjecting each to an identical attack by a brute force attempt at being cracked. Though limited in scope, the model allowed for a simple comparison to be made between the two password types and provided insight as to whether the length of the password in a given situation could be considered significant.

SAT-15   **Dawn of the Logistic Function**
Room 154   John W. Hoffman, *Youngstown State University*
11:05-11:20

The threat of a zombie attack looms in the future. Although the threat is not imminent, it is better to be prepared in the event that an outbreak occurs. In this presentation, I use a logistic function to analyze the spread of the infection and determine an approximate time to get to safety.

SAT-16
Room 155
11:05-11:20

The Decimal Expansion of $\frac{1}{2007}$

Scott R. Zimmerman, *John Carroll University*

The exploration of cycles in the decimal expansion of fractions similar to $\frac{1}{2007}$ and the observation and examination of patterns therein resulted in the emergence of surprising yet familiar results in the field of number theory.

SAT-17
Room 250
11:05-11:20

An Introduction to Fractals

Melissa A. Ciacchi, *Ashland University*

In this presentation, I will discuss a new idea in math, known as fractals. They are fragmented geometric shapes that are subdivided into parts from the larger shape. In the talk, I will present the history, features, classifications, and uses of them. Unknown to us, fractals are seen in our everyday life. Such an example would be the shape of snowflakes.

SAT-18
Room 255
11:05-11:20

An Introduction to Error-Correcting Codes

Frank A. Ballone, *Youngstown State University*

Within the last decade, there has been a major increase in the development of technology. As a result, this has created an increasing demand for efficient and reliable digital data transmission. With the constant transmission of data, it is especially important to keep the transmitted information uncorrupted and prone to errors. Coding makes data transmission much easier by putting the data into a simpler form. From this, error-correcting codes can be used to help prevent a message from being improperly transmitted by working to correct any mistakes or errors that occur during a transmission. The subject of error-correcting codes is fairly new to mathematics, and coding has developed many connections with algebra and combinatorics. Much of the technology and data transmission that we take for granted would not be possible without the help of error correcting codes.

SAT-19
Room 150
11:25-11:40

The Spin Out Puzzle and Recurrence Relations

Jon D. Stadler, *Capital University*

Puzzles are a great mathematical pastime and can lead to some interesting teaching applications. Spin Out is a puzzle by ThinkFun that affords such opportunities. The puzzle consists of seven elephants mounted to a sled that are placed in a thin track. The goal is to turn all elephants so that the sled can be removed from the track. We will solve the puzzle recursively and use our method as a springboard for solving recurrence relations in a fashion not traditionally found in textbooks. In particular, we motive the solution to equations whose characteristic polynomials have repeated roots.

SAT-20   **The Complexity of the Ideal Membership Problem: The Mayr-Meyer**
Room 153   **Example**
11:25-11:40   Bessam Mehanni, *Cleveland State University*

We will introduce the Mayr-Meyer example, which exhibits double exponential growth for the ideal membership problem. We will show that in order to check if a polynomial belongs to a certain ideal or not, we need almost unlimited computational resources (time and memory) in some cases.

SAT-21   **Can You Pick a Perfect Bracket?**
Room 154   Matthew M. Menzel, *Marietta College*
11:25-11:40

The NCAA Men's Basketball Tournament (a 64-team single elimination tournament) creates many interesting questions in combinatorics and probability. We will address some basic questions, and we will look at different methods for determining the probability of correctly picking a perfect bracket. Should a company feel safe if they offer a $1,000,000 prize to anyone who correctly picks a perfect bracket?

SAT-22   **Order from Chaos: Determinate Chaos Theory and the Butterfly Effect**
Room 155   Chris F. Buurma, *Ashland University*
11:25-11:40

Ever heard, "a butterfly flapping its wings in china can cause a hurricane in Florida?" I'm afraid you've heard a stab at Determinate Chaos Theory, the idea that chaotic situations and elements really come from one simple set of initial states and follow only one set of rules, yet their behavior seems erratic due to the rules used on the unknown initial states. In this seminar, we will explore Chaos Theory and all its elegance as well as a simple game to show the order from chaos.

SAT-23   **The Effects of the Parallel Postulate on Geometric Invariants**
Room 250   Carrie Ebright, *Otterbein College*
11:25-11:40

Euclid's Fifth Postulate has had much controversy over the years because it is so unlike Euclid's other axioms. While trying to prove the postulate, mathematicians altered it, forming non-Euclidean geometry. Despite the differences in appearance, there are properties called geometric invariants that hold true for all of the geometries. The idea of neutral geometry and geometric invariants is important because it shows how things can be so similar even when they appear so different.
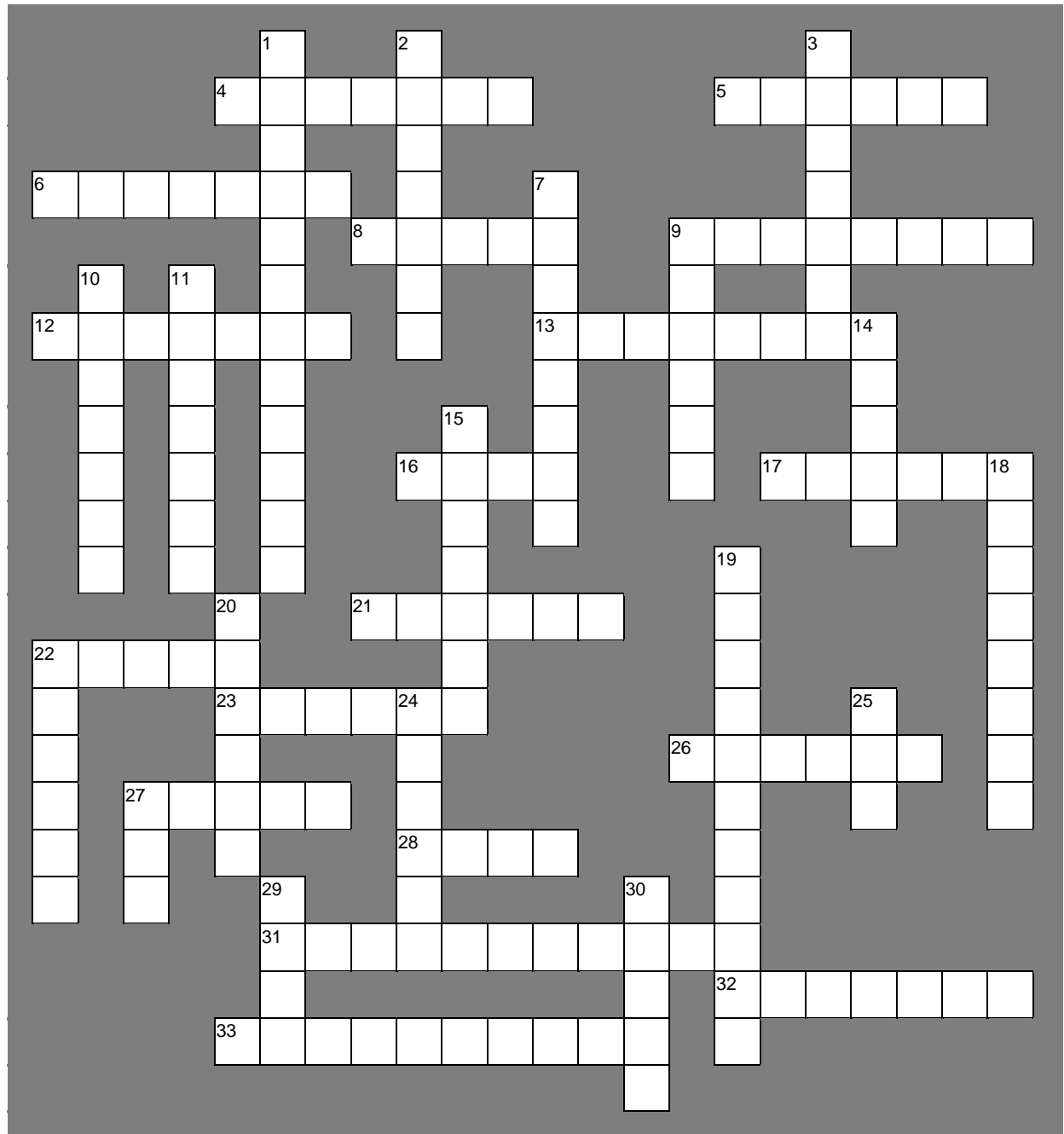

SAT-24   **Representations of Complex Numbers**
Room 255   Tara Cruickshank, *Youngstown State University*
11:25-11:40

In this talk, we consider alternative methods of representing complex numbers. We will look at representations in linear algebra and abstract algebra.

Explore the MAA Website!!
Created by Bill Fuller, Ohio Northern University

Classroom Note: A Hands-On Approach to the MAA Website

Offered here is a crossword puzzle I recently used as an exercise with the Junior mathematics majors at ONU. I explained to the majors that the point of doing the crossword was to learn what the website contained and where the content was located on the site. As a result there was a basic ground-rule: Answers could be obtained only by navigating the web-page menus and not by using any search utility or Google, nor by using the site map. The majors quickly got into the spirit of the puzzle and had a lot of fun with it. Even more, they now have an excellent idea of the resources available to them on the website.

Across

4. President of the MAA

5. One section of the MAA

6. Month that the MAA CPS organizers meet

8. Place where your MAA ID# is found

9. One of the benefits of MAA membership

12. David Stone is one of the chairs of this MAA committee

13. One of the five priorities in the MAA's "New Agenda"

16. Language that the Sampler software is written in

17. Your MAA member number

21. Content of the Ohio mini-focus

22. Award given for articles in the College Mathematics Journal

23. MAA award given for middle school teaching

26. University where the Allegheny section will meet in Spring 2008

27. Topic for Mathematics Awareness Month: Mathematics and the ?

28. Why study mathematics anyway? Math will _____ your world.

31. MAA's logo

32. Mathematician treated in Ivars Peterson's column

33. Person in charge of the JOMA GPS

Down

1. Project working to build strong undergraduate learning environments

2. The L in the MAA's DL

3. Person giving the MAA's third distinguished lecture

7. The O in USAMO

9. MAA group with new guidelines for College Algebra

10. New SIGMAA's added!

11. Mathematician present at Common Ground pilot meeting

14. Mathematician whose birthday the MAA is celebrating this year

15. Location of 2007 Mathfest

18. The del in EPADEL

19. MAA magazine for teaching history of math

20. Type of matrix discussed in the Monthly, March 2004

22. MAA's mission is to influence public _____

24. MAA Author who helps participants in the O in USAMO

25. Number of types of membership in MAA

27. You can purchase this baby item with MAA logo

29. What a column in Teaching and Learning can help teachers save

30. Author of new MAA book on "War Stories"

Notes

Acknowledgements

The Ohio Section would like to thank the faculty, staff, and students of the Mathematics Department at Shawnee State University, for their efforts in hosting this meeting. Special thanks go to Phil Blau, the Chair of the Local Arrangements Committee.

The Section also wishes to thank John Carroll University for providing the funds to print this program, as well as the exhibitors for their support of the meeting.

Save these Dates!

The Ohio Section Short Course, "Java Applets in Teaching Mathematics" will be presented by Dr. Joe Yanik from Emporia State University, at Baldwin-Wallace College in Berea, OH, on **June 20-22, 2007**.

The fall meeting of the Ohio Section will be held at Wittenburg University on **October 26-27**. Please note that this date differs from the date printed in the Spring 2007 *Ohio Focus*.

Mathfest will be in San Jose, CA, **August 3-5, 2007**.