Program of Activities
For the 90th Annual Meeting of the

Mathematical Association of America

Ohio Section

Spring 2006
The University of Akron
Akron, Ohio
March 31-April 1, 2006

MAA Ohio Section

Program

Friday, March 31, 2006

8:00—Noon	NExT Workshop	College of Arts and Sciences Building (CAS) Room 134
Noon—4:30	Registration	Student Union, Second Floor, Theatre Area
	Book exhibits	Student Union, Second Floor, Atrium
Noon—1:20	Student problem-solving team competition	CAS 107
12:15—1:15	Committee Meetings	
	CONCUR	Student Union, 308
	CONSACT	Student Union, 310
	CONSTUM	Student Union, 312
	CONTEAL	Student Union, 314
	Program Committee	Student Union, 316
1:30—1:45	Welcome and Announcements	Student Union Theatre
1:45—2:45	Invited address: **"Going Up and Down"** Georgia Benkart, University of Wisconsin – Madison	Student Union Theatre
2:45—3:10	Break & refreshments	Lobby Area, Student Union
3:10—4:05	Retiring President's address: **"Some Thoughts on Rings and Things"** Dwight Olson, John Carroll University	Student Union Theatre
4:20—6:15	**Contributed paper sessions**	College of Arts and Sciences Bldg (CAS)
4:20—6:15	**Special session on Applied Mathematics**	CAS
4:20—6:15	Executive Committee Meeting	CAS 124 Conference Room
6:15—6:45	Social Time	Martin University Center (Fir Street)
6:45—8:00	Banquet	Martin University Center (Fir Street)
6:15—8:00	Student Pizza Party	CAS Atrium and nearby rooms
8:00—8:45	After-dinner talk: **"Developing an undergraduate research program"** Tom Price, The University of Akron	Martin University Center (Fir Street)
8:45	Business meeting and presentation of teaching award	

Saturday, April 1, 2006

8:00—10:30	Registration	Student Union, Second Floor, Theatre Area
	Book exhibits	Student Union, Second Floor, Atrium
8:00—8:50	Coffee & donuts	Student Union, Second Floor, Theatre Area
8:05—8:45	Meeting of student leaders	Student Union, 318
	Meeting of Department Liaisons and Chairs	Student Union, 314
	Executive Committee Meeting continuation (if necessary)	
8:50—8:55	Announcements	Student Union Theatre
8:55—9:55	Invited address:	Student Union Theatre
	"Ladies of the Rings"	
	Georgia Benkart, University of Wisconsin–Madison	
9:55—10:20	Break & refreshments	College of Arts and Sciences Bldg, Atrium
10:20—11:55	**Contributed paper sessions**	College of Arts and Sciences Bldg
12:10—1:10	Invited address:	Student Union Theatre
	"Bicycle Tracks on the Plane and the Sphere"	
	David Finn, Rose Hulman Institute of Technology	
1:10	Closing remarks	Student Union Theatre

Abstracts of Invited Addresses

Speaker: Georgia Benkart, University of Wisconsin
Title: "Going Up and Down."
Abstract: A partially ordered set has its ups and downs. That is, on any set with a partial order there is an up operator and a down operator. These operators encode essential combinatorial information. Sometimes they even behave like the operators in the Heisenberg uncertainty principle. You can be certain that during this talk will be one of those times.

Speaker: Dwight M. Olson, John Carroll University
Title: "Some Thoughts on Rings and Things."
Abstract: Three scenarios will be addressed in which the defining axioms for a ring are modified. The resulting structures are Non-associative rings, Semirings and Hyper-rings. We will discuss some of the properties of rings that are lost as a result of the changes, and consider some properties that mathematicians have added back in to try to compensate for the change in axiomatic structure.

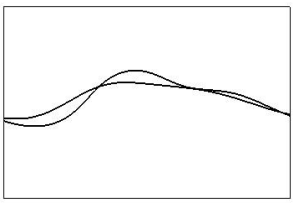
The talk will be aimed primarily at the undergraduates in the audience. It is hoped that students will find in the talk some interesting non-traditional areas for future undergraduate research.

Speaker: Thomas E. Price, The University of Akron
Title: "Developing an undergraduate research program."
Abstract: The Fibonacci numbers have a rich and interesting history. Most mathematicians are acquainted with the basics of their development and find delight in staying abreast of new Fibonacci Facts. These numbers inspired me to form an undergraduate research team called The Fibonacci Forum that evolved into my contributions to our mathematics REU program. In this talk I will discuss the chronological development of the Forum.

Speaker: Georgia Benkart, University of Wisconsin
Title: "Ladies of the Rings."
Abstract: A tale of science non-fiction about two women and their magical mathematics.

Speaker: David Finn, Rose Hulman Institute of Technology
Title: "Bicycle Tracks on the Plane and the Sphere."
Abstract: The title problem of the MAA book "**Which way did the bicycle go? … and other intriguing mathematical mysteries**" by Konhauser, Velleman and Wagon considers the following situation:

> *Imagine a 20-foot wide mud patch through which a bicycle has just passed, with its front and rear tires leaving tracks as illustrated below. In which direction was the bicyclist travelling?*



The origin of this problem is one brief conversation between Holmes and Watson in the Sherlock Holmes mystery, *The Priory School*, in which Holmes and Watson encounter a pair of tire tracks in the mud and the great detective immediately deduces the direction the bicycle was travelling. This

evidence then leads Holmes and Watson to find a duke's kidnapped son and arrest the murderer of a school teacher.

In this talk, we will describe how an incredibly gifted bicyclist could potentially fool the great detective when trying to determine in which direction the bicyclist was traveling. How, you ask? There is an infinite-dimensional class of bicycle tracks on both the plane and the sphere for which it is impossible to tell the direction the bicyclist was travelling. Moreover, there is also an infinite dimensional class of bicycle tracks on the plane and the sphere that only creates one curved track, leaving the great detective to wonder whether he is trailing a bicyclist or a unicyclist.

Biographies of Invited Speakers

Georgia Benkart, University of Wisconsin

Georgia Benkart was born 40 miles east of Akron in Youngstown, Ohio. She received her BS degree summa cum laude from Ohio State University and her Ph.D. degree from Yale University under the direction of Professor Nathan Jacobson. Since graduating, she has been at the University of Wisconsin - Madison, where presently she is E.B. Van Vleck Professor of Mathematics. She has held visiting positions at the Institute for Advanced Study and the Mathematical Sciences Research Institute. Her main research area is Lie algebras, but she has also worked in related areas, like quantum groups, combinatorics, and associative and nonassociative algebras. She has written over 100 papers and two AMS Memoirs and has had 21 Ph.D. students. She has been an editor of the Journal of Algebra, chair of the AMS Monographs and Surveys Committee, and a member of the AMS Council.

In 1987, Georgia Benkart received the University of Wisconsin's highest prize for distinguished teaching. She was the Polya Lecturer of the MAA (2000-2002) and has given 5 MAA-AMS Invited Hour Lectures and hundreds of other invited talks.

Dwight Olson, John Carroll University

Dwight Olson received his undergraduate degree from Jamestown College, Jamestown, ND, in 1966, and his Ph.D. from the University of Wyoming in 1971. He previously taught at Cameron University in Lawton, OK, and has been at John Carroll University since 1984, where he served as Chair of the Department of Mathematics and Computer Science from 1995 to 2003. He has published more than a dozen research articles on the theory of radicals in rings and semirings, and regularly writes reviews for Zentralblatt.

For the last few years Dwight has taught mainly abstract algebra and statistics. He is currently involved in an MSP grant program with the Cleveland Municipal Schools District teaching statistics/discrete math/algebra to middle school teachers in a JCU Master's program. He and his wife Colleen have two sons: Steig who is an attorney in New York City and Torrey who is a Ph.D. candidate in Math. Ed. at U. Cal. Davis, and who is the father of their only grandchild, 6-month-old Henry.

Thomas Price, The University of Akron

Thomas Price completed his Ph.D. in mathematics at the University of Georgia in 1976. That same year he accepted a position at The University of Akron and has remained there except for four professional leaves. During his 30-year career he has taken a shotgun approach to research and has publications in the areas of numerical analysis, approximation theory, number theory, fractal analysis, biomedical engineering, medicine, statistics, and mathematics education. Tom's primary academic love, however, is teaching mathematics. Most of his undergraduate mathematic education was strongly influenced by the Moore or "do it yourself" method. This teaching strategy coupled with the influence of his excellent professors instilled in him a love for mathematics and a desire to teach mathematics. Over the years Tom has endeavored to utilize the Moore style of teaching as much as possible to stimulate students' latent creative mathematical talent and gratification in doing mathematics. Tom enjoys trying new teaching strategies. Recently he developed an online course for teaching the software package Scientific Workplace.

During the past ten years Tom has combined his love for research and teaching by developing an undergraduate research group called the Fibonacci Forum. He used the Forum as a pilot program for his part of the mathematics REU program now located at UA.

David Finn, Rose Hulman Institute of Technology

David Finn is an Associate Professor of Mathematics at Rose-Hulman Institute of Technology in Terre Haute, Indiana. His degrees are from Stevens Institute of Technology in Hoboken, NJ (B.S. in Applied Mathematics) and Northeastern University in Boston, MA (M.S. and Ph.D. in Partial Differential Equations). Before arriving at Rose-Hulman in 1999, he taught at Goucher College in Baltimore MD and Merrimack College in North Andover, MA. As one might guess from his background, he is not a native Hoosier, rather he is a transplanted New England Yankee having been raised in a suburb of Boston. He, in fact, still possesses the Bostonian view of the world with Boston as the hub of the universe and everything orbiting Boston.

He has been a member of the MAA since graduate school, currently serving as Newsletter Editor for the Indiana Section and MAA Liaison for Rose-Hulman. He is a national NExT fellow (1996-97), an original Blue Dot. He has been awarded the MAA's George Polya Award for his article "Can a bicycle create a unicycle track?", the contents of which you will hear about in his talk. He is currently active in student research opportunities participating in the Rose-Hulman NSF-REU with students this summer working on a project called "*The Shape of a Cookie*" which continues the work of a student on an independent research project over the last year. In addition, over the past few summers, he has directed teams of programmers (MA/CS double majors) developing interactive java applets for teaching "Geometric Modeling", a geometry for computer graphics course, funded by an NSF-CCLI grant.

In what little free time he possesses, he can normally be found either walking the family dog "Frannie" (his second job) or playing with his son "Jonathan Avery" (4 years old) or reading/telling stories to him or baking cookies with him (pure recreational activity). Once "Avery" and "Frannie" go to sleep, he then gets to spend time with and talk to his wife Suzanne.

Abstracts of Contributed Papers

Friday 4:20 – 4:35

An Optimization Method for Finding the Bending Stiffness of a Graphene Sheet

Mark W. Roberts
Graduate Student, University of Akron

Abstract Number: 1. Consider the case where one set of parallel edges of a graphene sheet is fixed a small distance from a fixed, flat graphene sheet. The sheet with the fixed edges can be modeled as a continuous, uniform beam. The bending of the beam is modeled by a non-homogeneous non-linear fourth order differential equation. The external forces on the beam are derived by assuming a Lennard-Jones potential form for the molecular interaction between the two sheets. To find the bending stiffness of the beam, numerical solutions to the differential equation are compared to Molecular Dynamics (MD) simulations of the bending of the graphene sheet. An optimization procedure is used to find the value of the bending stiffness that resulted in the closest match between the numerical solutions and the MD simulations. The results of the optimization indicate that the bending stiffness of the graphene sheet is dependent on the length of the sheet and the distance between the two sheets.

The Emergence of Feingenbaum's Constant in Function Iteration

Todd J Mullen
Student, Ashland Univ

Abstract Number: 2. If we take an initial value (seed) and put it into certain functions and evaluate it, then re-insert the new value, then do it again, & again, ... n–times, the system exhibits what is known as “Ergodic behavior” (Chaos). Within this “Ergodic Regime” there occurs periods & windows where the chaotic behavior is “organized” & other interesting results appear. We will explore the large scale behavior of certain functions as we vary a parameter for the function class.

Obsession, Isolation, and Beauty – An Overview of The Proof of Fermat’s Last Theorem

Allen A Cox
Student, Kent St Univ-Kent

Abstract Number: 3. Fermat’s Last Theorem states that for positive integers x, y, and z, and for any natural number n greater than two, that no solution exists to the equation $x^n + y^n = z^n$. The theorem, formulated over 350 years ago, remained unproven for centuries by mathematicians across the globe. Through the developments of seemingly unrelated topics of modular forms and elliptic curves, Andrew Wiles would come to prove the theorem in 1994 after eight years of determination. An overview of the underlying mathematics of the proof and the 20th century developments and related topics leading up to the proof will be discussed.

I Want to Write a Scintillating Article ...

M.B. Rao
Faculty, Univ of Cincinnati

Abstract Number: 4. I must admit that I do not have the gift of writing riveting articles or the knack of uttering clever witticisms. I do have a modicum of skills in Mathematics, Computing, and Statistics. Maybe I can use my skills to compose a fabulous article. In this presentation, I weave a little story encompassing Probability, Computing, and the Art of Writing. A rudimentary knowldege of probability is good enough to follow the story.

Infinite Virtually Cyclic Subgroups of the Three-dimensional Crystallographic Groups

Lisa M Lackney
Student, The Univ of Akron

Abstract Number: 5. We investigate the existence of infinite virtually cyclic subgroups of three dimensional crystallographic groups. Using the well-known finite subgroups, we computed possible infinite virtually cyclic subgroups from their semi-direct products and amalgamated products. The existence of these subgroups was checked using the International Tables. We also proved that $F \times \mathbb{Z}$ is a subgroup of an n dimensional crystallographic group if and only if F is a finite subgroup of some n-1 dimensional crystallographic group. Our results are useful in computing the algebraic K-theory of crystallographic groups.

Various and sundry...

Carl Stitz
Faculty, Lakeland Community College

Abstract Number: 6. Working at a community college affords me the opportunity to re-discover some interesting bits and pieces of mathematics scattered throughout the two year college curriculum. No one in the Math Department at Lakeland had seen these trivia before, but found them interesting nonetheless. Maybe you'll find them interesting, too! This talk is accessible to students who have had one semester of Calculus.

Friday 4:40 – 4:55

Van der Walls Interaction of a Bending Carbon Nanotube with a Substrate

Andrew Mykrantz
Graduate Student, University of Akron

Abstract Number: 7. Potential applications for carbon nanotubes (CNT) include their use in atomic force microscopy and in adhesives. However, further analysis is needed. We present the modeling and analysis of a substrate interacting with a single-walled CNT that is fixed at one end. Our focus is on the bending and adhesive properties of the carbon nanotube. The CNT is modeled by a chain of rigid links connected by torsional springs. The effects of van der Waals forces are included in the model. In the static version of the problem, the substrate is fixed at various distances below the fixed end and steady-state solutions are found using minimization techniques. Currently we are working on verifying the accuracy of the model and obtaining more results for a larger number of links. After solving the static problem, we plan to treat the dynamic problem in which the substrate moves. Our results will provide additional understanding as to how CNT bend and how adhesive it is when the substrate pulls away from the carbon nanotube.

An Analysis of a Borda Style Voting Method

David Stuckey
Faculty, Defiance Coll

Abstract Number: 8. There is a system of voting for multiple candidates known as the “Michigan method” in which each voter ranks their preference of candidates with 1 being first choice. The candidate with the lowest score is declared the winner. It is identical in nature to the usual Borda method, which ranks the top candidate with the highest number and the candidate with the greatest score wins. The question arises as to what effect collusion between two voters will have on the

outcome of the election when there are five total voters. Cases up to four candidates will be considered.

Tessellations: Lessons for Every Age
Kate L Cerrone
Graduate Student, The Univ of Akron

Abstract Number: 9. Everyone has seen a mosaic, whether it is a beautiful work of art on an ancient building or the tiling on their bathroom floor. How many know the mathematics behind it though? Some mosaics and tilings are what mathematicians refer to as tessellations. This talk will discuss the lessons I have developed and tested over the past year. The inquiry-based lessons utilize the subject of tessellations to lead students in developing a relationship between geometry, symmetry, and even algebra.

Balanced (Signed) Ternary Notation
Brian J Shelburne
Faculty, Wittenberg Univ

Abstract Number: 10. In the 1840's Thomas Fowler, a self taught mathematician and inventor from Devonshire, England invented a calculating machine that used balanced ternary notation to perform its calculations. Fowler observed that the mechanics of calculation were simplified by using balanced ternary notation, its use being analogous to the use of binary notation in modern computers. However, balanced ternary notation has some advantages over binary notation, especially in the way negative numbers are handled. This talk is an introduction to balanced ternary notation and balanced ternary calculation.

Introduction to Markov chains and an application related to nuclear physics
David Gohlke
Student, Youngstown St Univ

Abstract Number: 11. A nuclear isomer is a long-lived energetic state of a nucleus. During the process of ongoing research with the physics department at Youngstown State University, nuclear isomers were examined to determine if the decay of these nuclei could be stimulated. An important characteristic of these decays is the presence of coincident gamma rays. Details about these coincident gamma rays can be extracted from the transition matrix of an associated Markov chain. Information concerning the number of gamma rays released and the joint probabilities of multiple gamma rays, as well as a general introduction to the theory of Markov processes will be explored in this presentation.

Power Indices
Carrie L Davis
Student, Youngstown St Univ

Abstract Number: 12. 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.

Friday 5:00 – 5:15

A Finite Difference Approach to a Nanofiber Deposition Problem
Paul Hamrick
Graduate Student, University of Akron

Abstract Number: 13. Plasma enhanced physical vapor deposition (PEPVD) is one proposed method to coat nanofibers and nanostructures with thin film materials. Experimental efforts in coating electrospun polymer nanofibers suggest a relationship between coating morphology and operating conditions. This motivates a theoretical model for coating growth. The model presented here assumes a coating growth that is uniform along the axial dimension of the nanofiber but non-uniform in the radial direction. The concentration of vaporized aluminum surrounding the coating growth is non-uniform due to the geometry of the coating growth; therefore modeling the morphology of the growth requires that the surrounding concentration field be determined. The concentration field is then supplied to an evolution equation. The mode of mass transport is diffusion; therefore the mathematical model consists of Laplace's equation over a polar domain. The domain is an annulus with an irregular inner boundary. A finite difference method is employed to solve the system. The irregular inner boundary geometry, as well as a complicated inner boundary condition, requires that interpolation schemes and ghost points be used at boundary points. The resulting matrix system is solved with a block SOR iterative method.

Equivalent Norm Coefficients

Matthew J Ward
Student, Youngstown St Univ

Abstract Number: 14. Standard proofs for "all norms defined on a finite dimensional vector space are equivalent" can be long and complicated. A simpler approach is examined through the use of generalized equivalent norm coefficients.

Outwitting the Lying Oracle: The Best Strategy for a Casino Betting Game

Christine M Truesdell
Student, Ashland Univ

Abstract Number: 15. This talk centers around a gambling game involving an oracle operating a table where gamblers place bets on coin flips. The oracle informs the players that he will tell them the outcome of the flip before they bet; however, he is allowed to occasionally lie. The focus is on determining the optimal strategy for placing bets. Initially, the problem lets the oracle lie at most once and then moves on to the solution for allowing multiple lies.

Using Cyclic Extensions to Classify Groups of Order 81

Michael W Garlow
Graduate Student, The Univ of Akron

Abstract Number: 16. Marcel Wild recently published a paper in the MAA monthly titled "Groups of Order 16 Made Easy." The main focus of this paper is to classify all groups of order 16 using cyclic extensions. When dealing with cyclic extensions, no advanced techniques in finite group theory are necessary. That is, only fundamental ideas are used in constructing cyclic extension types. The main feature of this talk is to present what are believed to be the 10 non-abelian groups of order 81, using cyclic extensions. In doing so, some general theorems about groups of order p^4 will also be presented.

Periodic Differential Equations

Paul C Havens
Student, Lakeland Community College

Abstract Number: 17. This talk will detail the derivation of a function that has an n^{th} derivative equivalent to the original function.

A Study of the Conjecture: "Between x^2 and (x+1)^2 There Exists at Least one Prime Number

Jeff Meyer
Student, Defiance College

Abstract Number: 18. Discussing the steps taken in studying the conjecture that leads to the conjecture that while ⍉(x) ~ x / log x, for any x, the number of primes between x^2 and (x+1)^2 is approximately [(x+1)^2 - x^2] / log (x+1)^2 and the possibilities given this new conjecture.

Friday 5:20 – 5:35

Deposition of Coatings onto Nanofibers

Kevin Moore
Graduate Student, University of Akron

Abstract Number: 19. Presented is a theoretical model of coating growth resulting from a procedure to coat nanofibers and core-clad nanostructures. These nanofibers and nanostructures are coated with thin film materials using plasma enhanced physical vapor deposition (PEPVD). In the experimental effort, electrospun polymer nanofibers are coated with metallic materials under varying operating conditions to observe changes in the coating morphology. A non-uniform axial growth with uniform radial growth is investigated here. The interrelationships among processing factors for the transport and deposition of the coating material are also investigated. This includes both the salient physical and chemical phenomena. This parametric study results in an evolution equation that describes the coating growth for a coating-free surface. This equation is first solved using a boundary perturbation method to determine the coating morphology as a function of operating conditions. This results in a solution that describes uniform coating growth. The weakly nonlinear solution is then determined. This solution describes non-uniform growth in the axial direction. The nonlinear evolution equation is then analyzed using linearization methods and a solution of separable form. This model also allows us to determine how specific terms affect the coating growth.

A Fractional Point

Anne M Rollick
Student, John Carroll Univ

Abstract Number: 20. An exploration of the decimal expansion of 1/p, where p is a prime, including relations between periods and primes.

Chinese Zodiac Mathematical Structure

Bryan M Ropp
Student, Ashland Univ

Abstract Number: 21. Chinese Zodiac place mats at chinese restaurants is a good way to pass the time while waiting for food. But how did the Chinese decide what animals were compatible or not? Did they just make it up, or is it because the mathematical structures that are formed? No one knows for sure, but I'll be arguing the mathematical side and how I think the Chinese developed the conclusions for the Chinese Zodiac.

An Application of Vibrational Analysis

Rebecca Grove
Student, Youngstown St Univ

Abstract Number: 22. The derivation of the formulas associated with vibrational analysis will be explored in this presentation. The formulas presented will include both general forms and specific forms for industrial application.

On a class of sequences related to the greatest prime factor function.

Lisa Scheckelhoff
Student, Ohio Northern Univ

Abstract Number: 23. Let gpf(x) be the greatest prime factor of the integer x. We will use the gpf function to generate a class of sequences of primes depending on the parameters p (a prime) and a,b (positive integers) in the following way: x(1) = p, and x(n+1)=gpf(a*x(n) + b) for n = 1,2,3,... We explore several properties of these "linear gpf sequences" and we formulate various conjectures. For example, the sequences corresponding to a = 2 and b = 1 appear to have the property of being ultimately periodic with the period (3,7,5,11,23,47,19,13) that does not depend on the choice of the first term p. Similar phenomena happen for other choices of the parameters a and b. In some cases we find nontrivial connections with the Mersenne primes. We also provide several MATLAB-generated plots illustrating the number of iterations needed to get into the limit cycle, as well as several other graphical representations.

Friday 5:40 – 5:55

Modeling of Nanofiber-Based Devices for Efficient Thermophotovoltaic Energy Conversion

Jared Hicks
Student, University of Akron

Abstract Number: 24. As much as thirty percent of the available energy in your automobile is expelled as wasted thermal energy through the exhaust gas. Recovering even a small percentage of this wasted energy as electricity could have a substantial impact on the environment and the economy. Thermophotovoltaics (TPV) is a promising energy conversion technology for the production of electricity from sources of thermal energy, such as vehicle exhausts. Novel approaches to TPV energy conversion are being developed at The University of Akron, in which TPV devices are constructed from electrospun polymer nanofibers that contain rare-earth materials. The hot gas source heats the rare-earth material to temperatures at which the material emits infrared light. This light is collected by a photovoltaic cell, where it is converted to electricity. The goal of the process engineer is to design TPV devices that maximize efficiency and overall power output at feasible temperatures. To achieve this goal, a comprehensive mathematical model is being formulated, analyzed, and solved to assist device design. The model will direct the process engineer toward optimal concentration and distribution of the rare-earth material in the nanofiber mesh, and placement of the photovoltaic cell for maximum energy transfer. TPV devices may also be applied to co-generation of electrical energy from exhaust streams of chemical reactors, power plants, incinerators and engines. Development of these TPV applications would reduce the demand for fossil fuels and impact the nation's energy use and economy.

Analyzing Calculated Probabilities Through Brute Force

Steven L Szente
Student, Defiance Coll

Abstract Number: 25. The calculated probabilities of standard 5 card poker hands were analyzed through the use of simulated human action. The brute force method by which large numbers of tests were conducted allowed for a real world view of how accurate the calculated probabilities would be in comparison with actual test results.

An Optimal Strategy for Pot-Limit Poker

Timothy H Nelson
Student, Ashland Univ

Abstract Number: 26. At a time when poker is huge and you can potentially make million of dollars in a single game, wouldn't it be nice if you could get an edge on your opponent(s) to have a bigger chance of winning the overall game? Is there a mathematical formula to allow you to get this edge on your opponent(s)? We will explore an optimal strategy that you can play in Pot-Limit Poker games to obtain this edge.

The Quantum Distance Between Matrix Spaces

David A Nassar
Student, Denison Univ

Abstract Number: 27. Matrix spaces can be used to represent physical situations as demonstrated by Heisenberg. For my summer research project, I calculated the quantum distance between two matrix spaces to gain insight on the interaction between the two physical situations they represented. This talk is suitable for those who have taken an elementary linear algebra course.

How Powers, Triangles, and Sums Come Together

Andrew J Miller
Student, Ashland Univ

Abstract Number: 28. Using geometry, counting methods, and pascal's triangle to find explicit formulas for summing the first n integers raised to some power.

Friday 6:00 – 6:15

Determination of Effective Properties of a Fiber Reinforced Composite with a Functionally Graded Transition Zone Under Axisymmetric Loading

Carey Childers
Graduate Student, University of Akron

Abstract Number: 29. Many materials are fabricated using fiber reinforced composite materials, which consist of a set of aligned stiff fibers embedded in softer matrix. The main goal is to develop a mathematical model to determine the local stress and strain fields for a transversely isotropic fiber reinforced composite with a linearly graded transition zone between the fiber and the matrix under axisymmetric loading. In a linearly graded transition zone, the displacements are governed by Cauchy Euler equations. How these equations are solved and analyzed will be discussed.

Randomness properties of elliptic curves

Justin Gieseler
Student, Ohio Northern Univ

Abstract Number: 30. Let f(x) be a separable cubic polynomial with coefficients in a (large) finite prime field. We study the distribution properties of the the sets obtained by projecting the elliptic curve $y^2 = f(x)$ onto the x-axis. By using the Legendre symbol, every such set X(a,b,p) can be represented as an "elliptic" walk B(a,b,p) of length p, so that any argument for (or against) the random character of the sets X(a,b,p) tranlates into an argument for (or against) the random character of the elliptic walks B(a,b,p).The randomness properties of the above defined mathematical objects are investigated by using various MATLAB-aided statistical tests as well as exponential sums.

Concept Maps: A window into students' understandings

David E Meel
Faculty, Bowling Green St Univ

Abstract Number: 31. Concept maps provide an external representation of students internal knowledge structures. In particular, concept mapping developed originally by Novak builds off the ideas of Ausabel and Deese concerning linkages in cognitive structures. This talk will (1) examine the structure of various types of concept maps, (2) discuss instructions and training and (3) provide examples of concept maps developed by students in an elementary linear algebra course.

Tiling Deficient Boards with Trominos

Jennifer R Picucci
Student, Ashland Univ

Abstract Number: 32. On an n × n board with one square removed can it be tiled using right trominos? Does n have to be odd or even? Are there any boards that cannot be tiled besides those not divisible by 3? These and more questions will be answered when looking at n × n boards with one square removed as n becomes larger and larger.

Overtime

Nicole E Thompson
Student, Ashland Univ

Abstract Number: 33. Given the option, what would be the optimal method of overtime in football? You would want to choose a method in which the coin toss has minimal effects on the outcome of the game and where the probability of each team winning is as close to equal as possible. We will explore two methods of overtime to determine which method would give the best probabilities for each team.

Saturday 10:20 – 10:35

Theoretical Development of a Self-Lubricating Porous Bearing

Joshua Johnston
Graduate Student, University of Akron

Abstract Number: 34. This presentation will discuss the utilization of the Brinkman-extended Darcy equations and a stress jump boundary condition to derive a modified Reynolds equation to model a new type of self-lubricating bearing. The design in question features a porous slider bearing and a pressurized reservoir that acts as a natural pump.

Ideal-divisor Graphs of Commutative Rings

Michael T McGowan
Student, John Carroll Univ

Abstract Number: 35. Given a commutative ring R, one can construct the zero-divisor graph of R by letting vertices correspond to non-trivial zero-divisors and by placing an edge between two vertices whose product is 0. This concept can be generalized to "ideal-divisor" graphs, and many interesting properties can be discovered, especially when examining the graphs of direct products of various rings.

The Steiner Problem on the Wide Cone

Colleen S Hughes
Student, Denison Univ

Abstract Number: 36. The general Steiner problem is a type of minimization problem that states: Given a set of n points in the plane, what is the shortest length network which will connect all n points? This shortest network for a set of points is called a Steiner network. A special case of the

Steiner problem is to consider the shortest length network connecting the points on a regular polygon. This was solved in 1934 for n < 6 and for n > 13 and solved for all n in 1987. Here, we turn our attention to the Steiner network for a regular octagon on a non-Euclidean surface, the wide cone.

P vs. NP, AKS, and RSA: The acronyms of Mathematics Awareness month

Emily N List
Student, Wittenberg Univ

Abstract Number: 37. We will begin by defining one of the seven millennium problems, the P vs. NP problem. Then, through looking at examples of problems that are labeled P or NP it will become clear why this problem is important. We will discuss the properties of prime numbers and their relation to the P vs. NP problem that make them very useful in internet security, including the RSA encryption method. The talk will finish with the explanation of a recent result that has some unpredicted implications relating to the P vs. NP problem and prime numbers.

Probability on Death Row

Leanna Cluff
Student, Youngstown St Univ

Abstract Number: 38. Of three prisoners on death row, one has been pardoned but the Governor doesn't want to announce his decision yet. One of the prisoners wishes to get some information from a prison guard (a close friend of the Governor), but the guard refuses. The prisoner gets an idea: What if the guard reveals which one of the other prisoners will be executed? Has the first prisoner received any helpful information? Does the information affect the the prisoner's chances of execution, or is it essentially irrelevant? What if the guard identifies the criminals with a certain probability? In this talk, we will investigate these issues and will hopefully be able to give advice to the anxious detainee.

Saturday 10:40 – 10:55

Cell Loss from the Corneal Endothelium: Life Rates of Loss and Impact of Surgical Procedures, Predictions from Mathematical Models.

Gideon Obi
Student, Cleveland State University

Abstract Number: 39. The purpose of this study is to use a simple mathematical model of the process of cell loss from the corneal endothelium to predict how rates of loss altered by surgical procedures will impact the integrity of the cornea. Methods are a statistical simulation of large samples of the human population with a normal distribution of initial endothelial cell densities and a gamma distribution of endothelial loss rates. The endpoint that was considered the outcome of interest was years to reach 500 cells/mm2 (failure). This is a density level considered a critical point for risk of corneal failure. Results indicated that years to failure were a linear function of the initial rate of loss, and that the least squares lines rotated as the rate of loss induced by the surgery increased and the intrinsic loss rate of the sampled subject was higher. The results allow estimation of time to failure with an accelerated rate of loss induced by surgery when the intrinsic rate of loss of a subject is measured. Additional applications such as setting limits of endothelial cell density for eye banking and corneal transplants and estimating sample sizes required for clinical studies can be realized using this model; and our results on these areas are presented.

Wilson's Theorem from Prime to Composite

Tim A Smith
Student, Cleveland St Univ

Abstract Number: 40. Wilson's Theorem states that (P-1)! = -1 (mod P) for a prime number P. That is, if we multiply together every positive integer less than P and add 1, the result is divisible by P. But what if P is a composite number? Using elementary concepts of number theory, and some help from Euclid, Euler, Gauss, Fermat and the 3rd-century CE Chinese, we will journey with Wilson's Theorem into the land of composite numbers.

Ford Trees

Donald A Hunt
Faculty, Ohio Northern Univ

Abstract Number: 41. We will define a subclass of binary trees known as Ford Trees. Various geometric and algebraic properties will be presented. Connections to Ford Circles, Farey Addition, and the Euclidean Algorithm will be discussed.

Perfectly Amicable

Darren D Wick
Faculty , Ashland Univ

Abstract Number: 42. We present a brief historical tour of perfect and amicable numbers. In particular, we look at the contributions of Euclid, Nicomachus, ibn Qurra and Euler.

A Card Trick and Perfect Shuffles

Kerry McIver
Student, John Carroll Univ

Abstract Number: 43. After explaining a simple card trick, we will see why perfect shuffles are much easier to accomplish in poker than in pinochle.

Saturday 11:00 – 11:15

Three-Dimensional Heat Transfer Analysis in the Float Glass Process

Ines Busuladzic
Graduate Student, University of Akron

Abstract Number: 44. Three-dimensional heat transfer in a float glass process is considered. Specifically, we consider the processing region where the glass is floating on a tin layer and the temperature varies between 1100 and 600 K during the cooling process. Two float glass systems are considered. First, we examine a one-layer system. For this system we solve the governing heat equation with boundary conditions. Secondly, we examine a layer system consisting of three layers. Here, a contaminated layer of glass is placed between two pure layers. The system heat transfer in the multi-layer system is determined by solving the governing heat equation and boundary conditions. For each system, an asymptotic analysis is performed. The small parameter is ratio of the glass height to length. The asymptotic analysis results in a simpler heat transfer model that is solved numerically.

The new "Quantitative Reasoning" Course and the Revised Mathematics Curriculum at Ursuline College

Michelle Wiggins
Faculty, Ursuline College

Abstract Number: 45. "Quantitative Reasoning" is one of the new and contemporary courses of the revised math curriculum at Ursuline College. This new course serves as a math requirement for non-math and non-science majors. It is designed to prepare students for other college-level courses, help them achieve success in their careers, and provide them with the critical thinking and quantitative reasoning skills needed to understand major life issues.

As part of the revision process, remedial courses were rearranged to better meet our students' needs. Some old courses were canceled and some new courses were added to the curriculum. New textbooks were adopted for all of the lower-level courses. The new curriculum was devised to realign our mathematics curriculum with that of other colleges and universities and improve mathematics learning at Ursuline as a whole.

Zeroes on the Diagonal: A Matrix problem from Quantum Entanglement

Michael Nathanson
Faculty, Kenyon College

Abstract Number: 46. Given a complex n by n matrix M, it is always possible to find a unitary U so that the diagonal entries of the matrix U^*MU are all equal. This nice result is fairly elementary and yet not widely known; we will sketch a proof.

The above lemma is useful in the study quantum entanglement, in which context an analogous question also arises: Given a set of n by n matrices $M_1, M_2, \ldots, M_k$; under what conditions does there exist a unitary U so that the diagonal entries of U^*M_iU are equal for each $i = 1,2..k$? A general answer to this question is not known; however, a few special cases will be described and the connection to Mutually Unbiased Bases of C^n will be explained.

Kotani's Ant Problem - (this has nothing to do with infestations.)

Adam E Parker
Faculty, Wittenberg Univ

Abstract Number: 47. In this talk we will discuss Kotani's Ant Problem which is a question about geodesics on a rectangular solid. We will show how to arrive at the surprising solution and will describe how I use this in my pre calculus classes. I will conclude with ideas for additional easy (and not so easy) projects for all levels of students.

Learn How to Launch an Object in a World Where Gravity has both Horizontal and Vertical Components.

Melissa E Merrill
Student, The Univ of Akron

Abstract Number: 48. Imagine the problem of launching an object using a catapult in a world where gravity has both horizontal and vertical components. I will give equations describing this situation. Then I will derive a formula to calculate the maximum distance such an object will travel.

Saturday 11:20 – 11:35

An Introduction to the Fractional Calculus

Jay Adams
Graduate Student, University of Akron

Abstract Number: 49. This presentation gives a brief introduction to the fractional calculus. Techniques of fractional differentiation and integration using the definitions of fractional derivatives and the Laplace transform are given. A discussion of the applications of fractional-order differential

equations is followed by two examples of systems with fractional-order characteristics, a long electrical line and a viscoelastic damper.

Compatible Pairs: Some Interesting Results of Pythagorean Triples
Ryan R Shearer
Student, Ashland Univ
Abstract Number: 50. If we evaluate the roots of a given quadratic equation, $ax^2 – bx + c$, and our results are integral values, then a compatible quadratic equation, $ax^2 – bx - c$, will also have integral roots. While investigating compatible pairs we find several interesting relationships involving Pythagorean Triples which will be examined. Through the examination of Pythagorean Triples we will be able to give a better understanding to when and how a quadratic equation is compatible.

Winning Percentages Can Be Misleading
Laurence D Robinson
Faculty, Ohio Northern Univ
Abstract Number: 51. In most sports situations, the "winning percentage" for a team (or conference, or league, or franchise) is an appropriate measure of accomplishment. However, there are situations where winning percentages can be misleading. In this talk we discuss two such situations, involving the NCAA Men's Basketball Tournament and the Super Bowl.

Some More Teaching Tips
Thomas Hern
Faculty, Bowling Green St Univ
Abstract Number: 52. I will present some tips that I didn't have time for in my talk at the last Section meeting.

Is 99,999,989 prime? Determining primality of 'small' numbers.
John P Stonestreet
Student, Marshall Univ
Abstract Number: 53. We know that 99,999,999 is not prime: the sum of the digits is 72, which is divisible by 9. Useful trick. What about 99,999,989? It's not even, and it's not divisible by 3 either. Would you divide by every integer less than 99,999,989? Why not just try the odds, or better yet only try the primes? And when can you stop? One of the more efficient methods for determining primality of "small" numbers (less than 1 billion) uses the Sieve of Eratosthenes, developed back in 240 BC. Come learn what this ancient genius said, and see its modern implementation using computer power!

Saturday 11:40 – 11:55

Spelling Me
Ryan Frase
Student, Ashland University
Abstract Number: 54. The Price Is Right is a popular game show that awards various prizes to contestants who correctly guess in pricing games. Some of these games are purely chance while others can use probability to develop a strategy. Spelling Bee is one of these games that uses probability, but I gave the game a little twist and came up with my version of the game, Spelling Me.

Solving Higher Order Dynamic Equations on Time Scales as First Order Systems

Elizabeth R Duke
Graduate Student, Marshall Univ

Abstract Number: 55. Time scales calculus seeks to unite two disparate worlds: that of differential, Newtonian calculus and the difference calculus. As such, in place of differential and difference equations, time scales calculus uses dynamic equations. Despite the newness of this field, many theoretical results have already been shown concerning solutions of dynamic equations. However, little work has been done in the arena of developing numerical methods for approximating solutions of dynamic equations. This thesis work attempts to develop a first step in obtaining numerical solutions for dynamic equations--a protocol for writing higher-order dynamic equations as systems of first-order equations.

The Solution to the Bill Benz Problem

Thomas P Dence
Faculty, Ashland Univ

Abstract Number: 56. At the Ohio Section meeting last October, President Bill Benz of Ashland University concluded his welcoming remarks by posing a problem to the Section. In this talk I revisit the problem and sketch its solution, and then pose the Dence Problem to the Section.

Ford Circles

Jason J Bockey
Student, Ohio Northern Univ

Abstract Number: 57. In 1938 a man by the name of L. R. Ford wrote an article in The American Mathematical Monthly entitled Fractions. In that paper he looked at what are now known as Ford Circles. That article was the inspiration for this paper. In this talk we will define Ford Circles, investigate some of their algebraic properties and answer the following questions: Can Ford Circles be tangent? Disjoint? Overlap? Is there an algebraic relationship that determines the intersection properties? Is there a procedure by which we can construct tangent Ford Circles? Can all Ford Circles be constructed with this procedure? Is the sum of the radii of all Ford Circles convergent? Is the sum of the areas of all Ford Circles convergent? Is there a Pythagorean Triple Property for Ford Circles?

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Calendar of Coming Events

The Ohio Section Summer Short Course on **"Baseball, Statistics, and the Role of Chance in the Game"** is scheduled for **June 7-9, 2006**, at Mount Union College in Alliance, Ohio. **James Albert**, professor of Mathematics and Statistics at Bowling Green State University, author of *Teaching Statistics Using Baseball*, and coauthor of *Curveball: Baseball, Statistics, and the Role of Chance in the Game* will lead the participants.

Mark your calendar for the **Fall 2006 Ohio Section Meeting** on **October 27-28, 2006** at Muskingum College in New Concord, Ohio.