Faculty Talk Schedule & Abstracts

Allegheny Mountain Section Meeting
Mercyhurst College
Saturday, April 14th, 2007

	Hirt 207	Hirt 212	Hirt 213	Hirt 214	Hirt 313	Hirt 314
10:10 – 10:25	**Functions, Matrices, and Image Processing** *Yu-Ju Kuo, Indiana University of Pennsylvania*	**Feasible Hierarchies for Power Distribution in Weighted Voting** *John Tolle, Carnegie Mellon University*	**Developmental Mathematics, A perspective and an experience** *Lalitha Subramanian, Potomac State College of West Virginia University*	**Uniform Integrability and Absolute Continuity with Respect to Lebesgue Measure** *Emily H Sprague, Edinboro University of PA*	**What are algebraic integers?** *Gregor Olavský, Penn State Erie/Behrend College*	**Some Properties of the Number Theoretic Functions τ, σ and φ.** *Dr. Peter A. Lindstrom, North Lake College, Irving Texas*
10:30 – 10:45	**When is O(n lg n) really O(n lg n)? A comparison of the Quicksort and Heapsort algorithms** *Gerald Kruse, Juniata College*	**Rhapsody's Pills** *Marc Brodie, Wheeling Jesuit University*	**Math 33-What's in it for me?: A look at a Mathematics and Science Partnership Grant** *Pam Wovchko, WV Wesleyan College*	**Return Map Characterizations of Singular Solutions for a Model of Bursting with Two Slow Variables** *Roger Griffiths, Mercyhurst College*	**Matching Covered Graphs** *Kimberly Burch, Indiana University of Pennsylvania*	**Mathematically Accurate Earthquake Locations can be Inaccurate: A Bootstrap and Piecewise Linear Regression Approach.** *Richard Brazier, Penn State University DuBois Campus*
10:50 – 11:05	**Bringing Napier to Life in the History of Math** *Michael Caulfield, Gannon University*	**Mathematics in Second Life's Virtual World** *Charles Redmond, Mercyhurst College*	**Using clickers in calculus: the good, the bad and the ugly** *Kim Roth, Juniata College*	**On A Class of Series** *Amos Ong, Behrend College*	**Graph Coloring Tools** *John Lattanzio, Indiana University of Pennsylvania*	**A Simple Scavenger Model** *Joe Previte, Penn State Erie*
11:10 – 11:25		**Team-Teaching with Prof. Euler** *John Bukowski, Juniata College*		**A Quick Guide to the Mandelbrot Set** *Daniel M. Look, Indiana University of Pennsylvania*	**Digraphs Having a Unique King Set** *Charles Cable, Allegheny College*	**Infinite Series In Operator Theory** *Larry Downey, Penn State Behrend*

10:10 – 10:25

Functions, Matrices, and Image Processing **207**
Yu-Ju Kuo, Indiana University of Pennsylvania

How does software adjust the color of images? How does software improve the quality of images? In this talk, we'll discuss mathematics behind those magical buttons in software with the focus on edge detection. We'll start with an introduction of digital images, how functions and matrices relate to image processing, and basic ideas of edge detection.

Feasible Hierarchies for Power Distribution in Weighted Voting **212**
John Tolle, Carnegie Mellon University

Consider a weighted voting systems (WVS) in which each voting party (called a player) casts a bloc of votes either supporting or opposing a proposal. The US electoral college system is an example of a 51-player WVS, assuming each state (and the District of Columbia) casts all of its electoral votes in accordance with the popular-vote outcome in that state (which is almost always true).

The proportion of votes assigned to each player does not give a reliable indicator of the actual potential of that player to affect outcomes. For instance, consider a three-player WVS in which Players 1 and 2 each get to cast 100 votes, and Player 3 only gets 1 vote. Suppose a strict majority of 101 votes (out of the total of 201) is needed to pass a measure. If any two players agree, the measure will pass, so in fact Player 3 is just as powerful as the other two.

In 1948, Lloyd Shapley and Martin Shubik proposed a measure of actual WVS power, and in 1965, John Banzhaf proposed another. The two measures are order-equivalent; though each may assign a different percentage of power to any given player, they always agree on the hierarchy of power present.

We survey some recent results concerning what hierarchies of power are feasible for weighted voting systems. If, for example, the intent of the WVS is for there to be a strict hierarchy of power, with no two players having equal power but the weakest player having some power, is this always possible? Are there any hierarchies which are impossible? Do the answers depend on the number of players? Is there an algorithm for creating a WVS which produces a prescribed hierarchy?

Developmental Mathematics, A perspective and an experience **213**
Lalitha Subramanian, Potomac State College of West Virginia University

I have taught high school mathematics in India and in the Middle East for more than 15 years, preparing students for college level mathematics programs in technical and non-technical fields. But I was astounded by the number of students requiring remedial mathematics programs when I began my post-secondary mathematics teaching career at the PSC in August 2005. I wish to present some of my observations regarding the common misconceptions, error patterns, and misplaced aptitudes/attitudes of these students and start an ongoing discussion that could focus on possible strategies to make the developmental programs more effective.

Uniform Integrability and Absolute Continuity with Respect to Lebesgue Measure **214**
Emily H Sprague, Edinboro University of PA

We explore relationships between the countably additive measures on [0,1] which are absolutely continuous with respect to Lebesgue measure and the families of Lebesgue integrable functions on [0,1] which are uniformly integrable. We connect the ideas to historic results in the study of trigonometric series and mention some consequences for Walsh series.

What are algebraic integers? **313**
Gregor Olavský, Penn State Erie/Behrend College

Goal of talk is to define an algebraic integer; then claim that the set of all algebraic integers forms an integral domain, and then to show that in some subdomains, unique factorization holds while in others it does not.

Some Properties of the Number Theoretic Functions, τ , σ and φ. **314**
Dr. Peter A. Lindstrom, North Lake College, Irving Texas

We all have met, befriended, and fought with the Number Theoretic Functions τ , σ **and** φ. One of their common properties is that they are multiplicative:
If $(m,n) = 1$,
$\tau(mn) = \tau(m)\,\tau(n)$,
$\sigma(mn) = \sigma(m)\,\sigma(n)$,
$\varphi(mn) = \varphi(m)\,\varphi(n)$.
The purpose of this talk is to use this common property to present other properties related to these functions.

10:30 – 10:45

When is O(n lg n) really O(n lg n)? A comparison of the Quicksort and Heapsort algorithms **207**
Gerald Kruse, Juniata College

The theoretically derived asymptotic performance of both Quicksort and Heapsort is proportional to n*lg(n) on random data of size n. Experimentally, Quicksort demonstrates n*lg(n) behavior, while Heapsort does not. In this talk we will contrast memory access behavior for the two sorts, and how this affects the performance of each.

Rhapsody's Pills **212**
Marc Brodie, Wheeling Jesuit University
In this talk, several questions of a probabilistic nature concerning removing marbles from an urn will be discussed. One such question may even be answered. For those who love easy-to-understand questions, as well as factorials and binomial coefficients, this is the talk!

Math 33-What's in it for me?: A look at a Mathematics and Science Partnership Grant **213**
Pam Wovchko, WV Wesleyan College

Math 33 is a Mathematics and Science Partnership Grant in Central West Virginia involving about 30 special education and/or mathematics teachers. While the project has been challenging and at times frustrating, the rewards have outweighed the frustrations. Come and find out what is so great about working with such a grant, and see how you can become involved in a Math and Science Partnership Grant in your area!

Return Map Characterizations of Singular Solutions for a Model of Bursting with Two Slow Variables **214**
Roger Griffiths, Mercyhurst College

Various physiological systems display bursting electrical activity (BEA). There exist numerous three variable models to describe this behavior. However, four variables may be required to explain some qualitative features of the BEA of some experimentally observed systems. We will present a model with two slow and two fast variables, then define a one dimensional return map, wherein, fixed points correspond to singular bursting solutions. We will also demonstrate that for different parameters bursting solutions may coexist with stable equilibria. Hence small variations in the initial conditions may drastically effect the dynamics.

Matching Covered Graphs **313**
Kimberly Burch, Indiana University of Pennsylvania

Let G be a graph of order V(G). G contains a perfect matching if there exists a set of disjoint edges of G such that the union of their vertices is V(G). G is said to be matching covered if for every edge e in G, there exists a perfect matching containing e. We present several types of graphs and prove that they are matching covered. We also examine necessary and sufficient conditions for a graph to be matching covered.

Mathematically Accurate Earthquake Locations can be Inaccurate: A Bootstrap and Piecewise Linear Regression Approach. **314**
Richard Brazier, Penn State University DuBois Campus

The mathematical errors given by the standard earthquake location regression calculations are misleading in many cases. Accurate locations not only require small errors but also a good distribution of distances and angles (azimuth) of seismic stations around the earthquake.

We show the affect of distance and azimuth by locating the same event multiple times systematically removing different seismic stations, perturbing the distance and azimuth distribution and assessing how this affects the location of the earthquake. A criteria is developed by using a piecewise linear regression to determine at what distances and azimuths the location breaks down.

10:50 – 11:05

Bringing Napier to Life in the History of Math **207**
Michael Caulfield, Gannon University

We will use a flock of pigeons, a psychic rooster, the meaning of the word "logarithm", and a new Flash application to put some flesh on Napier's bones.

Mathematics in Second Life's Virtual World **212**

Charles Redmond, Mercyhurst College

Second Life is an on-line 3-D virtual world which allows each user to interact with others and the environment via an "avatar", an in-world representation of the user. Unique to Second Life is the ability it gives to its users to create and sculpt the environment with powerful building and scripting tools. Numerous educational institutions have begun projects in Second Life. Classes are held, research projects are performed, and some institutions even have their own Second Life campuses. My question is whether the nature of this world can facilitate and supplement mathematics education and generate student interest in the subject. I believe the answer is yes, and to convince you I will show slides and movies of my mathematical adventures in Second Life.

Using clickers in calculus: the good, the bad and the ugly **213**
Kim Roth, Juniata College

Instant response systems have been used in science classes to quickly assess student understanding of concepts during class. This semester I have used them in my calculus classroom. Both benefits and difficulties will be discussed.

On A Class of Series **214**
Amos Ong, Behrend College

We will sum the series sum(n^c/(n^d+K)^2) using the Residue Theorem. As a function of K, it turns out to be asymptotic to 1/K^(2-(c+1)/d). This is being applied to the backward minimal vectors of the Volterra operator.

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Graph Coloring Tools **313**
John Lattanzio, Indiana University of Pennsylvania

In this presentation, we will provide a demonstration of a Mathematica package written by the presenter as a supplement to the standard package Combinatorica. A graph coloring algorithm is discussed along with an additional functions for coloring analysis.

A Simple Scavenger Model **314**
Joe Previte, Penn State Erie

In this talk we introduce a scavenger species onto a Lotka-Volterra predator prey system. The model serves as a baseline for further research and has nice pedagogical features.

11:10 – 11:25

Team-Teaching with Prof. Euler **212**
John Bukowski, Juniata College
In honor of the 300th birthday of Leonhard Euler, I have been bringing Euler's original work into my classes this semester. In this talk, we will investigate examples of such mathematics for a differential equations class and a liberal arts math class.

A Quick Guide to the Mandelbrot Set **214**
Daniel M. Look, Indiana University of Pennsylvania

We will discuss the meaning behind the Mandelbrot set and explore some interesting properties this set possesses.

Digraphs Having a Unique King Set **313**
Charles Cable, Allegheny College

Def. If D(V,A) is a digraph and K is a subset of V, then K is a king set of D if (i) for each y which is an element of V - K, there exists an x in V such that the directed distance from x to y is either 1 or 2 and (ii) no two vertices in K are adjacent. We give a characterization of digraphs having a unique king set.

Infinite Series In Operator Theory **314**
Larry Downey, Penn State Behrend

We discuss how the investigation of the (fairly new)concept of Extremal Vectors leads to the need to sum a class of infinite series.