Abstracts of Faculty Talks
Mathematical Association of America
Allegheny Mountain Section Meeting
Shepherd University
Saturday, April 6, 2019

10:15 - 10:30

Pam Wovchko, West Virginia Wesleyan College, Stutzman-Slonaker 201

MAA Highlights 2019

Learn about events, programs, resources, and opportunities available to you through the MAA. There will be time for your comments and suggestions.

Chad Kuhns, West Liberty University, Stutzman-Slonaker 202

How to predict solar eclipses

With some basic knowledge of analytic geometry in three dimensions and a reasonable coordinate system in which to work, one can very quickly develop facility with predicting eclipses. Such work opens the door to accessible explorations of calculus, geometry, and approximation theory, with clear insights into the history of mathematics (and science) along the way. In this talk we will engage as many of these as we can as we recapitulate an Honors Project in a History of Mathematics course that ran Fall 2017.

Patrick Headley, Gannon University, Stutzman-Slonaker 207

The Distance Magic Property and a Family of Product Graphs

Let G be a simple graph with N vertices, and suppose the vertices are labeled (bijectively) with the integers 1 through N in some way. The labeling is distance magic if there is a constant S such that, for every vertex, the sum of the labels of its neighbors is S. Seoud, Maqsoud, and Aldiban asked under what conditions the Cartesian product of a cycle graph C_m and a complete bipartite graph $K_{n,t}$ would have a distance magic labeling. I will present some progress on this problem, both in finding necessary conditions for m, n and t, and in constructing labelings in some of the cases where these conditions are met.

10:35 - 10:50

Erin Bancroft, Grove City College, Stutzman-Slonaker 201

Problem Days- A strategy for incorporating active learning in math courses

Many math teachers would like to incorporate more active learning into their classroom but feel limited by time and resource constraints. In this talk I will detail a strategy, which I call Problem Days, that I have implemented and refined over the past 8 years in all of my Calculus courses. In particular, I will discuss structuring the class period, selecting problems, minimizing grading, fostering student engagement, student feedback, and how this idea might be adapted to other courses.

Bismark Oduro, California University of Pennsylvania, Stutzman-Slonaker 202

Assessing the effect of fungicide treatment on Cocoa black pod disease: Insight from mathematical modeling

Black pod disease is caused by fungi of the species Phytophthora palmivora or Phytophthora megakarya. The disease causes darkening of affected areas of cocoa trees and/or fruits and leads to significant reduction in crop yields and decreases lifespan of the plant. I will present SIR-type model with variable population size to assess the impact of fungicide treatment on the dynamics of the black pod disease. Both theoretical and numerical simulation results will be presented.

Tim Flowers, IUP, Stutzman-Slonaker 207

A partition generalization of a Putnam problem

An m-ary partition is a way of expressing an integer n as a sum of powers of m. One of the problems on the 44th Putnam Exam in 1983 asked participants to count the number of binary partitions of n wherein each part is used at most 3 times. We will show how generating functions motivate a generalization of the Putnam problem to enumerating a two-parameter family of m-ary integer partitions, $b^*_{m,j}(n)$. We then use the generating functions and a bijection to give an identity between $b^*_{m,j}(n)$ and another family of m-ary partitions.

Tom Cuchta, Fairmont State University, Stutzman-Slonaker 209

An introduction to nonstandard topology

"Nonstandard analysis" was formally developed by Abraham Robinson in 1960 to justify the "infinitesimal" numbers that were used in early calculus by Leibniz and Newton. Since this time, "nonstandard" methods have been extended to many branches of mathematics. In this talk, we will lightly touch the history of nonstandard methods, introduce nonstandard topology, and look at a simple application to continuum theory.

10:55 - 11:10

Craig Dodge, Allegheny College, Stutzman-Slonaker 201

Utilizing Computation in Undergraduate Research

Finding accessible research problems in mathematics is often quite challenging. In recent experience I have been able to work with students on computationally focused projects within a theoretical abstract field. In this talk I will discuss both challenges and successes of these projects as well as potential to apply these lessons to future projects.

Asif Mahmood, Penn State York, Stutzman-Slonaker 202

A comparison between the Gaussian Process emulator and the Physics based emulator for granular flow simulations

Volcanic eruptions create hazardous conditions which affect people and human infrastructure near the volcano, in downstream valleys, and hundreds of miles away. PDE models of granular flows are invaluable tools for assessing hazard risks, but they are far from perfect and are expensive to run. Computational costs can be reduced by constructing a statistical emulator, an approximate response surface for selected output variables derived from several full simulator runs. A popular emulator is the Gaussian Separable Process emulator, or GaSP, which is constructed as the mean of a Bayesian posterior distribution over outputs. We present a comparison between the Gaussian Process emulator, and our developed emulator, which uses the knowledge about the model physics and models the mass flow as an Ornstein-Uhlenbeck (OU) process for sliding blocks over the topography.

Ivko Dimitric, Pennsylvania State University Fayette, Stutzman-Slonaker 207

Multivariable n-step maps

An n-step map is a map f whose n^{th} iterative power is the identity, $f^{\circ n}(x) = x$, hence, such a map is an iterative n^{th} root of the identity map. While there is an extensive literature on n-step maps of one (real) variable, the study of n-step maps of R^k is not as well developed, outside the framework of matrix theory. We provide some examples of and results on n-step maps of 2 and more variables. In particular, n-step affinely linear maps of R^2 are classified for n = 2, 3, and 4. Also, some classification of n-step Cremona transformations of the plane are obtained.

Lawrence Downey, Edinboro University, Stutzman-Slonaker 209

A complete solution to a problem posed by Walter Rudin

In 1969 Walter Rudin posed a fundamental question concerning a class of functions (bilinear operators) in his book 'Functions on a Polydisk'. Partial results were given in the 1970's, but a complete solution has not been known until now. We present here the background and results.

11:15 - 11:30

Robert J. Nichel, Fairmont State University, Stutzman-Slonaker 201

Machine learning and Monte Carlo at NASA

During the summer of 2017, our department was approached with a research opportunity for our students with a local NASA IV & V contractor, TMC^2 Technologies of West Virginia. We will discuss how the partnership was made, how we ran the internship/class, the expectations NASA had for us and the students, what we felt worked well (and what didn't) and how we plan to improve with future undergraduate projects. This talk was given at the 2019 Joint Meetings with Tom Cuchta.

Jeffrey Wheeler, University of Pittsburgh, Stutzman-Slonaker 202

Optimizing a Telecommunications Network via Graph Coloring

In telecommunications networks, it is desirable to minimize the number of virtual circuits. The situation can be modeled by a graph coloring where vertices are colored red or blue and edges are colored the color of their endpoints if they are the same or colored purple if the endpoints have different colors. A minimum number of virtual circuits is obtained if the number of purple edges is maximized. We present a coloring scheme for a general graph using only the graph's adjacency matrix and Newton's Method.

Kirk McDermott, Slippery Rock University of Pennsylvania, Stutzman-Slonaker 207

On the shift dynamics of groups of type Z

A group is said to be cyclically presented if it admits a presentation with a certain cyclic symmetry. Such a symmetry induces a periodic automorphism of the group called the shift, and the presence of nontrivial fixed points of the shift strongly impacts the structure of the group. Here we consider a family of cyclically presented groups - those of type Z - which arise from centrally extended triangle groups, and sketch a proof of the solution to the fixed point problem for these groups. Topological aspects of the problem will be considered as time allows.

Jared Burns, Seton Hill University, Stutzman-Slonaker 209

A Case For Generalization: Generalized Means & Calculi

In mathematics, we often seek to understand concepts by moving from abstraction towards considering examples and cases. In this talk, we will look at two topics covered in the presenters iteration of a Theoretical Calculus class: Generalized Means and non-Standard Calculi. It turns out that we may reinterpret many results as specific cases of more generalized ideas, and so gain an underlying intuition thus making a case for moving towards abstraction. We will end with some discussion of original results and reinterpretations of applied mathematics that the presenter worked on with an undergraduate researcher K. Barczynski.