FACULTY CONTRIBUTED PAPER SESSIONS

Shippensburg University
18 November 2017

Locations: DHC 102, 108, & 110

Amos Ong, Penn State Erie

Time: 12:50pm DHC102
Title: Triangles on a Flat Torus
Abstract: *Lewis Carroll proposed the following problem: "Three points are taken at random on an infinite plane. Find the chance of their being the vertices of an obtuse-angled triangle." Other authors have considered Dodgson's question, but on spaces where it is possible to have a uniform distribution. We address the issue on the two-dimensional flat torus.*

John Pesek, University of Delaware

Time: 1:08pm DHC108
Title: Volume Formulas for the Simplex and Set Partitions of the Vertices
Abstract: *Sommerville generalized the familiar formula for the volume of an n-dimensional simplex, $\frac{1}{n}Bh$, to a two part partition of the vertex set. The volume is given as a constant times the product of the volumes of the sub-simplexes determined by the members of the partition times the product of the sines of the principal angles between the sub-simplexes times the distance between the sub-simplexes. We generalize this result to partitions with any number of parts. The result is analogous except that distance between the sub-simplexes has to be replaced by the volume of a generalized altitude. The method of computation is the familiar method of known cross-section. The cross-sections turn out to be scaled Cartesian products of the sub-simplexes. The presentation will illustrate the results through a series of examples starting with the triangle and ending with an eight dimensional simplex.*

Amanda Lohss, Messiah College

Time: 1:26pm DHC110
Title: Regular Permutation Graphs
Abstract: *This talk will introduce permutation graphs, graphs whose edges correspond to inversions in permutations. One question of interest is how many permutation graphs are r-regular? There are numerous examples of r-regular permutation graphs, but certainty not all permutation graphs are regular. This talk will present an answer to this question. In fact, our research has shown that there are infinitely many connected r-regular permutation graphs for $r > 2$.*

Ting Gu, Elizabethtown College

Time: 12:50pm DHC102

Title: Correlation attacks against stream ciphers

Abstract: *Stream ciphers are widely used in various applications including cell phones and internet communications. In this talk, I will give an introduction to how stream ciphers work and how they can be attacked using statistical correlation. I will also present my recent work that improves on the statistical properties of classical correlation attacks.*

Eva Goedhart, Lebanon Valley College

Time: 1:08pm DHC108

Title: Using Linear Forms in Logarithms to Solve Diophantine Equations

Abstract: *After a quick look at the history of Diophantus, I will present a friendly version of how linear forms in logarithms can help to solve Diophantine equations.*

Tamara Eyster, Kaplan University

Time: 1:26pm DHC110

Title: Mathematical Self-Beliefs are Important

Abstract: *Mathematical Self-Beliefs are Important for successfully completing math classes, but they are also important for entering STEM fields and even Higher Education. Many people, especially older women, have low math self-beliefs, how can they be improved? We will look at some ways they can be improved, plus the results from my dissertation research involving students and serious math games.*

Karen Adams, Nicholas Martin, Shepherd University

Time: 12:50pm DHC102

Title: A Generalization of Minkowski's Inequality.

Abstract: *We will present a proof for the generalization of Minkowski's inequality using a straightforward application of the calculus method of finding the maximum value of a function with n variables.*

Ryan M. Evans, National Institute of Standards and Technology

Time: 1:08pm DHC108

Title: Precision Medicine and Nonlinear Partial Differential Equations

Abstract: *Tailoring therapies to individuals or specific subsets of a population in order to deliver personalized care could fundamentally remake healthcare delivery. However, widespread use of personalized care is currently limited by our ability to routinely measure pathology in individuals. Moreover, existing clinical diagnostics are in many cases prohibitively expensive. This has led to the development of Biological Field Effect Transistors (Bio FETs)microscale instruments in which ligand molecules diffuse through a solution-well onto a surface to bind with receptors. Ligand binding with receptors modulates current flow through the device, and produces a signal used to study the receptor ligand dynamics of interest. A nonlinear PDE model for Bio-FET experiments will be presented. Analyzing this model is a challenge, owing to multiple disparate time scales for reaction and diffusion. It will be shown that in this set of equations reduces to a nonlinear integrodifferential equation (IDE) with a singular convolution kernel. Numerical approximations to the solution to this equation will be presented. These results give experimentalists novel way of estimating binding affinities in biomolecule interactions; this is essential for identifying effective drug targets.*

Kevin Ferland, Bloomsburg University

Time: 1:26pm DHC110

Title: Fitting the Most Words in a Crossword Puzzle

Abstract: *In a crossword puzzle, there are a lot of words crammed into a small area. Have you ever wondered about the greatest possible number of words? Specifically, New York Times crossword puzzles fit into an American-style grid. That is, they must have connected white space, 180 degree rotational symmetry, and clue answers with at least three characters. Their daily puzzle grids are 15 by 15, and their Sunday ones are 21 by 21. Given the structure rules, we explore, for each n, the maximum number of clues in an n by n crossword puzzle grid. For even n, we have determined that number, and for odd n, we have a lower bound, that is shown to be sharp for all n up to 49. So we will see the maximal grids for New York Times Daily and Sunday puzzles, and more.*