FACULTY CONTRIBUTED PAPERS SESSIONS - ABSTRACTS

Muhlenberg College
2 April 2016

Locations: Trumbower Hall 140 & 149

Trumbower Hall 140 – 1:10pm **Rommel G. Regis,** Saint Joseph's University

TITLE: *On the Properties of the Cosine Measure in Derivative-Free Optimization*

ABSTRACT: A set of vectors S is said to positively span $\mathbb{R}^n$ if every element of $\mathbb{R}^n$ is a nonnegative linear combination of the elements of S. A well-known result in the area of derivative-free optimization is that if the gradient of a continuously differentiable objective function of n variables is nonzero at a point, then one of the vectors in any positive spanning set of $\mathbb{R}^n$ is a direction of improvement for the objective function from that point. One way of quantifying the positive spanning property of a set of vectors is by means of the cosine measure of that set. This talk will explore some of the properties of the cosine measure and discuss its application in the design of derivative-free optimization algorithms. It will be accessible to undergraduates with a background in linear algebra.

Trumbower Hall 140 – 1:30pm **Jesse Feller,** Kutztown University

TITLE: *An Introduction to Random Dynamics*

ABSTRACT: The study of (discrete time) holomorphic dynamical systems involves the study of the repeated composition $f \circ f \circ ... \circ f = f^n(z)$ of a single function $f(z)$ in a process called iteration. We will take a look at iteration in the case where the map is allowed to change at each step of the composition process. Given a family of functions $\{f_0, f_1\}$ suppose we have a sequence of random variables (c_n) where $c_n = 0$ or 1 and we look at the composition $... \circ f_{c_n} \circ ... \circ f_{c_2} \circ f_{c_1}(z)$. This is called random iteration. In this talk we will look at computer generated images of the corresponding filled Julia sets for some random iterations, and we will discuss a few known results in this area.

Trumbower Hall 140 – 1:50pm **Barry R. Smith,** Lebanon Valley College

TITLE: *A new look at a very old group*

ABSTRACT: I'll introduce a certain set of nearly-symmetric sequences of positive integers and define an operation on it. None of the group axioms are easy to check – nevertheless, the set forms a group. I'll sketch proofs of the axioms using properties of continued fractions. Time permitting, I'll connect this group with one that may be more familiar. The relevant definitions concerning groups and continued fractions will be introduced, so this talk should be accessible to most undergraduates. Some facility with elementary number theory – greatest common divisors and congruences – will be assumed.

Trumbower Hall 140 – 2:10pm **Charles Buehrle,** Franklin & Marshall College

TITLE: *Pancake Words*

ABSTRACT: The pancake problem is concerned with sorting a permutation (a stack of pancakes of different diameter) using only prefix reversals (spatula flips). Although the problem description belies simplicity, an exact formula for the maximum number of flips needed to sort n pancakes has been elusive. Here we present a different approach to the pancake problem, as a word problem on the symmetric group. Pancake flips are considered as generators for a presentation of the symmetric group. At present the full list of relations for this presentation are not known. Many relations are exposed, though, by looking at the Coxeter matrix of the generators.

Trumbower Hall 149 – 1:10pm **Christopher Catone,** Albright College

TITLE: *Bridging Calculus and Discrete Math via the Discrete Derivative*

ABSTRACT: Calculus and Discrete Mathematics are two early courses most mathematics majors take. These classes are often seen as disjoint by most undergraduate students. Although the discrete derivative is well known amongst mathematicians, it does not often make an appearance in either undergrad course. By leaving out this tool we miss an opportunity to emphasize the cohesive aspect of mathematical disciplines. In this talk we will present the discrete derivative as it could appear in a Discrete Math class and illustrate the parallels with the derivative studied in Calculus.

Trumbower Hall 149 – 1:30pm **Stephen Andrilli,** La Salle University

TITLE: *A Set of Axioms for the Finite Geometry of Pappus*

ABSTRACT: While a few college geometry textbooks contain a treatment of finite geometries, only a handful mention the finite geometry of Pappus (9 points, 9 lines). This geometry is derived from the classic collinearity theorem of Pappus in Euclidean geometry concerning 9 points: If A, B, C lie on one line, A' , B' , C' lie on another line, $AB' \cap A'B = D$, $AC' \cap A'C = E$, and $BC' \cap B'C = F$, then D, E, F are collinear. The axiom set for the Pappus Geometry presented in the classic texts of Eves, Cederberg, and Smart includes both a "parallel postulate" as well as its "dual" postulate. Here, a slightly simpler set of axioms will be presented, and a demonstration that these axioms precisely determine the Pappus Geometry, along with an illustration of the manner in which this geometry is derived from Pappus' Theorem. (This talk is accessible to undergrad students.)

Trumbower Hall 149 – 1:50pm **Michael Yatauro,** Penn State University, Brandywine

TITLE: *Eradication of Tree Networks in a Reliability Model Associated with Edge Covers*

ABSTRACT: Let G be a finite simple graph. Consider a model in which edges of G fail independently, and when an edge fails we remove it from G along with the incident vertices (this type of failure is sometimes referred to as an "edge explosion"). We say that a set of edges F is a *failure set* of G if after all edges of F fail, there are no remaining vertices (and thus, no edges as well). When this occurs, we say the associated network has been *eradicated*. If the probability of an edge failing is ρ, then the *unreliability* of G, denoted $\mathcal{U}_1(G, \rho)$, is the probability that a randomly selected set of edges is a failure set. Thus, $\mathcal{U}_1(G, \rho)$ measures the probability that G will be eradicated. In this talk, we present closed form formulas and recursion formulas for the unreliability of networks modelled by tree graphs. In addition, we prove which tree graph is most likely to be eradicated and which tree graph is least likely to be eradicated for any $0 < \rho < 1$.

Trumbower Hall 149 – 2:10pm **Frank Morgan,** Williams College

TITLE: *The Future of the AMS Notices*

ABSTRACT: As new Editor of the Notices of the American Mathematical Society, I would like to discuss some of the new features, such as invited lecture samplers, the Graduate Student section, the Back Page, and the online commentary. I want to hear your suggestions.