FACULTY CONTRIBUTED PAPERS SESSIONS - ABSTRACTS

Kutztown University
1 April 2017

Locations: Lytle 218 & 228

Francis Vasko, Kutztown University

Time: 1:20pm Lytle 218
Title: Balancing a Transportation Problem: Is It Really That Simple?
Abstract: *The Transportation Problem (TP) is discussed in all operational research textbooks. Although the TP can be formulated as a linear program, due to its special structure, it can be solved more efficiently than just using the standard simplex algorithm. Typically, the first step in solving a TP is to balance the problem. If total supply is not equal to total demand, then a dummy column (supply greater than demand) or dummy row (demand greater than supply) is created. The closer an initial heuristically-determined basic feasible solution is to the optimal solution, the fewer the required iterations of the modified transportation simplex to determine the optimal solution. The purpose of this paper is to empirically quantify the importance of how five TP heuristics (Northwest corner method, the Greedy heuristic, Vogels approximation method, Russells method and the Maximum Demand method) process the dummy column (row) in a balanced TP.*

John Pesek, University of Delaware

Time: 1:40pm Lytle 218
Title: The Case of the Missing Spheres
Abstract: *If the sides of a triangle are extended to lines, it is known that there four (or 2 squared) circles tangent to all three sides. This result extends to* n *dimensions where there are in general 2 to the* n*-th power spheres tangent to the* $n+1$ *hyperplanes forming the sides of the simplex. However, under certain circumstances the spheres can fail to exist. For example the regular tetrahedron has only five such spheres instead of eight. We have discovered that the missing spheres can be found in the hyperplane at infinity when this hyperplane is given the elliptic geometry induced by the Euclidean geometry of the* n*-dimensional space. As a consequence the dimension of the sphere is reduced by one. The talk will focus on the three dimensional case.*

Yun Lu, Kutztown University of PA

Time: 2:00pm Lytle 218
Title: An undergraduate research on final exam schedules
Abstract: *In this talk, we describe how an undergraduate student analysed the final exam schedules at Kutztown University in order to reduce student conflicts defined to be a student having three exams scheduled on the same day. The approach she developed, based on a balanced bin packing algorithm, was tested using actual data from the Fall 2015 semester and resulted in a 42% reduction in student conflicts. This approach, because of its simplicity and intuitive appeal, was widely accepted by the Kutztown University faculty and administrators and is implemented for the Fall 2016 semester at Kutztown University.*

Eric Landquist, Kutztown University

Time: 2:20pm Lytle 218

Title: Secure Hands-on Cryptosystems in an Undergraduate Cryptography Class

Abstract: *Could something as commonplace as a 52-card deck of playing cards hold the potential for encryption stronger than even the most rigorously scrutinized ciphers in use today? Students in an upper-division undergraduate cryptology course were surprised to learn that a well-shuffled deck of cards holds over 225 bits of entropy (randomness). Utilized to its maximum potential, this deck of cards could therefore provide better security than even 128-bit AES (a standard encryption algorithm). In the course, students were challenged to design cryptosystems in which both encryption and decryption could be carried out efficiently by hand, but would be able to withstand modern cryptanalysis. In this talk, we discuss a few of the ideas for secure hands-on cryptosystems that arose, the inspiration for these ideas, and the overall structure of the course that fostered curiosity and exploration.*

Ju Zhou, Kutztown University

Time: 1:20pm Lytle 228

Title: Perfect Matching Transitive Graphs

Abstract: *An automorphism of a graph $G = (V(G), E(G))$ is a permutation of the vertex set $V(G)$, such that the pair of vertices (u, v) form an edge if and only if the pair $(\sigma(u), \sigma(v))$ also form an edge. A perfect matching transitive graph is a graph such that for any two perfect matching M and N of G, there exists an automorphism of G such that $f(M) = N$. What kinds of graphs are perfect matching transitive? What is the relationship between perfect matching transitive and vertex transitive? What is the relationship between perfect matching transitive and edge transitive? In this talk, the author will talk about some preliminary research about perfect matching transitive graphs.*

Todd Gutekunst, King's College

Time: 1:40pm Lytle 228

Title: The Combinatorics of Weighted Voting

Abstract: *How many different ways can people share power? More specifically, in how many fundamentally-different ways can n players form a weighted voting system? In this talk, I will answer that question for small numbers of players and explain why the solution becomes computationally intractable as the number of players increases. Along the way we'll encounter partially-ordered sets, Catalan numbers, and integer linear programming.*

Oskars Rieksts, Kutztown University

Time: 2:00pm Lytle 228

Title: qSpaces: A New Area for Mathematical Exploration

Abstract: *The basic qSpace is an infinite, connected, directed graph defined by the function* $\mathrm{qs}(p,q) = r$, *where* p, q *and* r *are all prime and* $\mathrm{qs}(p,q) = \max(\mathrm{prdc}(pq+1))$, *where* $\mathrm{prdc}(x)$ *is the set of prime factors of* x *and* $\max(s)$ *is the maximum element of* s. *Each prime number,* q, *defines a separate qSpace. The conjecture is that every qSpace contains a cycle, something that has been found to be true for the first 100,000 primes. Among the variations of the* qs *function are:* $\mathrm{qsum}(p,q) = \mathrm{sum}(\mathrm{prdc}(pq+1))$, $\mathrm{qsk}(p,q,k) = \max(\mathrm{prdc}(pq+k))$, *and a* qsc *which is defined the same as* qs *but in which* r *can be prime or composite. These functions give rise to a number of interesting things. For example, the* qsc *function can be the basis for encryption, as follows: the plain text is* r, *the cipher text is* p, *a predecessor of* r *in* q, *and the key is* q *itself.*

Caroline Grant Melles, U. S. Naval Academy

Time: 2:20pm Lytle 228

Title: What is Social Network Analysis?

Abstract: *Small social networks can be the basis of a good undergraduate research project, because there are many interesting questions that can be investigated with graph theory and a little programming. Key members of a network may be identified using various notions of centrality, such as degree centrality, betweenness centrality, and eigenvector centrality. Notions of graph connectivity can be used to estimate the fragility of a network. The distribution of degrees may suggest possible models for the growth of the network. This talk will present some basic notions of social network analysis, with examples. It will also describe an application of an integer programming algorithm, due to Shen, Smith, and Goli, for finding sets of nodes or edges whose deletion breaks a graph into the smallest components. This presentation is intended to be accessible to undergraduate students. Some knowledge of linear algebra will be helpful.*