

Discrete Mathematics Seminar

Time: Friday, 30 January 2015, 2:00-3:00 PM
Room: 237 Derrick Hall
Title: A Characterization of Structural Frustration via Minimal Graphic Hyperplanes
Speaker: Vincent Liu, The Kinkaid School, Houston
Evan Tey, Liberal Arts & Science Academy, Austin
Jessica Yu, Westwood High School, Austin
Mentor: Dr. Lucas Rusnak, Mathematics Department

Abstract:

The Ising model is an established representation of communication in simple networks. To analyze and optimize complex systems such as neural networks, electrical circuits, or spin glasses, oriented hypergraphs have been introduced to improve upon the Ising model. These hypergraphs provide a more potent structure for modeling, and have since been classified according to balance - a characterization of stability in a system. While balanceable hypergraphs are well studied, unbalanceable hypergraphs - networks with inherent flaws - are poorly understood. Thus, we redefine the concept of frustration, a measure of negativity, in hypergraphs and investigate the nature of optimization in the hypergraphic model. Starting with fundamental subhypergraphs, called cross thetas, we quantified structural frustration by the size of a corresponding graphic hyperplane, the combination of which can more accurately model high-level systems. By revealing optimal flow in systems that resist correction, our work represents a crucial step in improving the Ising model and by extension neurological treatment and circuit design.