

Undergraduate Colloquium in Mathematics

Illinois State University

1:00–1:50 PM CST, September 30th, 2021

Speaker: Ron Gould, Emory University

Applications of Mathematics to Games and Puzzles

Abstract: Graph theory plays a fundamental role in science and real-life applications. It is the architect for the Internet, the world wide web, biological networks, utility infrastructures, social networks, and much more. One of the most important and interesting invariances of a graph is its spectrum which is defined as the set of eigenvalues of its adjacency matrix. The spectrum of a graph is crucial for many applications such as Google search algorithms, non-linear dynamics, controller design, data analysis, etc.

Two graphs are called isospectral if they share the same spectrum. In this talk, I will explain a new algebraic approach to the construction of isospectral graphs. This is a simple construction that has strong potential to attack some problems in the non-linear dynamics of a complex network of coupling oscillators. This is based on the joint work with Anna Krokline, Chun Hei Lam, Ton Meesena, William Jones, John Merzel, Jan Minac, Lyle Muller through the 2021 Fields Undergraduate Summer Research Program.

Time permitting, I will briefly discuss my recent joint work and further projects with Sunil Chebolu, Jan Minac, Lyle Muller, and Federico Pasini on some exciting investigations into the spectrum of certain graphs with inspirations from representation theory.

Biography: Tung T. Nguyen obtained his Ph.D. in 2020 from the University of Chicago with a specialty in algebraic number theory. He can trace his fascination with mathematics to his high school days where he became involved with various mathematical circles and Mathematical Olympiads. As an undergraduate student he collaborated on a book dedicated to research. Number theory and combinatorics have always been topics which he treasured. His recent research interests include spectral graph theory, representation theory, dynamical systems, and computational neuroscience. He loves to collaborate and to share his enthusiasm for mathematics with everyone. He directed 8 undergraduate students to do independent study and research in mathematics.

