

Talk for graduate students and faculty

Title: Graphs and Number Theory

Abstract: Graphs are the mathematical models for networks. Expander graphs are well-connected yet sparse graphs. The expansion property of a regular or bi-regular graph is governed by the second largest eigenvalue of its adjacency matrix. Optimal expanders are called Ramanujan graphs. We will introduce the notion of primes for graphs and define the Ihara-Zeta function and the Riemann Hypothesis in the context of graphs. Graphs satisfying the Riemann Hypothesis are Ramanujan. We will use methods from the representation theory of p -adic groups to construct infinite families of (regular and bi-regular) Ramanujan graphs.

Talk for undergraduates

Title: Rolle's Theorem for Polynomials over Finite Fields

Abstract: Rolle's Theorem from calculus states that a differentiable function f that takes the same value at two different points must have a horizontal tangent line between them. As a consequence, between any two zeros of f there must be a zero of its derivative function f' . Is this still true if f is a polynomial and the coefficients of f live in a world different from the real numbers? We will investigate what happens if this new world is a finite field (a finite set in which you can still perform operations similar to addition, subtraction, multiplication, and division).

No background beyond linear algebra is needed for this talk.