THE MATHEMATICS RESEARCH CENTER
DISTINGUISHED LECTURER SERIES
PRESENTS

Jacob Fox
(MIT)

ALL LECTURES MEET AT 3:15PM IN BUILDING N 380

LECTURE 1: Friday, January 17  Room 380-C
“The Graph Regularity Method”
(Reception at 4:15pm, after the talk, in Room 382-T)

LECTURE 2: Wednesday, January 22  Room 380-W
“The Green-Tao theorem and a relative Szemerédi theorem”

LECTURE 3: Friday, January 24  Room 380-C
“Dependent Random Choice”
Lecture 1: Friday, January 17  Room 380-C
“The Graph Regularity Method”
Abstract: Szemerédi’s regularity lemma is one of the most powerful tools in graph theory, with many applications in combinatorics, number theory, discrete geometry, and theoretical computer science. Roughly speaking, it says that every large graph can be partitioned into a small number of parts such that the bipartite subgraph between almost all pairs of parts is random-like. Several variants of the regularity lemma have since been established with many further applications. In this talk, I will survey recent progress in understanding the quantitative aspects of these lemmas and their applications.

Lecture 2: Wednesday, January 22  Room 380-W
“The Green-Tao theorem and a relative Szemerédi theorem”
Abstract: The celebrated Green-Tao theorem states that there are arbitrarily long arithmetic progressions in the primes. In this talk, I will explain the ideas of the proof and recent joint work with David Conlon and Yufei Zhao simplifying the proof. One of the main ingredients in the proof of the Green-Tao theorem is a relative Szemerédi theorem, which says that any subset of a pseudorandom set of integers of positive relative density contains long arithmetic progressions. Our main advance is a simple proof of a strengthening of the relative Szemerédi theorem, showing that a much weaker pseudo-randomness condition is sufficient. The key component in our proof is an extension of the regularity method to sparse hypergraphs.

Lecture 3: Friday, January 24  Room 380-C
“Dependent Random Choice”
Abstract: We describe a simple and yet surprisingly powerful probabilistic technique that shows how to find, in a dense graph, a large subset of vertices in which all (or almost all) small subsets have many common neighbors. Recently, this technique has had several striking applications, including solutions to a variety of longstanding conjectures of Paul Erdős. In this talk, we will discuss this technique and its diverse applications.