DocCourse Prague 2005

MODERN METHODS IN RAMSEY THEORY

Programme coordinators:
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January 24 – February 25, 2005

MODERN METHODS *in* RAMSEY THEORY

PROGRAM FOR THE 2ND WEEK JANUARY 31 - FEBRUARY 4

All lectures are held in S5 unless noted otherwise

Mo, Jan 31		
09-12	*E. Friedgut*	Modern Methods in Ramsey Theory
14-17	*M. Schacht, Z. Dvořák*	Exercises
Tu, Feb 1		
09-12	*E. Friedgut*	Modern Methods in Ramsey Theory
14-17	*M. Schacht, Z. Dvořák*	Exercises
We, Feb 2		
53RD MATHEMATICAL COLLOQUIUM		
10.30	*E. Friedgut*	Some Applications of Fourier Analysis in Combinatorics
Th, Feb 3		
10	*J. Matoušek*	Almost Spherical Sections
Fr, Feb 4		
10	*P. Valtr*	Some Ramsey-type Questions in Euclidean Space
11	*J. Nešetřil*	Characterization of Ramsey Classes II

Ehud Friedgut

Lectures

Monday:

Description of Fürstenberg's approach – proof of van der Waerden theorem using topology and algebra.

Tuesday:

Continuation of lectures – proof of Hindman's theorem.

53RD MATHEMATICAL COLLOQUIUM

Ehud Friedgut

Some Applications of Fourier Analysis in Combinatorics

Why do graph properties emerge so suddenly in random graphs when the edge probability changes slightly? What is the largest number of triangles one can construct with one million edges? (An edge can be shared by many triangles.) What are the optimal colorings of the graph of the n-fold product of a triangle? And most importantly – what do these questions have to do with Fourier analysis? The answers involve calculating partial derivatives, estimating different norms of certain functions, and understanding the eigenvalues of certain matrices – in short, a delicious mixture of mathematical flavors that arise when applying discrete Fourier analysis to combinatorial questions.

Pavel Valtr

Some Ramsey-type Questions in Euclidean Space

A sample collection of various Ramsey–type results and open problems in Euclidean spaces will be presented. For example, we will consider questions related to the Erdős–Szekeres theorem, and Ramsey–type questions for geometric graphs and for finite Euclidean configurations.

Jiří Matoušek

Almost Spherical Sections

Numerous fundamental results in convex geometry and in the local theory of Banach spaces have a Ramsey-theoretic flavor. We will formulate one of the earliest and most important results of this kind, Dvoretzky's theorem on almost spherical sections of convex bodies, and sketch a proof.

Jaroslav Nešetřil

Characterization of Ramsey Classes II

a (freely related) continuation of the lecture Jan 28.

Ramsey classes (defined first in 70ties) are classes of structures for which a Ramsey-type theorem holds for partitions (i.e. colorings) of all subobjects in any number of classes. Thus Ramsey theorem amounts to saying that finite complete graphs are a Ramsey class. Also (multi-dimensional) Hales-Jewett theorem induces a Ramsey class. We show a relationship of Ramsey classes with notions from model theory and with homogeneous structures in particular. This allows us to characterize all Ramsey classes in several important instances. Many problems remain.