PhD Seminar on Discrete and Applicable Mathematics in 2016

Seminars are listed in reverse chronological order, most recent first.

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25 November - Natasha Morrison (Oxford)
Maximising the number of induced cycles in a graph

How many induced cycles can a graph on n vertices contain? For sufficiently large n, we determine the maximum number of induced cycles and the maximum number of even or odd induced cycles. We also characterize the graphs achieving this bound in each case. This answers a question of Tuza, and a conjecture of Chvatal and Tuza from 1988.

This is joint work with Alex Scott.

18 November - Carlos Hoppen (UFRGS, Brazil)
Properly coloured spanning trees in an edge coloured random graph

Given a number of colours $k \geq 1$, we consider the probability space $\mathcal{G}_{n,p}^k$ of edge-coloured random graphs, whose elements are produced by first generating a graph G in the Erd\H{o}s-R\'{e}nyi probability space $\mathcal{G}_{n,p}$ and then colouring each edge of G independently and uniformly with a colour from the set $[k]=\{1,\ldots,k\}$. We determine the threshold function $p=p_k(n)$ for the property that such an edge-coloured random graph contains a properly coloured spanning tree, for all fixed $k \geq 3$. It turns out to coincide with the connectivity threshold, which is $\log(n)/n$. This contrasts with the case $k=2$, where the threshold is known to be $2\log(n)/n$ in light of recent work by Espig, Frieze and Krivelevich [Elegantly colored paths and cycles in edge colored random graphs, arXiv:1403.1453]. Among other ingredients, this involves a new result about maximum matchings in $\mathcal{G}_{n,p}$.

This is joint work with Pu Gao (Monash University, Australia) and Juliana Sanches (UFRGS)

14 October - Aaron Lin (LSE)
Sets with few ordinary circles

Let P be a set of n points in the plane. An ordinary circle is a circle which goes through exactly three points of P. We show that if P is not contained in a line or a circle, then P spans at least n^2/4 - O(n) ordinary circles. We also determine the

exact minimum number of ordinary circles for all sufficiently large n, and describe the extremal and near-extremal examples.

In order to show this, we prove that if P spans at most Kn^2 ordinary circles, then all but O(K) many points of P lie on an algebraic curve of degree at most four.

(Joint work with Mehdi Makhul, Hossein Nassajian Mojarrad, Josef Schicho, Konrad Swanepoel, and Frank de Zeeuw.)

7 October - Nóra Frankl (LSE)
Coverings by homothets of a convex body

Let K be a convex body in R^d and F be a family of its positive, smaller homothets. We define f(K,K) as the infimum of those t for which the following holds: If the total volume of F is at least t*vol(K), then F permits a translative covering of K. We improve the former upper bounds on f(K,K) and discuss further results.
Joint work with János Nagy and Márton Naszódi.

18 March - Paul Balister (Memphis)
The sharp threshold for making squares

Many of the fastest known algorithms for factoring large integers rely on finding subsequences of randomly generated sequences of integers whose product is a perfect square. Motivated by this, in 1994 Pomerance posed the problem of determining the threshold of the event that a random sequence of N integers, each chosen uniformly from the set $\{1,\dots,x\}$, contains a subsequence, the product of whose elements is a perfect square. In 1996, Pomerance gave good bounds on this threshold and also conjectured that it is {\em sharp}.

In a paper published in Annals of Mathematics in 2012, Croot, Granville, Pemantle and Tetali significantly improved these bounds, and stated a conjecture as to the location of this sharp threshold. In recent work, we have confirmed this conjecture. In my talk, I shall give a brief overview of some of the ideas used in the proof, which relies on techniques from number theory, combinatorics and stochastic processes.
Joint work with B\'ela Bollob\'as and Robert Morris.

26 February - Jan Hladky (Prague)
Cliques in dense inhomogeneous random graphs

The theory of dense graph limits comes with a natural sampling process which yields an inhomogeneous variant of the Erdos-Renyi random graph. Here we study the clique number of these random graphs. For a large class of graphons, we establish a formula which gives the almost sure clique number of these random graphs.

Joint work with Martin Dolezal and Andras Mathe.

19 February - Daniel Quiroz, (LSE)
Generalised colouring numbers of planar graphs

The generalised colouring numbers col_r(G) and wcol_r(G) were introduced by Kierstead and Yang as a generalisation of the colouring number, and have found important theoretical and algorithmic applications.

We will discuss an improvement on the known upper bounds to these numbers for graphs excluding a complete graph as a minor, from the exponential bounds of Grohe et al. to a linear bound on col_r(G) and an polynomial bound on wcol_r(G). We will look at some of the main techniques used to obtain these new bounds, with an emphasis on the results for planar graphs.

This is joint work with Jan van den Heuvel, Patrice Ossona de Mendez, Roman Rabinovich and Sebastian Siebertz.

12 February - Ahmad Abu-Khazneh (LSE)
Extremal problems related to covering and matching in multipartite hypergraphs

No abstract available

22 January - Pongphat Taptagaporn (LSE)
Competitive greedy portfolio

Classical portfolio problems look at maximizing utility functions such as wealth or its risk-adjusted version. However, our studies are around regret: how far is our wealth from an optimal model (defined as having access to some future information). We study a new greedy model and analyze various statistics and their asymptotic. These have flavours from online learning, information theory, game theory.