LSE Mathematics

PhD Seminar on Discrete and Applicable Mathematics in 2014

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

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12 December - Pongphat Taptagaporn (LSE)
Multi-armed bandit and portfolio problems

Multi-armed bandit is a well-known problem in learning theory & game theory that asks for an optimal strategy to maximise gains by making a sequence of choices on which slot machine to play in a casino. We will introduce this problem and its many variants, outline progress in this field, and discuss how this related to the problem of universal portfolio.

28 November - Matthew Jenssen (LSE)
The Multi-Coloured Ramsey Numbers of Odd Cycles

For a graph G and an integer $k \geq 2$, $R_k(G)$ denotes the smallest integer N for which any edge-coloring of the complete graph K_N by k colors contains a monochromatic copy of G. In 1973 Bondy and Erdős conjectured that, for an odd cycle C_n on $n \geq 3$ vertices,

$$R_k(C_n) = 2^{k-1}(n-1)+1 \quad \text{for} \quad n > 3.$$

Recenlty, Kohayakawa, Simonovits and Skokan resolved the $k = 3$ case of this conjecture for large n. For $k \geq 4$, the conjecture remains open. Luczak, Simonovits and Skokan provide the upper bound

$$R_k(C_n) \leq k2^k n + o(n) \qquad \text{as } n \to \infty.$$

In this talk we discuss recent improvements to this bound. We will build on the ideas of Luczak, Simonovits and Skokan, and import techniques from the theory of non-linear programming. We also discuss progress towards an asymptotic verification of the Bondy-Erdős conjecture.

21 November - Diana Piguet (Pilsen)
Embedding cycles of given length in oriented graphs

Kelly, Kuehn and Osthus conjectured that for any length L>3 and the smallest number k>2 that does not divide L, any large enough oriented graph G with minimum semidegree at least |V(G)|/k+1 contains a directed cycle of length L. I shall present an approximate solution of this conjecture for the case when L is large enough compared to k and k>3. The case when k=3 was already settled by Kelly, Kuehn and Osthus.

This is a joint work with Daniela Kuehn and Deryk Osthus.

14 November - Frank Mousset (ETH Zurich)
Packing a randomly edge-coloured graph with rainbow k-outs

Let G be a graph on n vertices and let k,c be fixed positive integers. The random subgraph G_k of G is obtained by letting each vertex of G pick k neighbours uniformly at random from its neighbourhood in G ("k-out"). On the other hand, the edge-coloured random subgraph G(p,c) is obtained by keeping each edge independently with probability p, and then colouring each edge randomly with a color from the set {1,...,c}.

We show that if p >> log n/delta(G), then in a typical H ~ G(p,kn), one can find t = (1-o(1)) delta(G)p/(2k) edge-disjoint subgraphs H_i, with the following properties:
(a) each H_i is almost distributed like G_k, in the sense that monotone properties of G_k transfer to H_i;
(b) each H_i is rainbow, i.e., each edge is painted in a different colour.
Since the typical G_k has kn edges (average degree 2k), and since the average degree of G(p,kn) is delta(G)p, this result is asymptotically optimal.

Immediate applications of this result are rainbow packing problems in G(p,c). For example, it follows that if p >> log n/n, the typical H ~ K_n(p,23n) contains (1-o(1)) np/46 edge-disjoint rainbow Hamilton cycles. Another example: if G has minimum degree (1+eps) n/2, then there exist c=O(n) and t=O(np) such that G(p,c) (for p >> log n/n) contains t edge-disjoint rainbow Hamilton cycles. Although these results are far from optimal, their proofs are extremely easy.

7 November - Frank Page (Indiana University Bloomington)
Parameterized Games and K-Correspondences

For a large class of nonatomic, parametrized games, including all nonatomic discounted stochastic games of the type studied by Nowak and Raghavan (1992), we show that each game in the class has a Nash payoff correspondence that is a K-correspondence - or equivalently, is a correspondence having the K-limit property.[1] We then show that if a Nash payoff correspondence has the K-limit property, then its induced Nash payoff selection correspondence is approximable in the weak star topology and therefore has fixed points. Our results lead directly to the resolution of a long-standing open problem in the theory of discounted stochastic games (see Page, 2014).

This is joint work with Jieshuang He (Indiana University Bloomington)

24 October - Benny Sudakov (ETH Zurich)
Grid Ramsey problem and related questions

The Hales-Jewett theorem is one of the pillars of Ramsey theory, from which many other results follow.

A celebrated result of Shelah says that Hales-Jewett numbers are primitive recursive. A key tool used in his proof, known as the cube lemma, has become famous in its own right. In its simplest form, it says that if we color the edges of the Cartesian product $K_n \times K_n$ in r colors then, for n sufficiently large, there is a rectangle with both pairs of opposite edges receiving the same color.

Hoping to improve Shelah's result, Graham, Rothschild and Spencer asked more than 20 years ago whether the cube lemma holds with n which is polynomial in r. We show that this is not possible by providing a superpolynomial lower bound in r. We also discuss a number of related questions, among them a solution of a problem of Erdos and Gyarfas on generalized Ramsey numbers.

This is joint work with Conlon, Fox and Lee.

4 July - Nicola Wittur (LSE)
Shapley Value on Convex Geometries

A central question in cooperative game theory is the problem of a "fair" allocation of the value that has been generated by a coalition of players among the individual players. The Shapley value is one of the most common allocation rules studied so far. It is based on the assumption that every subset of players is a feasible coalition. There have been attempts to analyze situations (and the corresponding Shapley value) in the case of restricted cooperation possibilities. Based on a paper by Bilbao and Edelman, we will present the case in which the feasible coalitions form a convex geometry: we will introduce their main findings and will point at some drawbacks of their approach.

20 June - Andrzej Rucinski (Poznan)
Exponential bounds for Folkmann numbers

Abstract not available

21 March - Julia Ehrenmueller (TU Hamburg-Harburg)
Almost acyclic avoider-enforcer games

In this talk we consider biased (1:b) Avoider-Enforcer games in the monotone and strict versions. In particular, we show that Avoider can keep his graph being a forest for every but maybe the last round of the game if b \geq 200 n \ln n. By this

we obtain essentially optimal upper bounds on the threshold biases for the non-planarity game, the non-k-colorability game, and the K_t-minor game. Moreover, we give a slight improvement for the lower bound in the non-planarity game.

This is joint work with Dennis Clemens, Yury Person, and Tuan Tran.

14 March - Yury Person (Goethe-Universität, Frankfurt)
Minimum degree of minimal Ramsey graphs for multiple colors

A graph G is called H-Ramsey if no matter how one colors its edges red/blue, there is a monochromatic copy of H.

We say that G is minimal H-Ramsey if G is H-Ramsey, but no proper graph of it is. Burr, Erd\H{o}s and Lovász studied minimum degree among all minimal K_t-Ramsey graphs and showed that it equals $(t-1)^2$. We discuss generalizations of their result to more colors.

Joint work with Jacob Fox, Andrey Grinshpun, Anita Liebenau and Tibor Szabó.

7 March - Daniel Quiroz (LSE)
Generalized coloring numbers

Based on a paper of Kierstead and Yang (Orderings on Graphs and Game Coloring Number, 2003) generalized coloring numbers will be presented. The existence of upper bounds for the k-coloring number will be discussed for the case of planar graphs, together with some applications.

28 February - Jozsef Balogh (Illinois & Szeged)
Subdivisions of a large clique in C_6-free graphs

Mader conjectured that every C_4-free graph has a subdivision of a clique of order linear in its average degree. We show that every C_6-free graph has such a subdivision of a large clique.

We also prove the dense case of Mader's conjecture in a stronger sense, i.e.for every c, there is a c' such that every C_4-free graph with average degree $cn^{1/2}$ has a subdivision of a clique K_ℓ with $\ell=\lfloor c'n^{1/2}\rfloor$ where every edge is subdivided exactly 3 times.

This is joint work with Hong Liu and Maryam Sharifzadeh.

21 February - Alexey Pokrovskiy (FU Berlin)
Graphs with 2|G|-2 edges

We discuss graphs on n vertices which have 2n-2 edges and no proper induced subgraphs of minimum degree 3. Erdős, Faudree, Gyárfás, and Schelp conjectured that such graphs always have cycles of lengths 3,4,5,...,C(n) for some increasing function C(n). We'll talk about a disproof this conjecture. We'll also discuss a related problem about possible leaf to leaf path lengths in trees.

This is joint work with Narins and Szabó.

14 February - Ron Peretz (LSE)
Tutorial: Blackwell's Approachability Theorem

24 January - Matthew Jenssen (LSE)
Minimum degree Turán problems

Turán problems concern the maximum number of edges in an F-free r-graph, but it is also natural to ask about the maximum possible minimum degree. More precisely, for an r-graph G and 0\leq s \leq r-1 let \delta_s(G) be the minimum over all sets S of s vertices of the number of edges containing S. We can then define a generalised Turán number ex_s(n,F) as the largest value of \delta_s(G) attained by an F-free r-graph G on n vertices. We will discuss recent developments in the study of such Turán numbers and establish the best known asymptotic lower bound for ex_2(n,K_4^3)/n.

17 January - Zibo Xu (Stockholm School of Economics)
Title and abstract not available