Graz University of Technology

Institut für Diskrete Mathematik

Friday 28th April

Combinatorics Day

09:30 - 10:15 - **Mauricio Collares** (TU Graz) *"Set-colouring Ramsey numbers"*

(SR 1 Geometry Institute, Kopernikusgasse 24)

10:30 - 11:00 Coffee Break

(Geometry Institute, Kopernikusgasse 24)

11:00 - 11:45 - **Sahar Diskin** (Tel Aviv University) *"The Erdős-Rényi component phenomenon: component sizes in percolation on high-dimensional product graphs"* (Part of the Advanced Topics seminar)

(SR 2 Geometry Institute, Kopernikusgasse 24)

12:00 - 14:00 - Lunch Break

14:00 - 15:00 - Rigorosum of Tuan Anh Do

(AE06, Steyrergasse 30)

16:00 - 16:30 - Coffee Break

(2nd Floor, Steyrergasse 30)

16:30 - 17:30 - **Michael Krivelevich** (Tel Aviv University) *"Fast construction on a restricted budget"*

(BE01, Steyrergasse 30)

Abstracts can be found at

https://www.math.tugraz.at/comb/workshops/Workshop2023Abstracts.pdf

Joshua Erde, Mihyun Kang

Graz University of Technology

Institut für Diskrete Mathematik

Friday 28th April 09:30

SR 1 Geometry Institute, Kopernikusgasse 24

Set-colouring Ramsey numbers

Mauricio Collares

(Graz University of Technology)

The set-colouring Ramsey number $R_{r,s}(k)$ is defined to be the minimum n such that if each edge of the complete graph K_n is assigned a set of s colours from $\{1,\dots,r\}$, then one of the colours contains a monochromatic clique of size k. The case $s = 1$ is the usual r-colour Ramsey number, and the case $s = r - 1$ was studied by Erdős, Hajnal and Rado in 1965, and by Erdős and Szemerédi in 1972. For general s, recent progress was made by Conlon, Fox, He, Mubayi, Suk and Verstraëte (CFHMSV), who proved lower and upper bounds which imply that $R_{r,s}(k) = 2^{\Theta(kr)}$ if s/r is bounded away from 0 and 1, but which can diverge significantly when $s = r - o(r)$.

In this talk, we will describe some of the previous constructions and proofs mentioned above, as well as a new (random) colouring which matches the upper bound of CFHMSV up to polylogarithmic factors in the exponent for essentially all r, s and k.

Joint work with Lucas Aragão, João Pedro Marciano, Taísa Martins and Rob Morris.

Joshua Erde, Mihyun Kang

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Friday 28th April 11:00

SR 2 Geometry Institute, Kopernikusgasse 24

The Erdős-Rényi component phenomenon: component sizes in percolation on high-dimensional product graphs

Sahar Diskin

(Tel Aviv University)

In the bond (edge) percolation model, a random subgraph G_p is formed by retaining every edge of G independently with probability p. In 1960, Erdős and Rényi showed that $(K_n)_p$ undergoes a fundamental change around $p = 1/n$: with high probability (that is, with probability tending to 1 as n tends to infinity), from components of order at most logarithmic to a unique giant component of linear order, with all other components of logarithmic order. Similar behaviour has been shown in other models. One well-researched example is the percolated hypercube Q_p^d around the probability $p = 1/d$, as shown by Ajtai, Komlós, and Szemerédi in 1982 and Bollobás, Kohayakawa, and Łuczak in 1991. We generalise these results and show that such behaviour holds typically for all Cartesian products of many regular graphs of bounded order. Joint work with Joshua Erde, Mihyun Kang and Michael Krivelevich.

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Friday 28th April 16:30

BE01, Steyrergasse 30

Fast construction on a restricted budget

Michael Krivelevich

(Tel Aviv University)

We introduce a model of a controlled random graph process. In this model, the edges of the complete graph K_n are ordered randomly and then revealed, one by one, to a player called Builder. He must decide, immediately and irrevocably, whether to purchase each observed edge. The observation time is bounded by parameter t, and the total budget of purchased edges is bounded by parameter b. Builder's goal is to devise a strategy that, with high probability, allows him to construct a graph of purchased edges possessing a target graph property P, all within the limitations of observation time and total budget.

We analyze this model in the context of several graph theoretic properties such as minimum degree, Hamiltonicity, and the containment of fixed-size trees and cycles.

Joint work with Alan Frieze and Peleg Michaeli.

The talk will be aimed at a general combinatorial audience.