Combinatorics Session

Schedule

14:00–14:50 : Dan Hefetz (Ariel University) - Rainbow trees in uniformly edge-coloured graphs
15:00–15:50 : Chaya Keller (Ariel University) - On Multicolor Ramsey Numbers and Subset-Coloring of Hypergraphs
16:20–17:10 : Noam Lifshitz (Hebrew University) - Hypercontractivity for global functions

Abstracts

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14:00–14:50 : Dan Hefetz (Ariel University)

Title : Rainbow trees in uniformly edge-coloured graphs

Abstract: I will discuss sufficient conditions for the emergence of spanning and almost-spanning bounded-degree rainbow trees in various host graphs, having their edges coloured independently and uniformly at random, using a predetermined palette. Our first result asserts that a uniform colouring of $\mathbb{G}(n,\omega(1)/n)$, using a palette of size n, a.a.s. admits a rainbow copy of any given bounded-degree tree on at most $(1-\eps)n$ vertices, where $\eps > 0$ is arbitrarily small yet fixed. This serves as a rainbow variant of a classical result by Alon, Krivelevich, and Sudakov.

Given an n-vertex graph G with minimum degree at least δn, where $\delta > 0$ is fixed, we use our aforementioned result in order to prove that a uniform colouring of the randomly perturbed graph $G \cup \mathbb{G}(n,\omega(1)/n)$, using $(1+\alpha)n$ colours, where $\alpha > 0$ is arbitrarily small yet fixed, a.a.s. admits a rainbow copy of any given bounded-degree spanning tree. This can be viewed as a rainbow variant of a result by Krivelevich, Kwan, and Sudakov.

Finally, and with G as above, we prove that a uniform colouring of $G \cup \mathbb{G}(n,\omega(n^{-2}))$ using $n-1$ colours a.a.s. admits a rainbow spanning tree. That is, the trivial lower bound on the size of the palette required for supporting a rainbow spanning tree is also sufficient, essentially as soon as the random perturbation a.a.s. has edges.

Based on joint work with Elad Aigner-Horev and Abhiruk Lahiri.

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15:00–15:50 : Chaya Keller (Ariel University)

Title: On Multicolor Ramsey Numbers and Subset-Coloring of Hypergraphs

Abstract:
The multicolor hypergraph Ramsey number Rk(s,r) is the minimal n, such that in any k-coloring of all r-element subsets of [n], there is a subset of size s, all whose r-subsets are monochromatic. We present a new "stepping-up lemma" for Rk(s,r): If Rk(s,r)>n, then Rk+3(s+1,r+1)>2n. Using the lemma, we improve some known lower bounds on multicolor hypergraph Ramsey numbers. Furthermore, given a hypergraph H=(V,E), we consider the Ramsey-like problem of coloring all r-subsets of V such that no hyperedge of size >r is monochromatic. We provide upper and lower bounds on the number of colors necessary in terms of the chromatic number $\chi(H)$. In particular, we show that this number is $O(\log^{(r-1)}(r\cdot\chi(H))+r)$, where $\log^{(m)}$ denotes m-fold logarithm.

Joint work with Bruno Jartoux, Shakhar Smorodinsky, and Yelena Yuditsky.

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16:20 – 17:10: Noam Lifshitz (Hebrew University)

Title: Hypercontractivity for global functions

Abstract:
The hypercontractivity theorem on the Boolean cube is a central tool in the analysis of Boolean functions.

In the talk we will:
1) Explain the theorem and its main implications.
2) Show how we generalize the hypercontractivity theorem to other settings, such as the symmetric group.
3) Describe applications of our machinery to additive and extremal combinatorics as well as isoperimetry.