Combinatorics Seminar

Uniform Hypergraphs Containing no Grids

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Abstract: A hypergraph is called an $r \times r$ *grid* if it is isomorphic to a pattern of r horizontal and r vertical lines, i.e., a family of sets $\{A_1, \ldots, A_r, B_1, \ldots, B_r\}$ such that $A_i \cap A_j = B_i \cap B_j = \emptyset$ for $1 \leq i < j \leq r$ and $|A_i \cap B_j| = 1$ for $1 \leq i, j \leq r$. Three sets C_1, C_2, C_3 form a *triangle* if they pairwise intersect in three distinct singletons, $|C_1 \cap C_2| = |C_2 \cap C_3| = |C_3 \cap C_1| = 1$, $C_1 \cap C_2 \neq C_1 \cap C_3$. A hypergraph is *linear*, if $|E \cap F| \leq 1$ holds for every pair of edges $E \neq F$.

In this paper we construct large linear r-hypergraphs which contain no grids. Moreover, a similar construction gives large linear r-hypergraphs which contain neither grids nor triangles. The latter case is related to the Brown, Erdős, Sós conjecture and we utilize Behrend's construction. For $r \geq 4$ our constructions are almost optimal. This is a joint work with Zoltán Füredi.

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