

DISSERTATION
DEFENSE

Problems in Extremal Combinatorics

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Abstract

In this talk we consider several problems from extremal combinatorics. In particular, we concentrate on Ramsey and Turán-type problems.

First, we will be interested in quantitative results for Folkman numbers. For given integers r, k and l we define an edge (vertex) Folkman number by the minimum number of vertices in a K_l -free graph with the property that every r -coloring of its edges (vertices) yields a monochromatic copy of K_k . In particular, we will show that there exists a K_4 -free graph of order 941 such that any 2-coloring of its edges yields a monochromatic copy of K_3 . This gives an answer to the question of Chung and Graham. Moreover, in the case of vertex Folkman numbers we will deliver the first general polynomial upper bound.

Second, we will investigate an analogue of the Ramsey Theorem for Steiner systems. We will show that for given k, l and t there exists a partial Steiner (k, l) -system such that whenever an l -element subset from every edge is chosen, the resulting l -uniform hypergraph contains a clique of size t . Moreover, we will determine asymptotic bounds on the size of such cliques with respect to the order of Steiner triple systems.

Furthermore, we will consider an extension of the Turán Theorem to infinite graphs. Especially, we will put focus on infinite graphs which do not contain an increasing path of a given length. We will give asymptotic bounds on the edge density of such graphs disproving a conjecture of Czipser, Erdős and Hajnal.

Advisor: Vojtěch Rödl

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