DISSERTATION
DEFENSE

Ramsey Theorem and Ramsey Turán Type Results for Hypergraphs

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Abstract: This thesis defense includes Ramsey Theorem type results and Ramsey-Turán type results. Both topics involve finding substructures within hypergraphs under certain conditions.

Ramsey Theorem type results:
The Induced Ramsey Theorem (1975) states that for $c, r \geq 2$ and every r-graph G, there exists an r-graph H such that every c-coloring of the edges of H contains a monochromatic induced copy of G. A natural question to ask is what other subgraphs F (besides edges) of G can be partitioned and have the F-Ramsey property. We give results on the F-Ramsey property of two types of objects: hypergraphs or partial Steiner systems. We find that while the restrictions on the Ramsey properties of hypergraphs are lifted by any linear ordering of the vertex set, the Ramsey properties for partial Steiner systems (with vertex set linearly ordered or unordered) are quite restricted.

Ramsey-Turán type results:
Turán's Theorem (1941) states that for $1 < k \leq n$, every graph G on n vertices not containing a K_{k+1} has at most $|E(T_k(n))|$ edges, where $T_k(n)$ is the graph on n vertices obtained by partitioning n vertices into k classes of each size $\lfloor \frac{n}{k} \rfloor$ or $\lceil \frac{n}{k} \rceil$ and joining two vertices if and only if they are in two different classes. In 1946, Erdős and Stone showed that any sufficiently large dense graph will contain $T_k(n)$. Nearly 75 years later, in spite of considerable interest and effort, no generalization of Turán's Theorem or Erdős-Stone Theorem for hypergraphs is known. Instead, we consider a variant of this question where we restrict to quasi-random hypegraphs and prove some partial results in this direction.

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