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* **Princeton Discrete Math Seminar** *

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Co-degree Density of hypergraphs

Abstract

Given a family F of r-uniform hypergraphs, the classical Turán theory studies the maximum proportion of r-sets an n element set can have without containing F. This limit, as n becomes large, is sometimes called the Turán density of F. We consider the related problem of determining the (normalized) maximum possible minimum co-degree that the family of r-sets in an n element set can have without containing F. As n goes to infinity, this approaches a limit which we call the co-degree density of F, and write $g(F)$. For each $r > 1$, let $G_r = \{g(F) : F \text{ is a family of } r\text{-graphs}\}$. Our main result is that for each $r > 2$, G_r is dense in $[0, 1)$. This is in stark contrast to the fact that $G_2 = \{0, \frac{1}{2}, \frac{2}{3}, \frac{3}{4} \ldots\}$, a fact that follows from the Erdős-Simonovits-Stone theorem. This phenomenon is similar to the existence of real numbers that are not jumps in hypergraphs, proved by Frankl and Rödl. Several other results about co-degree densities are provided parallel to those of the classical Turán theory.

This is a joint work with Dhruv Mubayi.