

# The number of flats spanned by a set of points

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## Abstract

A  $k$ -flat (or  $k$ -dimensional affine subspace)  $G$  is spanned by a set  $P$  of points in  $d$ -dimensional real space if  $G$  contains  $k+1$  affinely independent points of  $P$ . The study of the extremal combinatorics of the flats spanned by sets of points in real space is a classical area of study in discrete geometry, with numerous applications to computational geometry. In the late 1980s, Purdy asked for a characterization of those sets of points that span fewer hyperplanes than  $(d-2)$ -flats. In this talk, I will give a nearly complete answer to this question, based on a new measure of the degeneracy of a point set. This work also leads to a generalization of a point-hyperplane incidence bound, proved by Elekes and Toth in 2005.

Defense Committee: Prof. Shubhangi Saraf (Chair), Prof. Swastik Kopparty, Prof. Mario Szegedy, Prof. Zeev Dvir (Princeton)