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)