Dissertation Defense

Half Covering, Half Coloring

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Abstract: We will discuss two types of problems in extremal combinatorics. First, we discuss problems about covering sets of points using affine hyperplanes. We consider a higher multiplicity generalization of a result of Alon and Füredi about the minimum number of hyperplanes needed to cover all but one vertex of an n-cube. We then discuss related covering problems for triangular grids. Next, we answer a question in arithmetic Ramsey theory. For a fixed set D, of positive integers, let $\Delta(D, k; 2)$ be the smallest N such that any 2-coloring of $\{1, 2, \cdots, N\}$ contains a monochromatic sequence $a_1 < a_2 < \cdots < a_k$, whose consecutive differences, $a_{i+1} - a_i$, are all elements of D. We provide the first example of a set D where $\Delta(D, k; 2)$ grows faster than any polynomial in k.

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