

N.M. Singhi (Tata Institute)

Studying t-Designs and Other Families of Subsets of a Finite Set Algebraically

Abstract for the Combinatorics Seminar 2005 June 27

I will describe a general t-k existence problem and some algebraic methods developed to study such problems. Special cases of the problem include well known unsolved problems like characterising parameters of t-designs or degree sequences of k-uniform hypergraphs. Some other closely related unsolved problems are characterising f-vectors of pure simplicial complexes, parameters of partial Steiner systems, and orders of projective planes, and calculating diagonal forms, invariants for incidence matrices, etc. I will describe the recent concept of tags on subsets of finite sets, which act like a basis for a subset in lexicographic ordering and provide a unified approach to some of these classical problems and results. I will also discuss vector-space analogues of the concept and their uses.

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