IPM Combinatorics II: Design Theory, Graph Theory, and Computational Methods
April 22-27, 2006, IPM, Tehran

Clique and Exact Cover Algorithms in Combinatorics

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Constructing (or classifying) combinatorial objects—or solving subproblems in such work—can often be phrased as finding one solution (or all solutions) of instances of clique and exact cover problems. A clique is a set of pairwise adjacent vertices in a graph. For a given set U and a collection $\mathcal{S} = \{S_1, S_2, \ldots, S_m\}$, where $S_i \subset U$, an exact cover is a subset of $\mathcal{S}$ that partitions U. In general, packing problems lead to clique instances and tiling (that is, simultaneous packing and covering) problems to exact cover instances. In this talk we discuss algorithms for such problems, present construction/classification problems to which they can be applied, and look at several new results obtained recently by the speaker and his colleagues.