

Knapsack Problem on 3 Classes of Conflict Graphs

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We consider the classical 0-1 knapsack problem with an additional disjunctive relation on pairs of items represented by a conflict graph. This means that adjacent vertices in the graph correspond to items that may not be packed together in the knapsack. Clearly, every feasible solution of this knapsack problem constitutes a stable (independent) set in the conflict graph. While this feature has been studied for bin packing problems it is a new concept for knapsack problems.

Since the combination of two NP-complete problems does not make them any easier, we look for special structures of the conflict graph that allow exact solution methods with pseudopolynomial running time. Currently, we are successful for trees and more general for graphs of bounded treewidth, as well as for chordal graphs. For all these cases a dynamic programming scheme can be developed which follows a bottom-up approach through a certain tree representation of the considered graph. For graphs with bounded treewidth we use a tree decomposition, in particular, we exploit the properties of nice tree decompositions. For chordal graphs, we base the dynamic programming scheme on its representation as a clique tree. Furthermore, for these special cases we can derive also fully polynomial time approximation schemes (FPTAS).