

Knapsack Problems: Applications, Algorithms and Generalizations

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This survey starts with a short introduction to the knapsack problem, one of the most frequently treated integer programs with a single constraint, where a subset of n given items, each of them with profit and weight, must be selected such that the total profit is maximized and the total weight remains below a given capacity bound. The significance of the knapsack problem will be illustrated by real-world application scenarios.

We present and discuss the best currently available exact algorithms both from a complexity and a running time point of view. Moreover, we will give a brief description of the best currently known approximation scheme for the knapsack problem.

Finally, we give an overview of generalizations such as the cardinality constrained knapsack problem, where at most k items may be packed, the multi-dimensional knapsack problem, where every item consumes m different types of resources and each of the corresponding m capacity constraints must be fulfilled, and the multiple knapsack problem, which generalizes the packing concept by filling several knapsacks instead of a single one.