

Transforming Constraints into Objectives: Biobjective Solution Method for Solving Bidimensional Knapsack Problems

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We consider constrained combinatorial optimization problems and relax one or several of the constraints. In this way, we formulate associated multiple objective optimization problems. This allows us to analyze the trade-off between constraint satisfaction on one hand and original objective value on the other hand.

As a concrete example problem, we consider bidimensional knapsack problems (i.e., one objective and two knapsack constraints) and their associated biobjective, single-constraint knapsack problems. A dynamic programming based solution approach is adapted to compute the nondominated set of the transformed problem or a subset of it. It is shown that a representation of the nondominated set is obtained at little extra cost as compared to the solution of the original problem. In this context we discuss strategies for bound computation and for handling negative cost coefficients, which occur through the transformation. Numerical results comparing the multiple objective approaches are presented.