

# Transforming Constraints into Objectives: Experiments with Bidimensional Knapsack Problems

Schulze, Britta (\*)  
University of Wuppertal

Klamroth, Kathrin  
University of Wuppertal

Paquete, Luis  
University of Coimbra

We consider constrained combinatorial optimization problems and formulate associated multiple objective optimization problems, where one or several of the constraints are relaxed and interpreted as additional objective functions. In this way, the trade-off between constraint satisfaction on one hand and original objective value on the other hand can be analyzed. 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. It is shown that a dynamic programming based solution approach can be adapted in such a way 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 single- and multiple objective approaches are presented.

**Keywords:** Bidimensional Knapsack Problem, Constraint Handling, Dynamic Programming, Multi-Criteria Combinatorial Optimization.