Reoptimization for 0-1 knapsack problems

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Reoptimization consists in exploiting the solving of a given instance of a problem (P) to accelerate the solving of another instance (P') next to the previous one (e.g. with a slight modification of part of the data). Thus, having reoptimization in mind, while solving (P) it is important to store informations that might be useful for the resolution of (P').

We extended the use of reoptimization techniques for a large sequence of instances, typically when an iterative algorithm (like subgradient method) is used for solving Lagrangian duals of two types of 0-1 knapsack problem: the 0-1 linear biknapsack problem (BKP) and the 0-1 quadratic knapsack problem (QKP). In these two cases, all along the subgradient algorithm one or several sequences of one dimensional 0-1 knapsack problems (KP) have to be solved. And in each sequence, all the problems have the same constraint and only differ, one to another, on the objective function via the evolution of the Lagrangian multipier.

Two main advantages may be observed for this study: first, the subgradient method context for which the 0-1 knapsack problems tend to be connected the further the iterations advanced, and second, our good knowledge of the different algorithmic tools for solving problem (KP) (see [2]). The ultimate goal of this work is obviously the reduction of the global computation time of the dual solvings.

First, we recall the results obtained for problem (BKP) (see [3]) and for problem (QKP) (see [1]). Second, as concerns the one dimensional 0-1 knapsack problem, we propose to extend the reoptimization techniques to the main phases of its solving: the linear continuous relaxation, the Lagrangean relaxation, the variable fixing and the exact solving method. Numerical experiments validate the relevance of our approach.

References

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