

A multi-criteria approach to approximate solution of multiple-choice knapsack problem

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Abstract

We propose a method for finding approximate feasible solutions to multiple-choice knapsack problems. We convert the multiple-choice knapsack problem to a bi-objective optimization problem by redefining the cost constraint as a cost criterion. By this, the specific structure of multiple-choice constraint is exposed. Next, a series of linear scalarized bi-objective problems are solved by a closed-end formula.

The method is computationally analyzed on a set of large-scale problem instances of two categories: uncorrelated and weakly correlated. Computational results show that after solving, in average 10 scalarized problems, the accuracy of the objective function optimal value is comparable to the accuracies which can be obtained by the greedy algorithm and an exact algorithm. The respective approximate solution (for which the approximate optimal value is assumed) can be found without resorting to the dynamic programming. In the test problems, the number of multiple-choice constraints ranges up to hundreds with hundreds variables in each constraint.

References

- [1] Ewa M. Bednarczuk, Janusz Miroforidis, Przemysław Pyzel (submitted) A multi-criteria approach to approximate solution of multiple-choice knapsack problem.
- [2] Ehrgott M., *Multicriteria Optimization*, Springer Berlin Heidelberg New York, 2005
- [3] Kellerer, H., Pferschy, U., Pisinger, D., *Knapsack Problems*, Springer, 2004

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