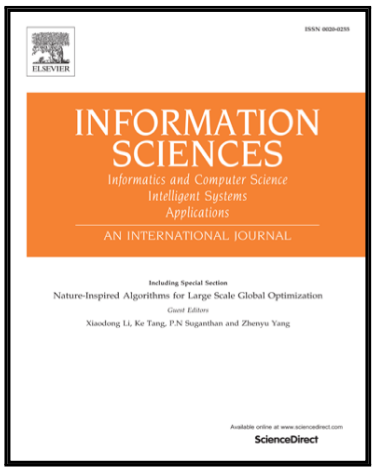

A two-phase tabu-evolutionary algorithm for the 0–1 multidimensional knapsack problem

Xiangjing Lai, Jin-Kao Hao, Fred Glover, Zhipeng Lü

PII: S0020-0255(18)30036-7
DOI: 10.1016/j.ins.2018.01.026
Reference: INS 13380

To appear in: *Information Sciences*

Received date: 6 November 2017
Revised date: 8 January 2018
Accepted date: 13 January 2018

Please cite this article as: Xiangjing Lai, Jin-Kao Hao, Fred Glover, Zhipeng Lü, A two-phase tabu-evolutionary algorithm for the 0–1 multidimensional knapsack problem, *Information Sciences* (2018), doi: 10.1016/j.ins.2018.01.026

A two-phase tabu-evolutionary algorithm for the 0–1 multidimensional knapsack problem

Xiangjing Lai [a], Jin-Kao Hao [b,c,*], Fred Glover [d], Zhipeng Lü [e]

[a] *Institute of Advanced Technology, Nanjing University of Posts and Telecommunications, Nanjing 210023, China*

[b] *LERIA, Université d'Angers, 2 Boulevard Lavoisier, 49045 Angers, France*

[c] *Institut Universitaire de France, 1 Rue Descartes, 75231 Paris, France*

[d] *OptTek Systems, Inc., 2241 17th Street Boulder, Colorado 80302, USA*

[e] *SMART, School of Computer Science and Technology, Huazhong University of Science and Technology, 430074 Wuhan, P.R.China*

Minor Revision, 8 January 2018

Abstract

The 0–1 multidimensional knapsack problem is a well-known NP-hard combinatorial optimization problem with numerous applications. In this work, we present an effective two-phase tabu-evolutionary algorithm for solving this computationally challenging problem. The proposed algorithm integrates two solution-based tabu search methods into the evolutionary framework that applies a hyperplane-constrained crossover operator to generate offspring solutions, a dynamic method to determine search zones of interest, and a diversity-based population updating rule to maintain a healthy population. We show the competitiveness of the proposed algorithm by presenting computational results on the 281 benchmark instances commonly used in the literature. In particular, in a computational comparison with the best algorithms in the literature on multiple data sets, we show that our method on average matches more than twice the number of best known solutions to the harder problems than any other method and in addition yields improved best solutions (new lower bounds) for 4 difficult instances. We investigate two key ingredients of the algorithm to understand their impact on the performance of the algorithm.

Keywords: Combinatorial optimization; Multidimensional knapsack problem; Solution-based tabu search; Meta-heuristics.

* Corresponding author.

Email addresses: laixiangjing@gmail.com (Xiangjing Lai), jin-kao.hao@univ-angers.fr (Jin-Kao Hao), glover@opttek.com (Fred Glover), zhipeng.lui@gmail.com (Zhipeng Lü).