LOCAL SEARCH ALGORITHM FOR THE BI–LEVEL FACILITY LOCATION AND DESIGN PROBLEM

Yu. Kochetov, I. Sokolova

Sobolev Institute of Mathematics,
Novosibirsk State University, Novosibirsk
e-mail: jkochet@math.nsc.ru

In the bi–level facility location and design problem, two players (a leader and a follower) compete to attract clients from a given market. Each player has a budget and tries to maximize own market share. At first, the leader opens facilities and determines their attractiveness for the clients. Later on, the follower makes the similar decision for own facilities. Each client splits own demand probabilistically over all facilities in the market proportionally with attraction to each facility and inversely proportional to the distance between client and facility. The location and attractiveness of the leader facilities are to be determined so as to maximize his market share [1].

For this Stackelberg game we present a local search heuristic based on the optimal and near optimal solutions for the follower. For a given solution of the leader, we formulate the follower problem as 0–1 nonlinear multiple–choice knapsack problem and solve it by the branch and bound method. To compute the upper bounds, we relax the integrality constraints and apply the gradient method for this convex problem. Stochastic tabu search approach is developed to find high quality feasible solution in initial node of the branching tree. Moreover, we accumulate statistical information by this local search and use it in new branching rule. The idea of backdoor branching [2] is modified to this end. Computational experiments for the test instances from [3] indicate that the local search algorithm takes a small number of steps in order to produce optimal or near optimal solutions.

REFERENCES

1. Yu. Kochetov, N. Kochetova, A. Plyasunov. *A matheuristic for the leader–follower facility location and design problem* — Metaheuristic International Conference (MIC 2013), Singapore, August 4–8 2013.

2. M. Fischetti, M. Monaci. *Backdoor branching* — INFORMS Journal on Computing. — 2013. — Vol. 25, N 4. — P. 693–700.

3. R. Aboolian, O. Berman, D. Krass. *Competitive facility location and design problem* — Eur. J. Oper. Res. — 2007. — Vol. 182. — P. 40–62.