Upper Bound for a Problem of Competitive Facility Location and Capacity Picking in a Case of Multiple Demand Scenarios*

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The paper considers a bilevel mathematical model where two competing parties sequentially open their facilities with the aim to capture customers and maximize profit. One of the parties, called a Leader, opens its facilities first, and after it, knowing Leader's decision, another party, called a Follower, opens its facilities at the second turn. Customer capture depends on customer's preferences which are given by linear order on the set of potential locations. The party captured the customer can assign only those facilities to serve him or her which are more preferable for the customer than any competitor's facility.

In the model under consideration, multiple demand scenarios are possible, but only one of them is to be realized. That scenario is revealed after Leader's turn and before the Follower's one. Thus, Follower makes its decision knowing both Leader's decision and the set of customers with all their attributes. We assume that operating cost of the facility is a sum of its fixed cost and a term which is proportional to the facility's capacity. Leader's goal in the competition is to determine the set of open facilities and their capacities so that that its profit is maximized in a worst scenario while Follower acts rationally by maximizing own profit in each scenario as well.

The present paper presents further progress of the method of estimating problems construction what enables us to calculate upper bounds for competitive location problems and develop methods to solve them optimally. The method consists in formulating additional constraints of Leader's problem which improve high-point problem estimations. The technique was introduced in [1, 2] and extended by adding new constraints improving the quality of the upper bounds obtained.

References

1. Beresnev, V.: On the competitive facility location problem with a free choice of suppliers. Automation and Remote Control 75, 668–676 (2014)
2. Beresnev, V., Mel'nikov, A.: The branch-and-bound algorithm for a competitive facility location problem with the prescribed choice of suppliers. Journal of Applied and Industrial Mathematics 8, 177–189 (2014)

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