On some effective algorithms for solving capacitated clustering and location problems on the tree and the real line

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Keywords: capacitated FLP, exact algorithm, tree network, line graph

The network $G = (V, E)$ is considered. At the vertices of the set $V = \{1, \ldots, n\}$ there are consumers of some product and possible places of its production. For each vertex $i \in V$, there are given demand volume b_i, the cost g_i^0 for the placement of the facility and the restriction a_i on the facility's capacity. For each edge $e \in E$, there are given the cost transportation of the product unit and the maximum quantity c_e of a product that can be transported along this edge. It is required to find open facilities which satisfy all demand with minimal total cost of opening facilities and delivering consumers.

The report proposes an exact algorithm for solving the problem on a tree network with time complexity $O(nb^2)$ (where $b = \sum_{i=1}^{n} b_i$). We note that in [1] an algorithm is given with the same time complexity, but in the case of unlimited production volumes, and the algorithm in [2] solves a problem on a linear graph without restrictions on edge capacities in time $O(n^5)$.

In the case of unit demand, the algorithm proposed in the report works in time $O(n^3)$. An algorithm in [3] works with the same time complexity, but in the case of a linear graph and the absence of constraints on the edge capacities.

References

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* The authors are supported by the Russian Foundation for Basic Research grants 16-07-00168 and 15-01-00976.