

On Some Efficiently Solvable Classes of the Network Facility Location Problem with Constraints on the Capacities of Communication Lines

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Abstract—We study the network facility location problem with constraints on the capacities of communication lines, called Restricted Facility Location Problem (RFLP). It is required to locate facilities at the vertices of a given network graph so as to simultaneously satisfy at minimum cost the demands of customers located at the vertices of the graph. We consider two statements of the problem: the multiple allocation RFLP, where the demand of a customer can be satisfied jointly by several facilities, and the single allocation RFLP, where the demand of a customer must be entirely satisfied by a single facility. We show that the single allocation RFLP is NP-hard even if the network is a simple path and strongly NP-hard if the network is a tree. The multiple allocation RFLP is weakly NP-hard on trees. For this problem, we propose a pseudopolynomial-time algorithm for the case where the network graph has constant treewidth and a linear-time algorithm for the case where the network is a simple path.

Keywords: facility location problem, capacities, multiple allocation, single allocation, NP-hard problem, treewidth, pseudopolynomial-time algorithm, polynomial-time algorithm.

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