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An Exact Solution Approach for Multi-objective Location-Transportation Problem for Disaster Response

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Abstract

This paper considers a three-objective location-transportation problem for disaster response. The location problem aims at determining the number, the position and the mission of required humanitarian aid distribution centers (HADC) within the disaster region. The transportation problem deals with the distribution of aid from HADCs to demand points. Three conflicting objectives are considered. The first objective minimizes the total transportation duration of needed products from the distribution centers to the demand points. The second objective minimizes the number of agents (first-aiders) needed to open and operate the selected distribution centers. The third objective minimizes the non-covered demand for all demand points within the affected area. We propose an epsilon-constraint method for this problem and prove that it generates the exact Pareto front. The proposed algorithm can be applied to any three-objective optimization problem provided that the problem involves at least two integer and conflicting objectives. The results obtained in our experimental study show that the computing time required by the proposed method may be large for some instances. A heuristic version of our algorithm yielded, however, good approximation of the Pareto front in relatively short computing times.

Keywords: Emergency response, location-transportation problems, multi-objective combinatorial optimization, exact method, epsilon-constraint method.

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