A genetic algorithm based approach to vehicle routing problem with indirect deliveries in humanitarian logistics

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Abstract

Humanitarian logistics specializes in the coordination of activities for the delivery of supplies and services after the occurrence of natural catastrophes (earthquakes, tsunamis or floods), and man-made crises (wars, spills or nuclear emergencies).
One of the most critical aspects is the distribution of humanitarian aid (water, food, personal items, health care assistance) to affected people, who are located separately in the disaster zone. Decisions on vehicle routing play an important role, since it determines the efficiency and effectiveness of disaster relief activities.

Humanitarian agencies should consider different criteria for delivering limited supplies by means of constrained resources. Apart from early response, equality and fair distribution among aid-recipients need to be considered.

The purpose of the study is to provide a modelling approach to deal with aid-distribution in the initial phase of response, taking into account the particularities in humanitarian relief operations. It considers disconnections in the routing system between nodes caused by inaccessible ways, for which an auxiliary transportation mode is necessary.
The mathematical model aims to minimize the total suffering of the system based on a cumulative time function. The problem is known to be a VRP with cumulative-time objective and indirect deliveries. The solution approach is based on MIP models that solve to optimality small instances. Additionally, an approximated approach based on genetic algorithms proves to return close-to-optimal solution for medium-size instances randomly generated.

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