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Last-mile Delivery with Crowdshipping: a multi-objective approach

Crowdshipping has emerged as an innovative solution for last-mile delivery, in which customers can receive their groceries, parcels, or other purchases delivered by ordinary individuals (occasional couriers) instead of by a professional courier. This strategy offers faster, more cost-effective same-day delivery and greater flexibility to meet fluctuating demand. Occasional couriers (OCs) can be categorized as dedicated OCs, who register with platforms and accept delivery tasks proactively, or en-route OCs, who are in-store customers delivering goods along their usual routes. While most research has focused on minimizing delivery costs, customer satisfaction is also vital to the success of this model. This study adopts a multi-objective approach to minimize total delivery costs while maximizing service levels. The first objective includes costs associated with professional fleets, en-route OCs, and dedicated OCs. The second focuses on improving service by minimizing deviations from customers'preferred time windows. We developed a bi-objective heuristic based on the Greedy Randomized Adaptive Search Procedure (GRASP) to address these objectives, incorporating multi-directional improvement strategies. The heuristic explores the solution space using a combination of intra-route (relocate, exchange, 2-opt) and inter-route (insert, crossover, swap) operators during the local search. This method effectively approximates the Pareto front.

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