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## Multi-Objective Heuristics for the Vehicle Routing Problem

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Abstract—The distribution service of commodities has tremendous impacts on cost-effective performance and level of customer satisfaction for third party logistics. One of main concerns is how to balance workloads among vehicles and ensure delivery time for each vehicle within the required duration. In this study, a multi-objective mixed zero-one integer programming model for the vehicle routing problem with balanced workload and delivery time are presented. In order to provide high quality solutions in short period of computational times, a heuristic-based solution method is developed. In the developed heuristic, we first generate an initial solution using savings-based procedures. Next, we devise heuristic-based procedures to improve solutions and to make sure that the workload and delivery time for each vehicle are within the limits. Then, a search heuristic procedure is used to ensure that every route is balanced in terms of workload and delivery time. An industrial size problem is applied for illustrating the proposed approach. The obtained vehicle routing schedule is better than the existing one in terms of balance in workload and delivery time among each vehicle. We also perform the computational efforts by running the developed heuristic for 12 case problems. Results suggest that the developed heuristics performs satisfactorily in terms of solution quality and execution time.

Keywords-Vehicle routing problem, Multi-objective optimization model, Heuristics

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