Combining Constraint Programming and Tabu Search to Solve Vehicle Routing Problem with Time Windows

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Abstract: The vehicle routing problem with time windows (VRPTW) is an extension of the vehicle routing problem (VRP) where the service at each customer must start within an associate time window. The goal is to determine the optimal set of routes to be performed by a fleet of vehicles to serve a given set of customers, without violating all predefined capacity constraints and time window constraints. In this work, we propose a two-stage approach to solve VRPTW. The first stage aims to minimize the number of vehicles used and the second stage is to minimize the total travel distance performed by the used vehicles. The approach is based on a combination of Tabu search method and constraint programming technology. The main idea is to apply the power of constraint propagation in constraint programming to reduce the computational cost when Tabu search needs to scan the whole neighborhood to find the best non-tabu moves at each iteration.

We experimented the proposed approach on Solomon's 56 VRPTW benchmark instances. Experimental results show that the approach is very effective in minimizing the number of vehicles used and also yields the solutions with the total travel distances close to the best results reported in literature.

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