A Powerful Route Minimization Heuristic for the Vehicle Routing Problem with Time Windows

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The vehicle routing problem with time windows (VRPTW) is one of the most important and widely studied problems in the operations research. The objective of the VRPTW is to minimize the number of routes (primary objective) and, in case of ties, the total travel distance (secondary objective). Given the hierarchical objective, most of the recent and best heuristics for the VRPTW use a two-stage approach where the number of routes is minimized in the first stage and the total distance is then minimized in the second stage. It has also been shown that minimizing the number of routes is sometimes the most time consuming and challenging part of solving VRPTWs.

In this talk, we will present an efficient heuristic method for reducing the number of routes in VRPTWs. The suggested method is based on the idea of the ejection pool that is combined here with the tabu search framework to determine the ejections. Moreover, we incorporate a powerful insertion procedure that accepts temporal infeasible insertions, followed by an attempt to restore the feasibility.

The suggested method was tested on the 300 well-known large-scale benchmark problems of Gehring and Homberger. The computational results demonstrate that the proposed method outperforms the best heuristics that have been applied to these benchmarks in terms of the number of routes. It found all best-known and 18 new best-known solutions, resulting in 10290 of the cumulative number of routes.