Metaheuristics for the vehicle routing problem with job availability constraints

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Keywords: Vehicle routing, scheduling, weighted tardiness, release dates, hybrid population-based metaheuristics, path-relinking.

Abstract

We describe a novel vehicle routing and scheduling problem which generalises the capacitated vehicle routing problem. This general problem introduces release dates, due dates and weights per unit of tardiness for each customer/order. An order becomes available at the depot on its release date; a route cannot begin until all assigned orders are available. The objective is to minimise a sum of the total distance travelled and weighted tardiness. We emphasise the separate routing and scheduling objectives differently, producing a variety of objective functions. A goal of this work is to integrate concepts and experience from both machine scheduling and vehicle routing, with both practical and theoretical motivations.

We propose heuristics to solve instances of practical size and difficulty. A path-relinking algorithm has been designed featuring strategic solutions recombination, neighbourhood search to improve offspring solutions, and population diversity control. The performance is benchmarked against a standard iterated local search obtained by extending the same neighbourhood search. These approaches apply the neighbourhood search frequently, we therefore utilise efficient neighbourhood exploration techniques and propose a logarithmic time move evaluation technique.

A set of benchmark instances has been generated to capture a sufficient variety for this investigation. Using these extensive computational testing has been performed. We present results from the parameter calibration for the path-relinking algorithm, and compare and analyse the experimental performance.