# Experimental Analysis of Metaheuristic Algorithms for the VRPTW

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The vehicle routing problem with time windows (VRPTW) is an extension to the traditional vehicle routing problem for which a large number of heuristic procedures have been proposed. A general methodology to evaluate heuristic performance on these problems is still missing. In the current literature on vehicle routing, heuristic performance is commonly evaluated through tests performed on some benchmark problem set. Such an approach limits, however, any conclusions made to the specific problems considered in this benchmark set. Statistical meaningful conclusions can be obtained by applying an experimental design on the different levels of the various algorithmic parameters and by using the appropriate techniques for comparing results.

Only a small number of papers ([2],[7], ...) have made notion of using either design of experiment techniques or statistical tools for exploring data and testing hypotheses, even though this need for more scientific rigour in the operations research and heuristic community was already called for many years ago([1], [3],[4], ...). Hooker [3], for example, discussed the competitive emphasis used in testing heuristic algorithms and stated that while this may indicate which algorithms perform better, it does not give any explanation why these are better. Even more, the competitive approach only tells us which algorithm is better for the collection of test instances used in the experimentation stage. Without the use of proper statistical analysis, no conclusions can be made for unseen problem instances [5]. A heuristic algorithm performing well on some set of standard benchmark problems does not generalize to it working well on any problem set. Although these statements date back twenty years ago, they are still relevant

today since a lot of current research still focuses on being competitive rather than gaining knowledge and understanding.

Current VRP research can therefore make a significant methodological progress by applying a statistical approach to obtain a more rigorous evaluation and gain a more complete insight in and understanding of the different results. This research aims at developing such a methodological framework. It proposes to apply a multilevel regression perspective in order to gain complete insights over the full range of algorithmic parameter values and problem characteristics. These insights will provide an understanding of how performance is affected by the addition of a component or by changing a parameter to another level, which combinations of parameter values and heuristic components perform well or not and how the problem characteristics influence this relationship with performance. Does the applied change lead to a better performing metaheuristic in a statistically significant way, or are any performance gains simply due to chance[7] ?

A first analysis will be performed on a set of artificially generated VRPTW instances that are solved using a simplified version of the Adaptive Large Neighbourhood Search metaheuristic [6].

## Références


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