Attempting Transformation Strategies Conserving Sparsity between Arc and Node Routing Problems

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Among the class of routing problems, Vehicle Routing Problems, namely VRP, are the most studied. Although Arc Routing Problems (ARP) have large and wide real applications, but they were not well developed until the last decades. Most arc routing problems are defined on sparse graphs. A sparse graph is a graph whose number of edges is relatively small by comparing it to its number of vertices. As there is no strict distinction between sparse and dense graphs, we may give here an attempt to define what a sparse graph looks like. Let $G = (V, E)$ be a graph where V is the set of vertices and E is the set of edges. G is said to be sparse if $|E| = O(|V|^{\alpha})$ with $1 < \alpha < 2$. In this work, we present a new transformation technique that transforms the Capacitated Arc Routing Problem (CARP) into Capacitated Vehicle Routing Problem (CVRP) conserving the structure of the problem as well as the structure of the graph itself. This technique shows its efficiency on some particular sparse graphs, and this is validated by numerical instances. It should be mentioned that all previous transformations of ARP into VRP have considered the obtained VRP on its complete graph ([1], [3]). The main contribution of our work is that the introduced transformation transforms an ARP on a sparse graph into a VRP on a sparse graph too, and as the first consideration of VRP on its sparse original graph has been done by Oukil [2], we can invest his obtained results to solve the obtained VRP on its sparse graph without considering the complete one.

References

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