

## **A Polynomial Time Clustering Algorithm for Solving the Assignment Problem in the Vehicle Routing Problem**

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**Abstract :** The vehicle routing problem (VRP) consists of a group of customers that needs to be served. Each customer has a certain demand of goods. A central depot having a fleet of vehicles is responsible for supplying the customers with their demands. The problem is composed of two subproblems: The first subproblem is an assignment problem where the number of vehicles that will be used as well as the customers assigned to each vehicle are determined. The second subproblem is the routing problem in which for each vehicle having a number of customers assigned to it, the order of visits of the customers is determined. Optimal number of vehicles, as well as optimal total distance, should be achieved. In this paper, an approach for solving the first subproblem (the assignment problem) is presented. In the approach, a clustering algorithm is proposed for finding the optimal number of vehicles by grouping the customers into clusters where each cluster is visited by one vehicle. Finding the optimal number of clusters is NP-hard. This work presents a polynomial time clustering algorithm for finding the optimal number of clusters and solving the assignment problem.

**Keywords :** vehicle routing problems, clustering algorithms, Clarke and Wright Saving Method, agglomerative hierarchical clustering

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