

Hybrid CW-GA Metaheuristic for the Traveling Salesman Problem

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Abstract. The Traveling Salesman Problem (TSP) is one of the most challenging problems in Logistics and Supply Chain Management. Its relevance in routing planning and distribution has significant impact on reduction of operative costs for all enterprises. However, due to its NP-hard complexity, it is difficult to obtain optimal solutions for TSP instances. This paper describes a hybrid approach based on Clarke and Wright (CW) and Genetic Algorithms (GA) to provide near optimal solutions for the TSP. Performance of this meta-heuristic was assessed by comparing it with other well-known methods such as CW, GA and Tabu-Search (TS). Results obtained from experiments with TSP instances corroborated the suitability of the hybrid approach for the TSP.

Keywords: traveling salesman problem, tabu search, metaheuristics, Clarke and Wright, genetic algorithms.

1 Introduction

The Traveling Salesman Problem (TSP) [1] is one of the most important and challenging problems in Logistics and Supply Chain Management. This is because operative costs associated to transportation and distribution are correlated to the efficiency of route planning, and TSP is focused on finding the route of minimum distance to cover a set of customer points.

However, solving the TSP is a computational task of NP-hard complexity. Thus, it is difficult to obtain exact or optimal solutions for large instances of the TSP (number of customer points higher than 100). This is the reason why the TSP is one of the combinatorial optimization problems that has attracted many researchers to propose and analyze metaheuristic algorithms to solve it in polynomial time. Among the algorithms used for this purpose, the following can be mentioned: Genetic algorithms (GA) [2], Tabu-Search (TS) [3], Clarke and Wright (CW) [4].

For GAs different strategies and implementations have been proposed. This has led to different reported performance for the TSP: average errors from best-known solutions between 1.56% and 7.64% for 14 TSP instances [5], 0.00% to 1.62% for 40 instances [6], 0.00% to 2.54% for 22 TSP instances [7], 0.00% to 2.46% for 29 instances