Optimizing Prioritized Vehicle Routing: A Tailored Approach with a Modified Clarke-Wright Algorithm Emphasizing Route Time and Customer Priority

Rabih Tarraf[1], Kassem Danach[1]
[1] Faculty of Business Administration, Al Maaref University, Beirut, Lebanon
{rabih.tarraf,Kassem.danach}@mu.edu.lb

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1 Introduction

In the domain of logistics and transportation, the Vehicle Routing Problem (VRP) stands as a formidable challenge, particularly for large enterprises aiming to streamline their operations. The crux of this combinatorial problem lies in efficiently distributing goods from one or more depots to customers with known demands, all while adhering to a set of realistic constraints. The Clarke-Wright algorithm has long been a go-to solution for its computational efficiency, making it a practical choice for handling large-scale logistics tasks.

However, the simplicity and computational efficiency of the Clarke-Wright algorithm come with a trade-off – it doesn't offer a guarantee of producing solutions that are close to the optimum. This limitation becomes more apparent in complex scenarios with diverse constraints and dynamic factors, potentially leading to suboptimal solutions.

This work addresses a critical concern faced by enterprises – the need to efficiently serve prioritized customers within the constraints of a vehicle routing framework. To meet this challenge, we propose a modified version of the Clarke-Wright algorithm that places emphasis on two crucial aspects: route time and customer priority. The modification ensures that all customers are serviced in a timely manner based on their pre-assigned priorities, taking into account the required working hours.

The evaluation of our modified algorithm demonstrates its effectiveness in not only optimizing routes but also in addressing the priority assigned to customers. The results indicate significant improvements over the traditional Clarke-Wright algorithm, offering a valuable solution for enterprises seeking to balance computational efficiency with the need to prioritize certain customers.

This research contributes to the field of vehicle routing by presenting an algorithmic modification that enhances the Clarke-Wright approach. As with any algorithm, the choice between computational efficiency and solution optimality is nuanced, and our modified algorithm provides a pragmatic solution for enterprises navigating the complexities of prioritized vehicle routing.

2 Problem Statement

The Vehicle Routing Problem (VRP) poses a significant logistical challenge for large enterprises aiming to optimize their transportation operations. While the Clarke-Wright algorithm is known for its computational efficiency, it lacks inherent mechanisms to address the prioritization of customers efficiently. This becomes a critical concern for enterprises with diverse customer priorities and various constraints such as route time and working hours. The standard Clarke-Wright algorithm may generate suboptimal solutions in scenarios requiring the prioritized servicing of customers.

3 Objective

The primary objective of this research is to enhance the Clarke-Wright algorithm to cater specifically to the needs of enterprises seeking efficient prioritized customer service in the context of vehicle routing. The modification aims to address both route time and customer priority, ensuring timely deliveries while optimizing overall logistics efficiency. The objective is to provide enterprises with an improved algorithm that aligns with the complexities of real-world vehicle routing scenarios, offering a more effective solution for their logistical challenges.

4 Conclusion

In conclusion, this research endeavors to address a critical aspect of the Vehicle Routing Problem (VRP) by enhancing the Clarke-Wright algorithm to accommodate the prioritization of customers based on route time and customer priority. While the Clarke-Wright algorithm is celebrated for its computational efficiency, its simplicity and lack of mechanisms for prioritization may lead to suboptimal solutions, especially in scenarios where timely and prioritized customer service is essential.

The modified algorithm proposed in this research aims to strike a balance between computational efficiency and solution optimality. By incorporating considerations for route time and customer priority, the enhanced algorithm seeks to provide enterprises with a more effective tool for addressing their logistical challenges. The evaluation of the modified algorithm will shed light on its effectiveness in optimizing routes while ensuring the timely servicing of prioritized customers.

In essence, this research contributes to the ongoing dialogue on improving algorithms for solving real-world logistical problems. The findings from this study are expected to provide valuable insights for enterprises seeking solutions that align with the complexities of their operational requirements. As with any algorithmic enhancement, it is crucial to consider the trade-offs and select the most suitable tool based on the specific needs of the problem at hand.