Theoretical Algorithms Analysis Project

Project Overview

In addition to the practical implementation, you will select one algorithm that you used in your transportation optimization system and conduct an in-depth theoretical analysis. This component will test your understanding of algorithmic concepts, mathematical foundations, and analytical skills.

Requirements

1. Algorithm Selection

Choose one of the following algorithms that you implemented in your practical project:

- Minimum Spanning Tree algorithms (Kruskal's or Prim's)
- Shortest Path algorithms (Dijkstra's or A*)
- Dynamic Programming solutions for scheduling or resource allocation
- Greedy algorithms for optimization problems

2. In-Depth Analysis

Prepare a detailed analysis of your chosen algorithm covering:

- Mathematical foundations and formal proof of correctness
- Detailed complexity analysis (time and space)
- Comparison with alternative approaches
- Specific modifications you made for the transportation problem
- Performance characteristics and optimization opportunities

3. Presentation

Create a presentation (10-15 minutes) that includes:

- Introduction to the algorithm and its general applications
- Mathematical foundations and pseudocode
- Complexity analysis with rigorous proof
- Your specific implementation and modifications
- Performance analysis results
- Comparison with alternatives
- Conclusion and lessons learned