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ENEE469O
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Project Proposal: Reimplementation and Enhancement of a Transportation Cost Optimization Model

Project Title:
Rebuilding and Improving the Transportation Cost Minimization Model

Project Summary:
We are going to be doing a comprehensive reimplementation of the transportation cost optimization project found here: https://github.com/Sambonic/transportation-cost-minimization. This classic problem involves determining the most cost-efficient way to transport goods from multiple sources to multiple destinations while satisfying supply and demand constraints.

Our goal is to build a more robust, flexible, and analytically rigorous model from the ground up, applying the optimization and modeling techniques we have learned throughout the course. This includes both improving the model's structure and extending its capabilities to more complex and realistic logistical challenges.

What We're Doing:

- Reconstructing the transportation optimization model in Python using modern programming practices and clearly defined modular components.
- Expanding the model to accommodate real-world complexities such as variable supply/demand, route constraints, and cost structures.
- Testing the model against both synthetic and realistic datasets to evaluate accuracy, efficiency, and adaptability.
- Using data visualization tools to interpret and communicate optimization outcomes.

Techniques We Will Apply:

- **Linear Programming**: Formulating the transportation problem as a linear program and solving it using libraries such as PuLP and OR-Tools.
- **Problem Decomposition**: Structuring the model to clearly separate input data, constraint definitions, objective functions, and solver logic.

- **Sensitivity Analysis**: Exploring how changes in supply, demand, or cost affect the optimal solution.

- **Model Validation and Debugging**: Applying techniques such as constraint relaxation and step-by-step output analysis to verify correctness.

- **Visualization and Interpretation**: Using libraries like Matplotlib and Seaborn to visualize shipping flows, cost breakdowns, and optimization results.

Plan for Completion:
We will begin by carefully analyzing the original repository to understand its structure and assumptions. From there, we will reimplement the core functionality using modular code. Next, we will integrate enhancements that allow for greater flexibility in inputs and constraints, leveraging our knowledge of optimization modeling. Throughout the process, we will test our implementation using known datasets, compare results to the original model, and iterate on performance and clarity.