Optimization & Operations Research Projects

Hasan Çinar

Project 1: Multi-Commodity Distribution Network Design Optimization

Designed a cost-optimal distribution network for a multi-product supply chain, routing three commodity classes from regional distribution centers to retailers across a 10-node, 16-arc network. Formulated the problem as a fixed-charge, capacitated multi-commodity network flow MILP in Python/Gurobi, jointly optimizing which routes to activate (binary decisions with fixed opening costs) and how to allocate pallet flows under per-commodity variable costs, shared arc capacities, and flow conservation. The model delivers the minimum-cost network configuration, identifying exactly which lanes to open and the optimal flow plan for each product category.

Project 2: Route Optimization — Exact and Heuristic Approaches to the Traveling Salesman Problem

Solved a multi-stop routing problem end-to-end, combining exact optimization with classical heuristics to quantify the trade-off between solution quality and computational effort. Built a Gurobi MILP with Miller-Tucker-Zemlin subtour elimination to obtain the provably optimal tour, then implemented and benchmarked nearest-neighbor construction, the Clarke-Wright savings algorithm, and 2-opt exchange-based local search against it. The analysis verified that the improved heuristic tour matched the exact optimum, demonstrating both rigorous modeling and practical algorithm evaluation skills.

Project 3: Strategic Facility Location and Capacity Planning

Developed a full decision-support workflow for warehouse siting, from continuous-space screening to discrete optimization. Applied the center-of-gravity method and total annual cost analysis (facility + transportation) to compare candidate regions, built a MILP in Gurobi to select the best new warehouse among candidate sites while re-optimizing shipment flows to demand zones, and formulated a generalized facility location model incorporating capacity expansion options and unmet-demand penalties. The result is a defensible, cost-ranked location recommendation backed by an extensible optimization framework.

Project 4: Assignment-Based Patching Heuristic for Large-Scale Asymmetric TSP

Engineered a scalable solution pipeline for the asymmetric traveling salesman problem where exact methods become impractical. The system solves an assignment problem relaxation with Gurobi, detects the resulting subtours, and iteratively merges them via a minimum-cost-increase patching procedure until a single feasible tour emerges — reporting the optimality gap contributed by each patch. Includes a robust data-ingestion layer (pandas/NumPy) that automatically locates and cleans cost matrices from unstructured Excel files, making the tool reusable on new datasets without manual preprocessing.