Jay Vijay Nehete

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Research Interests

Optimization and analytics in operations management, data-driven decision-making, healthcare and service operations, supply chain optimization, algorithmic approaches for managerial decision systems.

Education

Master of Science in Computer Science August 2023 – August 2025
Texas A&M University, College Station, TX GPA: 3.89/4.00
Relevant Coursework: Design of Algorithms, Machine Learning, Statistics in Research, Generative AI, Survey of Optimization

Bachelor of Engineering in Computer Engineering August 2019 – July 2023
Savitribai Phule Pune University, India GPA: 9.36/10.00

Research Experience

Research Assistant October 2023 – May 2025
Information and Operations Management Department, Mays Business School, College Station, TX
Project: Optimization of Single-Donor Organ Exchange Chains
Advisors: Dr. Chelliah Sriskandarajah, Dr. Jon Stauffer, Dr. Rakesh Mallipeddi & Dr. Yunxia Zhu

- Developed and implemented **mixed-integer programming models** to maximize transplant success rates in **single-donor kidney exchange chains** under multiple medical compatibility criteria including blood type and donor-patient compatibility constraints.
- Coded algorithms for **optimal chain construction** and developed computational framework demonstrating **strong NP-Hardness** of the general problem with exact algorithms for special cases.
- Implemented chain mechanism optimization using **Python and Gurobi**, conducting computational experiments on realistic kidney exchange network instances and developed **heuristic algorithms** to solve large-scale instances efficiently.
- Achieved **an optimality gap of 13%** between exact and heuristic solutions while improving the running time from hundreds of seconds to seconds, enabling real-time decision support for organ allocation.

Research Assistant October 2023 – May 2025
Information and Operations Management Department, Mays Business School, College Station, TX
Project: Two-Stage Outpatient Clinic Scheduling with Patient No-Shows
Advisors: Dr. Chelliah Sriskandarajah & Dr. Jon Stauffer

- Implemented complete **optimization framework** for **block scheduling** in two-stage clinics with physician-PA coordination under patient heterogeneity, **no-show uncertainty**, and **robust overbooking strategies**.
- Translated **heuristic algorithms** from theoretical foundations into executable Python systems, including **no-idle scheduling procedures** and **block sequence optimization** methods using **Gurobi**.
- Implemented **stochastic and robust programming models** to minimize weighted costs of provider idle time, overtime, and patient waiting time under service time uncertainty and probabilistic patient arrival.
- Conducted computational experiments comparing deterministic heuristics with **robust optimization approaches** across scenarios in healthcare operations modeling and combinatorial algorithm design.

Independent Research Projects

Electric Vehicle Routing Problem with Time Windows

- Formulated and implemented **mixed-integer linear programming model** for **electric vehicle routing optimization** under battery capacity constraints, time windows, and vehicle capacity limits using **Miller-Tucker-Zemlin subtour elimination**.
- Designed solution framework combining **exact MILP methods** using Gurobi with **constructive heuristics** like greedy nearest-neighbor.
- Developed **computationally tested** generating synthetic instances (10-30 customers) and conducted extensive experiments comparing exact versus heuristic solution quality and computational efficiency trade-offs.
- Demonstrated **MILP optimality** for instances up to 20-30 customers within acceptable time limits, while heuristics enabled real-time decisions for larger fleets with **less than 5% optimality gap**.

Fair Maximum Diversity Selection with Equity Constraints

- Implemented **mixed-integer linear programming model** for **Maximum Diversity Problem (MDP)** extending classical diversity maximization with **fairness constraints** ensuring minimum group representation.

- Implemented and compared **exact MILP methods** with **metaheuristic algorithms** (greedy construction, GRASP) on randomly generated benchmark instances.
- Demonstrated **proven optimality** for instances up to 50 elements within one minute using linearized MILP; **GRASP achieved optimal solutions 50-90 times faster** for larger instances with greedy heuristic deviating only **0.25-2.25% from optimality**.
- Contributed algorithmic implementations and empirical insights for **equity-aware combinatorial selection problems**, with applications in portfolio optimization, facility location, and team formation.

Predict-then-Optimize Portfolio Allocation under Operational Constraints

- Developed integrated **predictive-prescriptive framework** combining **Ridge regression forecasting** with Gurobi-implemented **mean-variance portfolio optimization** under turnover and concentration constraints.
- Designed **two-stage decision system**: (i) per-asset supervised learning models generating expected return forecasts from momentum, volatility, and lagged features; (ii) constrained quadratic optimizer allocating capital to maximize risk-adjusted returns.
- Implemented **Ledoit-Wolf covariance shrinkage** for high-dimensional risk estimation and linearized turnover constraints via buy-sell variable decomposition in MILP formulation.
- Conducted **walk-forward backtesting** on 10 large-cap equities, achieving **284.5% cumulative return**, **2.18 Sharpe ratio**, and 30.9% maximum drawdown across 352 rebalances.

Technical Skills

Programming Languages: Python (NumPy, Pandas, SciPy, scikit-learn), C++, Java, SQL
Optimization Software: Gurobi, Python optimization libraries (PuLP, OR-Tools)
Modeling Frameworks: Mixed-integer linear programming, stochastic programming, robust optimization, heuristic algorithm design
Data Analysis & ML: Statistical analysis, machine learning (regression, classification), deep learning, reinforcement learning, time series forecasting, data visualization
Development Tools: Git, Jupyter Notebook, LaTeX, high-performance computing environments