Report on Supermarket Shelf Space Optimization

Course: IE 501 - Optimization Models

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Overview

Efficient shelf space allocation is crucial for maximizing supermarket profitability. With limited space and increasing customer demands, the project focuses on developing an optimization model to allocate products to shelves while considering real-world constraints and parameters.

Objective

The primary objective of this project is to maximize revenue through optimized product placement. Parameters such as shelf capacity, weight, height, visibility, and product-specific factors like demand, space usage, fragility, and turnover are incorporated into the model. The problem is formulated as a Mixed-Integer Linear Programming (MILP) model using Pyomo/GLPK.

Key Methodology

- **Model Formulation:** Defined decision variables, constraints, and an objective function to maximize profitability.
- **Data Simulation:** Simulated product details including demand, profit margins, and physical constraints.
- **Optimization Technique:** Used MILP to allocate products efficiently.

Constraints

The model ensures adherence to shelf space, fragility, weight, height, and diversity constraints. Linearization techniques were employed to maintain computational efficiency.

Outcome

The MILP model provided optimized shelf allocations, detailing which products and how many facings should be assigned to each shelf. This solution enhances customer satisfaction by ensuring product availability, minimizes operational costs, and maximizes profitability.

Conclusion

This project demonstrates the potential of optimization techniques in retail management. The approach is scalable and can address real-world challenges effectively, making it a valuable tool for improving supermarket operations.

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