# Linear Programming Model – Supermart Grocery Optimization

## Objective

The objective of this Linear Programming (LP) model is to determine the optimal monthly stock quantity for each product category in order to maximize profit while staying within budget, storage capacity, and demand limits.

## Decision Variables

Let the decision variables represent the quantity of each category to stock monthly:  
- x₁ = Oil & Masala  
- x₂ = Beverages  
- x₃ = Food Grains  
- x₄ = Fruits & Veggies  
- x₅ = Bakery  
- x₆ = Snacks  
- x₇ = Eggs, Meat & Fish

## Objective Function

Maximize Z = 365.83x₁ + 375.43x₂ + 378.51x₃ + 374.05x₄ + 374.04x₅ + 375.28x₆ + 380.78x₇  
  
Where:  
- Coefficients are the average profit per unit for each category  
- The solution gives maximum profit Z = ₹1,42,857.14 for x₃ = 75.62 and x₇ = 300

## Constraints

1. Storage Capacity Constraint:

1.5x₁ + 2x₂ + 3x₃ + 1x₄ + 2x₅ + 1x₆ + 1.5x₇ ≤ 5000  
Actual used: 226.87 (x₃) + 450 (x₇) = 676.87 ≤ 5000

2. Budget Constraint:

256.08x₁ + 262.80x₂ + 264.96x₃ + 261.83x₄ + 261.83x₅ + 262.70x₆ + 266.54x₇ ≤ 100000  
Actual used: ₹20,036.90 (x₃) + ₹79,963.10 (x₇) = ₹100000

3. Maximum Demand Limits:

x₁ ≤ 800, x₂ ≤ 600, x₃ ≤ 500, x₄ ≤ 400, x₅ ≤ 400, x₆ ≤ 500, x₇ ≤ 300  
Satisfied values: x₁=0, x₂=0, x₃=75.62, x₄=0, x₅=0, x₆=0, x₇=300

## Solution Summary

Optimal Quantities to Stock Monthly:  
- Food Grains: 75.62 units  
- Eggs, Meat & Fish: 300 units  
  
Total Profit Achieved: ₹1,42,857.14  
Total Cost Incurred: ₹1,00,000  
Total Space Used: 676.87 units  
All constraints satisfied.