Assignment 02-QMM

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**The Problem has been solved under the following basis.**

# 1. Objective

Maximize the profit = (420 X y no of Large) + (360 X y no of Medium) + (300 X y no of small)

# 2. Constraints and Assumptions

**Capacity constraints (per plant) - Each plant has a maximum capacity**

• Plant 1: yLarge +yMedium + ySmall ≤ 750

• Plant 2: yLarge +yMedium + ySmall ≤ 900

• Plant 3: yLarge +yMedium + ySmall ≤ 450

**Storage constraints - Storage space per plant**

• 20 × yLarge +15 × yMedium + 12 × ySmall ≤ 13,000 for Plant 01

• 20 × yLarge +15 × yMedium + 12 × ySmall ≤ 12,000 for Plant 02

• 20 × yLarge +15 × yMedium + 12 × ySmall ≤ 5,000 for Plant 03

**Sales constraints - The maximum number of each size that can be sold**

• yLarge plant 1+ yLarge plant 2 + yLarge plant 3 ≤ 900 for large

• yMedium plant 1+ yMedium plant 2 + yMedium plant 3 ≤ 1,200 for medium

• ySmall plant 1+ ySmall plant 2 + ySmall plant 3 ≤ 750 for small

**Equal capacity usage: Each plant uses the same percentage of its total capacity**

# Load the lpSolve library  
library(lpSolve)  
  
# Coefficients of the objective function (profit per unit)  
objective <- c(420, 360, 300, 420, 360, 300, 420, 360, 300) # Large, Medium, Small for 3 plants  
  
# Constraints matrix  
constraints <- matrix(c(  
 # Capacity constraints  
 1, 1, 1, 0, 0, 0, 0, 0, 0, # Plant 1 (<= 750)  
 0, 0, 0, 1, 1, 1, 0, 0, 0, # Plant 2 (<= 900)  
 0, 0, 0, 0, 0, 0, 1, 1, 1, # Plant 3 (<= 450)  
   
 # Storage constraints  
 20, 15, 12, 0, 0, 0, 0, 0, 0, # Plant 1 (<= 13000 sq ft)  
 0, 0, 0, 20, 15, 12, 0, 0, 0, # Plant 2 (<= 12000 sq ft)  
 0, 0, 0, 0, 0, 0, 20, 15, 12, # Plant 3 (<= 5000 sq ft)  
   
 # Sales constraints  
 1, 0, 0, 1, 0, 0, 1, 0, 0, # Large sizes (<= 900)  
 0, 1, 0, 0, 1, 0, 0, 1, 0, # Medium sizes (<= 1200)  
 0, 0, 1, 0, 0, 1, 0, 0, 1 # Small sizes (<= 750)  
), nrow = 9, byrow = TRUE)  
  
# RHS of the constraints  
rhs <- c(750, 900, 450, 13000, 12000, 5000, 900, 1200, 750)  
  
# Constraint direction  
direction <- c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=")  
  
# Solve the linear programming problem  
solution <- lp("max", objective, constraints, direction, rhs)  
  
# Display the results  
solution$objval # The maximum profit

## [1] 708000

solution$solution # The optimal production plan

## [1] 350.0000 400.0000 0.0000 0.0000 400.0000 500.0000 0.0000 133.3333  
## [9] 250.0000