Assignment 02-QMM

Chandima Attanayake

2024-09-22

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
```

```r
# 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
```

```r
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
```