Quantitative Management Modeling Module 4

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#recalling LP model pacakge  
library(lpSolve)  
  
#it is a Maximization task  
#Where I asssign, x1-Number of large-sized units produced; x2-Number of medium-sized units produced;  
#x3-Number of small-sized units produced.  
# Maximize Z = 420x1 + 360x2 + 300x3  
  
#Constrains of maximizing of profit are as follows:  
  
##Production capacity constraints   
#Plant 1: x1 + x2 + x3 ≤ 750  
#Plant 2: x1 + x2 + x3 ≤ 900  
#Plant 3: x1 + x2 + x3 ≤ 450  
  
##Storage space constraints for plants  
#Plant 1: 20x1 + 15x2 + 12x3 ≤ 13,000  
#Plant 2: 20x1 + 15x2 + 12x3 ≤ 12,000  
#Plant 3: 20x1 + 15x2 + 12x3 ≤ 5,000  
  
  
##Sales forecasts constraint: 900x1 + 1200x2 + 750x3 ≤ Total Sales a DAY  
  
# Coefficients for the objective function (profit)  
f\_obj <- c(420, 360, 300)  
  
# Define the matrix of coefficients for the constraints  
f\_con <- matrix(c(  
 1, 1, 1,  
 1, 1, 1,  
 1, 1, 1,  
 20, 15, 12,  
 20, 15, 12,  
 20, 15, 12  
), nrow = 6, byrow = TRUE)  
print (f\_con)

## [,1] [,2] [,3]  
## [1,] 1 1 1  
## [2,] 1 1 1  
## [3,] 1 1 1  
## [4,] 20 15 12  
## [5,] 20 15 12  
## [6,] 20 15 12

# Define the right-hand side values for the constraints  
rhs <- c(750, 900, 450, 13000, 12000, 5000)  
  
  
# Define the direction of the inequalities (all <= constraints)  
dir <- rep("<=", 6)  
  
# Define the coefficients of the equation  
coeff\_x1 <- 900  
coeff\_x2 <- 1200  
coeff\_x3 <- 750  
  
# Calculate the Total Sales as the sum of the coefficients  
Total\_Sales <- coeff\_x1 + coeff\_x2 + coeff\_x3  
  
# Sales forecasts constraint (optional, if provided)  
if (Total\_Sales <= max(rhs)) {  
 rhs <- c(rhs, Total\_Sales)  
 f\_con <- cbind(f\_con, c(coeff\_x1, coeff\_x2, coeff\_x3))  
 dir <- c(dir, "<=")  
} else {  
 cat("Sales Forecasts constraint cannot be added as it exceeds plant capacity.\n")  
}  
  
# Solve the linear programming problem  
lp\_solution <- lp(direction = "max", objective.in = f\_obj, const.mat = f\_con, const.dir = dir, const.rhs = rhs)

## Warning in rbind(const.mat, const.dir.num, const.rhs): number of columns of  
## result is not a multiple of vector length (arg 2)

# Print the optimal solution  
print(lp\_solution)

## Success: the objective function is 420

# Calculate the optimal solution  
x1 <- lp\_solution$solution[1] # Number of large-sized units to be produced  
x2 <- lp\_solution$solution[2] # Number of medium-sized units to be produced  
x3 <- lp\_solution$solution[3] # Number of small-sized units to be produced  
max\_profit <- lp\_solution$objval # Maximum Profit (Z)  
  
# Print the results  
cat("Number of large-sized units to be produced (x1):", x1, "\n")

## Number of large-sized units to be produced (x1): 1

cat("Number of medium-sized units to be produced (x2):", x2, "\n")

## Number of medium-sized units to be produced (x2): 0

cat("Number of small-sized units to be produced (x3):", x3, "\n")

## Number of small-sized units to be produced (x3): 0

cat("Maximum Profit (Z):", max\_profit, "\n")

## Maximum Profit (Z): 420