# Pavan Chaitanya QMM Assignment 2 Module 4 LP Problem

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library(lpSolve)

# Objective Function is to maximize
# The objective function is then
# Max Z = 420L1 + 360M1 + 300S1 + 420L2 + 360M2 + 300S2 = 420L3 + 360M3 +
300S3

f.obj<-c(420,360,300,420,360,300,420,360,300)

# Subject to
#   L1 + M1 + S1 ≤ 750
#   L2 + M2 + S2 ≤ 900
#   L3 + M3 + S3 ≤ 450
#
#   20L1 + 15M1 + 12S1 ≤ 13000
#   20L2 + 15M2 + 12S2 ≤ 12000
#   20L3 + 15M3 + 12S3 ≤ 5000
#
#   L1 + L2 + L3 ≤ 900
#   M1 + M2 + M3 ≤ 1200
#   S1 + S2 + S3 ≤ 750
#
# Write down the above constraints using all 9 variables in each inequation
as follow:
# L1 + M1 + S1 + 0L2 + 0M2 + 0S2 + 0L3 + 0M3 + 0S3 ≤ 750
# 0L1 + 0M1 + 0S1 + L2 + M2 + S2 + 0L3 + 0M3 + 0S3 ≤ 900
# 0L1 + 0M1 + 0S1 + 0L2 + 0M2 + 0S2 + L3 + M3 + S3 ≤ 450
# 20L1 + 15M1 + 12S1 + 0L2 + 0M2 + 0S2 + 0L3 + 0M3 + 0S3 ≤ 13000
# 0L1 + 0M1 + 0S1 + 20L2 + 15M2 + 12S2 + 0L3 + 0M3 + 0S3 ≤ 12000
# 0L1 + 0M1 + 0S1 + 0L2 + 0M2 + 0S2 + 20L3 + 15M3 + 12S3 ≤ 5000
# L1 + 0M1 + 0S1 + L2 + 0M2 + 0S2 + L3 + 0M3 + 0S3 ≤ 900
# 0L1 + M1 + 0S1 + 0L2 + M2 + 0S2 + 0L3 + M3 + 0S3 ≤ 1200
# 0L1 + 0M1 + S1 + 0L2 + 0M2 + S2 + 0L3 + 0M3 + S3 ≤ 750

# The coefficients of the constraints can be written in the matrix form as
#   1 1 1 0 0 0 0 0 0
#   0 0 0 1 1 1 0 0 0
#   0 0 0 0 0 0 1 1 1
#   20 15 12 0 0 0 0 0 0
#   0 0 0 20 15 12 0 0 0
#   0 0 0 0 0 0 20 15 12
```

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#   1 0 0 1 0 0 1 0 0
#   0 1 0 0 1 0 0 1 0
#   0 0 1 0 0 1 0 0 1
#
# Formulating the Constraints in the Matrix form :

f.con<- matrix(c(1,1,1,0,0,0,0,0,0,
                 0,0,0,1,1,1,0,0,0,
                 0,0,0,0,0,0,1,1,1,
                 20,15,12,0,0,0,0,0,0,
                 0,0,0,20,15,12,0,0,0,
                 0,0,0,0,0,0,20,15,12,
                 1,0,0,1,0,0,1,0,0,
                 0,1,0,0,1,0,0,1,0,
                 0,0,1,0,0,1,0,0,1), nrow=9, byrow=TRUE)

#Seting the direction of inequalities constraints
f.dir <- c("<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=")

# seting the right hand side coefficients
f.rhs = c(750,900,450,13000,12000,5000,900,1200,750)

#Finding the value of Objective fUNCTION
lp("max",f.obj,f.con,f.dir,f.rhs)

## Success: the objective function is 708000

#Getting the values of Variables
lp("max",f.obj,f.con,f.dir,f.rhs)$solution

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