Assignment_2

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Formulation of LP problem

$$ \text{The objective function is Max} \hspace{.3cm} Z = 420(L_1+L_2+L_3)+360(M_1+M_2+M_3)+300(S_1+S_2+S_3)$$

$$ \text{Rearraning the objective function Max} \hspace{.3cm} Z = 420L_1 + 360M_1 + 300S_1 + 420L_2 + 360M_2 + 300S_2 + 420L_3 + 360M_3 + 300S_3 $$

subject to

$$L_1 + M_1 + S_1 \leq 750$$

$$L_2 + M_2 + S_2 \leq 900$$

$$L_3 + M_3 + S_3 \leq 450$$

$$20L_1 + 15M_1 + 12S_1 \leq 13000$$

$$20L_2 + 15M_2 + 12S_2 \leq 12000$$

$$20L_3 + 15M_3 + 12S_3 \leq 5000$$

$$L_1 + L_2 + L_3 \leq 900$$

$$M_1 + M_2 + M_3 \leq 1200$$

$$S_1 + S_2 + S_3 \leq 750$$

Non negativity constraints

$$L_1, L_2, L_3, M_1, M_2, M_3, S_1, S_2, S_3 \geq 0$$

The above LP problem constaraints can be written as

$$L_1 + M_1 + S_1 + 0L_2 + 0M_2 + 0S_2 + 0L_3 + 0M_3 + 0S_3 \leq 750$$

$$0L_1 + 0M_1 + 0S_1 + L_2 + M_2 + S_2 + 0L_3 + 0M_3 + 0S_3 \leq 900$$

$$0L_1 + 0M_1 + 0S_1 + 0L_2 + 0M_2 + 0S_2 + L_3 + M_3 + S_3 \leq 450$$

$$20L_1 + 15M_1 + 12S_1 + 0L_2 + 0M_2 + 0S_2 + 0L_3 + 0M_3 + 0S_3 \leq 13000$$

$$0L_1 + 0M_1 + 0S_1 + 20L_2 + 15M_2 + 12S_2 + 0L_3 + 0M_3 + 0S_3 \leq 12000$$

$$0L_1 + 0M_1 + 0S_1 + 0L_2 + 0M_2 + 0S_2 + 20L_3 + 15M_3 + 12S_3 \leq 5000$$

$$L_1 + 0M_1 + 0S_1 + L_2 + 0M_2 + 0S_2 + L_3 + 0M_3 + 0S_3 \leq 900$$

$$0L_1 + M_1 + 0S_1 + 0L_2 + M_2 + 0S_2 + 0L_3 + M_3 + 0S_3 \leq 1200$$

$$0L_1 + 0M_1 + S_1 + 0L_2 + 0M_2 + S_2 + 0L_3 + 0M_3 + S_3 \leq 750$$

```r
# Solution
# Install the required packages
# install.packages("lpSolve")

# Load the lpSolve library
library(lpSolve)

# Define the objective function to maximize Z
f.obj <- c(420, 360, 300, 420, 360, 300, 420, 360, 300)

# Represent the constraints in 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)

# Define the direction of inequalities (less than or equal to)
f.dir <- c(
  "<=",
  "<=",
  "<=",
  "<=",
  "<=",
  "<=",
  "<=",
  "<=",
  "<="
)

# Define the right-hand side (RHS) values of the constraints
f.rhs <- c(
  750,
  900,
  450,
  13000,
  12000,
  5000,
```

```
  900,
  1200,
  750)


#finding the value of the objective function
lp("max", f.obj, f.con, f.dir, f.rhs)

## Success: the objective function is 708000

#Values of the 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
```