Assignment_2 QMM

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Formulation of LP problem

The objective function is Max $Z = 420(L_1 + L_2 + L_3) + 360(M_1 + M_2 + M_3) + 300(S_1 + S_2 + S_3)$

Rearraning the objective function Max $Z = 420L_1+360M_1+300S_1+420L_2+360M_2+300S_2+420L_3+360M_3+300S_3$ 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

$$L_1 + M_1 + S_1 + 0L_2 + 0M_2 + 0S_2 + 0L_3 + 0M_3 + 0S_3 \leq 750$$
$$0L_1 + 0M_1 + 0S_1 + L_2 + M_2 + S_2 + 0L_3 + 0M_3 + 0S_3 \leq 900$$
$$0L_1 + 0M_1 + 0S_1 + 0L_2 + 0M_2 + 0S_2 + L_3 + M_3 + S_3 \leq 450$$
$$20L_1 + 15M_1 + 12S_1 + 0L_2 + 0M_2 + 0S_2 + 0L_3 + 0M_3 + 0S_3 \leq 13000$$
$$0L_1 + 0M_1 + 0S_1 + 20L_2 + 15M_2 + 12S_2 + 0L_3 + 0M_3 + 0S_3 \leq 12000$$
$$0L_1 + 0M_1 + 0S_1 + 0L_2 + 0M_2 + 0S_2 + 20L_3 + 15M_3 + 12S_3 \leq 5000$$
$$L_1 + 0M_1 + 0S_1 + L_2 + 0M_2 + 0S_2 + L_3 + 0M_3 + 0S_3 \leq 900$$
$$0L_1 + M_1 + 0S_1 + 0L_2 + M_2 + 0S_2 + 0L_3 + M_3 + 0S_3 \leq 1200$$
$$0L_1 + 0M_1 + S_1 + 0L_2 + 0M_2 + S_2 + 0L_3 + 0M_3 + S_3 \leq 750$$

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#Solution

#install packages
#install.packages("lpSolve")

#library
library(lpSolve)

#Here the objectve function is to maximize Z = 420L1 + 360M1 + 300S1 + 420L2 + 360M2 + 300S2 + 420L3 + .
f.obj<-c(420,360,300,420,360,300,420,360,300)


#Below are the  constraints written 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)

# set the direction of the inequalities using subject to equation for this.
f.dir <-c("<=",
          "<=",
          "<=",
          "<=",
          "<=",
          "<=",
          "<=",
          "<=",
          "<=")

#set the right hand side of the coefficients

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
```

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#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
```