QMM

Rohith

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```
#installation("lpSolve")

library("lpSolve") #Activation of lpSolve Package
```

To solve the problem we need to define the objective, constraints, direction and constants

Objective Function

Objective function is to $Max \ \ Z = 420(A_1 + A_2 + B_3) + 360(B_1 + B_2 + B_3) + 300(C_1 + C_2 + C_3)$

$$

$$

that can be written as $Z = 420A_1 + 360B_1 + 300C_1 + 420A_2 + 360B_2 + 300C_2 + 420A_3 + 360B_3 + 300C_3$

Subject to the following constraints

$$A_1 + B_1 + C_1 \leq 750$$

$$A_2 + B_2 + C_2 \leq 900$$

$$A_3 + B_3 + C_3 \leq 450$$

$$20A_1 + 15B_1 + 12C_1 \leq 13000$$

$$20A_2 + 15B_2 + 12C_2 \leq 12000$$

$$20A_3 + 15B_3 + 12C_3 \leq 5000$$

$$A_1 + A_2 + A_3 \leq 900$$

$$B_1 + B_2 + B_3 \leq 1200$$

$$C_1 + C_2 + C_3 \leq 750$$

Non Negativity Constraints

$$A_1, A_2, A_3, B_1, B_2, B_3, C_1, C_2, C_3 \geq 0$$

The above constraints can be written as below

$$A_1 + B_1 + C_1 + 0A_2 + 0B_2 + 0C_2 + 0A_3 + 0B_3 + 0C_3 \leq 750$$

$$0A_1 + 0B_1 + 0C_1 + A_2 + B_2 + C_2 + 0A_3 + 0B_3 + 0C_3 \leq 900$$

$$0A_1 + 0B_1 + 0C_1 + 0A_2 + 0B_2 + 0C_2 + A_3 + B_3 + C_3 \leq 450$$

$$20A_1 + 15B_1 + 12C_1 + 0A_2 + 0B_2 + 0C_2 + 0A_3 + 0B_3 + 0C_3 \leq 13000$$

$$0A_1 + 0B_1 + 0C_1 + 20A_2 + 15B_2 + 12C_2 + 0A_3 + 0B_3 + 0C_3 \leq 12000$$

$$0A_1 + 0B_1 + 0C_1 + 0A_2 + 0B_2 + 0C_2 + 20A_3 + 15B_3 + 12C_3 \leq 5000$$

$$A_1 + 0B_1 + 0C_1 + A_2 + 0B_2 + 0C_2 + A_3 + 0B_3 + 0C_3 \leq 900$$

$$0A_1 + B_1 + 0C_1 + 0A_2 + B_2 + 0C_2 + 0A_3 + B_3 + 0C_3 \leq 1200$$

$$0A_1 + 0B_1 + C_1 + 0A_2 + 0B_2 + C_2 + 0A_3 + 0B_3 + C_3 \leq 750$$

Describing the Objective Function - f.obj

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

Describing the Constraints - f.con

```
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=T)
```

Describing the Direction of the constraints - f.dir

```
f.dir <- c('<=',

           '<=',

           '<=',

           '<=',

           '<=',

           '<=',

           '<=',

           '<=',

           '<=')
```

Describing the constants i.e. the right hand side values - f.rhs

```
f.rhs <- c(750,900,450,13000,12000,5000,900,1200,750)
```

Calling the lp function to solve the problem basing the objective function i.e. to maximize the profits

```
lp('max',f.obj,f.con,f.dir,f.rhs)
```

```
## Success: the objective function is 708000
```

Calling the lp function again to get the values for the variables defined above

```
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
```

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