

# Assignment

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```
#Loading the library  
library(tinytex)
```

```
## Warning: package 'tinytex' was built under R version 4.1.3
```

```
library(lpSolve)
```

```
## Warning: package 'lpSolve' was built under R version 4.1.3
```

## Formulation of LP problem

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

Rearranging 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 constraints can be written as

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

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

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

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

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

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

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

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

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

```
#objective function
f.obj<-c(420,360,300,420,360,300,420,360,300)
#Constraints
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 inequality signs
f.dir<- c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=" )
#set right hand side coefficients
f.rhs<-c(750, 900, 450, 13000, 12000, 5000, 900, 1200, 750)
#value of z
lp("max", f.obj, f.con, f.dir, f.rhs)
```

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

```
#value 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
```