Assignment-2 QMM

Srinivasarao Madala

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Problem

Suppose

The Production of Plants in Large Size

$$= A$$

The Production of Plants in Medium Size

$$= B$$

The Production of Plants in Small Size

$$= C$$

Objective Function is

$$Max \quad Z = 420(A_1 + A_2 + A_3) + 360(B_1 + B_2 + B_3) + 300(C_1 + C_2 + C_3)$$

Reorganizing the objective function

$$Max \quad Z = 420A_1 + 360B_1 + 300C_1 + 420A_2 + 360B_2 + 300C_2 + 420A_3 + 360B_3 + 300C_3$$

Subject to

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

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

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

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

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

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

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

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

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

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 LP problem constraints can be writing in this format also

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

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

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

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

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

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

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

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

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

```
#Solution

#installing the required packages
#install.packages("lpsolve")

#library
library(lpSolve)

#The objective function is to maximize Z = 420A1 + 360B1 + 300C1 + 420A2 + 360B2 + 300C2 + 420A3 + 360B

Obj_fun<-c(420,360,300,420,360,300,420,360,300)

#Below constraints are written in the matrix form:
```

```
con_fun <-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.

Dir_fun <-c("<=",
            "<=",
            "<=",
            "<=",
            "<=",
            "<=",
            "<=",
            "<=",
            "<=")
```

```
#set the right hand side of the coefficients

rhs_fun <-c(750,
            900,
            450,
            13000,
            12000,
            5000,
            900,
            1200,
            750)
```

```
#finding the objective function value


lp("max", Obj_fun, con_fun, Dir_fun, rhs_fun)
```

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

```
#Values of each variable


lp("max", Obj_fun, con_fun, Dir_fun, rhs_fun)$solution
```

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