Assignment-2

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2023-09-22

Problem

Suppose

The Plants Production in Larger Size

$$= x$$

The Plants Production in Medium Size

$$= y$$

The Plants Production in Small Size

$$= z$$

Objective Function of Problem is

$$Max \quad Z = 420(x_1 + x_2 + x_3) + 360(y_1 + y_2 + y_3) + 300(z_1 + z_2 + z_3)$$

Rearranging the objective function

$$Max \quad Z = 420x_1 + 360y_1 + 300z_1 + 420x_2 + 360y_2 + 300z_2 + 420x_3 + 360y_3 + 300z_3$$

Subject to

$$x_1 + y_1 + z_1 \leq 750$$
$$x_2 + y_2 + z_2 \leq 900$$
$$x_3 + y_3 + z_3 \leq 450$$
$$20x_1 + 15y_1 + 12z_1 \leq 13000$$
$$20x_2 + 15y_2 + 12z_2 \leq 12000$$
$$20x_3 + 15y_3 + 12z_3 \leq 5000$$
$$x_1 + x_2 + x_3 \leq 900$$
$$y_1 + y_2 + y_3 \leq 1200$$
$$z_1 + z_2 + z_3 \leq 750$$

Non-negativity constraints :

$$x_1, x_2, x_3, y_1, y_2, y_3, z_1, z_2, z_3 \geq 0$$

The LP problem limitations listed above can also be written in this format

$$x_1 + y_1 + z_1 + 0x_2 + 0y_2 + 0z_2 + 0x_3 + 0y_3 + 0z_3 \leq 750$$

$$0x_1 + 0y_1 + 0z_1 + x_2 + y_2 + z_2 + 0x_3 + 0y_3 + 0z_3 \leq 900$$

$$0x_1 + 0y_1 + 0z_1 + 0x_2 + 0y_2 + 0z_2 + x_3 + y_3 + z_3 \leq 450$$

$$20x_1 + 15y_1 + 12z_1 + 0x_2 + 0y_2 + 0z_2 + 0x_3 + 0y_3 + 0z_3 \leq 13000$$

$$0x_1 + 0y_1 + 0z_1 + 20x_2 + 15y_2 + 12z_2 + 0x_3 + 0y_3 + 0z_3 \leq 12000$$

$$0x_1 + 0y_1 + 0z_1 + 0x_2 + 0y_2 + 0z_2 + 20x_3 + 15y_3 + 12z_3 \leq 5000$$

$$x_1 + 0y_1 + 0z_1 + x_2 + 0y_2 + 0z_2 + x_3 + 0y_3 + 0z_3 \leq 900$$

$$0x_1 + 0y_1 + z_1 + 0x_2 + 0y_2 + z_2 + 0x_3 + 0y_3 + z_3 \leq 750$$

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#Solution

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

#library
library(lpSolve)

#The objective function is to maximize Z = 420x1 + 360y1 + 300z1 + 420x2 + 360y2 + 300z2 + 420x3 + 360y

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

#Below constraints are written in the 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.

fun.dir <-c("<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=",
           "<=")
#set the right hand side of the coefficients

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

```
          5000,
          900,
          1200,
          750)

#finding the objective function value


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

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## Success: the objective function is 708000
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#Values of each variable


lp("max", f.obj,f.con,fun.dir, f.rhs)$solution
```

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