assignment 2

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```r
#package activation to slove lp model.
library(lpSolveAPI)
library(lpSolve)
library(tinytex)
lprec<-make.lp(0,3)

#objective function from the given question.
set.objfn(lprec,c(420,360,300))

#adding the constraint values to lp model.
add.constraint(lprec,c(1,1,1),"<=",750)
add.constraint(lprec,c(1,1,1),"<=",900)
add.constraint(lprec,c(1,1,1),"<=",450)
add.constraint(lprec,c(20,15,12),"<=",13000)
add.constraint(lprec,c(20,15,12),"<=",12000)
add.constraint(lprec,c(20,15,12),"<=",5000)
add.constraint(lprec,rep(1,3),"<=",900)
add.constraint(lprec,rep(1,3),"<=",1200)
add.constraint(lprec,rep(1,3),"<=",750)

#set bounds
set.bounds(lprec,lower = c(1,3),columns = c(1,3))
set.bounds(lprec,upper = c(1,20),columns = c(1,3))

#giving names to the rows
rownames<-c("Capacity1","Capacity2","Capacity3","Storage1","Storage2","Storage3","Sales1",
"Sales2","Sales3")

colnames<-c(paste("Plant",c(1:3),sep = ""))

dimnames(lprec)<-list(rownames,colnames)

#solving the lp model and getting the required objectives,variables and constraints.
solve(lprec)
```

```
## [1] 0
```

```r
get.objective(lprec)
```

```
## [1] 1320
```

```r
get.variables(lprec)
```

```
## [1] 1 0 3
```

```r
get.constraints(lprec)
```

```
## [1]   4   4   4 56 56 56   4   4   4
```

Objective Function

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

$$

$$

which can be written as $Z = 420L_1 + 360M_1 + 300S_1 + 420L_2 + 360M_2 + 300S_2 + 420L_3 + 360M_3 + 300S_3$

subject to constraints

$$L_1 + M_1 + S_1 \leq 750$$

$$L_2 + M_2 + S_2 \leq 900$$

$$L_3 + M_3 + S_3 \leq 450$$

$$20L_1 + 15M_1 + 12S_1 \leq 13000$$

$$20L_2 + 15M_2 + 12S_2 \leq 12000$$

$$20L_3 + 15M_3 + 12S_3 \leq 5000$$

$$L_1 + L_2 + L_3 \leq 900$$

$$M_1 + M_2 + M_3 \leq 1200$$

$$S_1 + S_2 + S_3 \leq 750$$

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

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

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

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

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

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

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

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

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

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

```
#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
```