QMM ASSIGNMET 2

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```
table=matrix(c(420,750,13000,20,900,360,900,12000,15,1200,300,450,5000,12,750),ncol=5, byrow=T)
colnames(table)=c('PROFIT','EXCESS CAP','STORAGE','UNIT','SALES')
rownames(table)=c('large','medium','small')
table
```

```
##        PROFIT EXCESS CAP STORAGE UNIT SALES
## large     420        750   13000   20   900
## medium    360        900   12000   15  1200
## small     300        450    5000   12   750
```

No of large units produced at plant1: D_l1 No of medium units produced at plant1: D_m1 No of small units produced at plant1: D_s1 No of large units produced at plant1: D_l2 No of medium units produced at plant1: D_m2 No of small units produced at plant1: D_s2 No of large units produced at plant1: D_l3 No of medium units produced at plant1: D_m3 No of small units produced at plant1: D_s3

Objective function:

$$MAX \quad Z = 420(D_l1 + D_m2 + D_s3) + 360(D_l1 + D_m2 + D_s3) + 300(D_l1 + D_m2 + D_s3)$$

Constraints

Production capacity constraints:

The production of each size at each plant should not exceed the respective plants capacity excess capacity for each plant is 750, 900 and 400 units per day.

$$D_l1 + D_m1 + D_s1 \leq 750$$

$$D_l2 + D_m2 + D_s2 \leq 900$$

$$D_l3 + D_m3 + D_s3 \leq 450$$

Storage space restrictions at present: the production of ecah size at each plant should not exceed the available in process storage space

$$20D_l1 + 15D_m1 + 12D_s1 \leq 13000$$

$$20D_l2 + 15D_m2 + 12D_s2 \leq 12000$$

$$20D_l3 + 15D_m3 + 12D_s3 \leq 5000$$

Demand constraint:

The production of each size meet the scale forecast.

$$D_l1 + D_m1 + D_s1 \leq 900$$

$$D_l2 + D_m2 + D_12 \leq 1200$$

$$D_l3 + D_m3 + D_s3 \leq 750$$

Restrictions on layoffs of employees:

$$(D_l1 + D_m1 + D_s1)/750 = (D_l2 + D_m2 + D_s2)/900 = (D_l3 + D_m3 + D_s3)/450$$

Non negativity constraints:

$$Dl > 0, Dm > 0, Ds > 0$$

SOLVING LP MODEL IN R

```
library(lpSolve)

# Defining the sizes and plants of the weigelt corporation
sizes <- c("large","medium","small")
plants <- c("plant1","plant2","plant3")

# The profit per unit for each size of the plant

profit <- c(420, 360, 300)

# The excess production capacity for each plant
capacity <- c(750, 900, 450)

# The available in-process storage space for each plant
storage_space <- c(13000, 12000, 5000)

# The space requirement per unit for each size
space_per_unit <- c(20, 15, 12)

# The sales forecasts for each size
sales_forecast <- c(900, 1200, 750)

# Objective coefficients
obj_coef <- c(420, 360, 300, 420, 360, 300,420, 360, 300)

# Constraint matrix (left-hand side)
const_matrix <- 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)

# Right-hand side of constraints
rhs <- c(750, 900, 450, 13000, 12000, 5000, 900, 1200, 750)

# Constraint direction (less than or equal)
const_dir <- rep("<=", 9)

# Solve the linear programming problem
lp("max", obj_coef, const_matrix, const_dir, rhs)
```

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

```
# Extract the solution
lp("max", obj_coef, const_matrix, const_dir, rhs)$solution
```

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