Assignment 2

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Assigning Variables

Let,(PLANT 1)

a_1(L)=No.of large units produced per day in Plant 1

b_1(M)=No.of medium units produced per day

c_1(S)=No.of small units produced per day

Let,(PLANT 2)

a_2(L)=No.of large units produced per day in Plant 2.

b_2(M)=No.of medium units produced per day.

c_2(S)=No.of small units produced per day.

Let,(PLANT 3)

a_3(L)=No.of large units produced per day in Plant 3.

b_3(M)=No.of medium units produced per day.

c_3(S)=No.of small units produced per day.

Decision Variables

$$DecisionVariables = a_1(L), b_1(M), c_1(S), a_2(L), b_2(M), c_2(S), a_3(L), b_3(M), c_3(S)$$

Objective Function

$$Maximize \;\; P = 420(a_1(L) + a_2(L) + a_3(L)) + 360(b_1(M) + b_2(M) + b_3(M)) + 300(c_1(S) + c_2(S) + c_3(S))$$

Subject to the constraints

$$ProductionCapacity \;\; = a_1(L) + b_1(M) + c_1(S) \leq 750$$

$$a_2(L) + b_2(M) + c_2(S) \leq 900$$

$$a_3(L) + b_3(M) + c_3(S) \leq 450$$

$$StorageSpace \quad = 20a_1(L) + 15b_1(M) + 12c_1(S) \leq 13000$$

$$20a_2(L) + 15b_2(M) + 12c_2(S) \leq 12000$$

$$20a_3(L) + 15b_3(M) + 12c_3(S) \leq 5000$$

$$SalesForecast \quad = a_1(L) + a_2(L) + a_3(L) \leq 900$$

$$b_1(M) + b_2(M) + b_3(M) \leq 1200$$

$$c_1(S) + c_2(S)1 + c_3(S) \leq 750$$

Capacity Utilization

$$((a_1(L)+b_1(M)+c_1(S))/750) = ((a_2(L)+b_2(M)+c_2(S))/900) = ((a_3(L)+b_3(M)+c_3(S))/450) = \infty$$

Non Negativity

$$a_1(L), b_1(M)c_1(S), a_2(L), b_2(M), c_2(S), a_3(L), b_3(M), c_3(S) \geq 0$$

As for the objective function is to maximize P = 300c_1(S) + 300c_2(S) + 300c_3(S) + 360b_1(M) + 360b_2(M) + 360b_3(M) + 420a_1(L) + 420a_2(L) + 420a_3(L) (In Sequence for the Mathematical function)

```
library(lpSolve)

# Objective function
objective.func <- c(300, 300, 300, 360, 360, 360, 420, 420, 420)

# Constraints
cstraints <- matrix(c(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,
                      12, 0, 0, 15, 0, 0, 20, 0, 0,
                      0, 12, 0, 0, 15, 0, 0, 20, 0,
                      0, 0, 12, 0, 0, 15, 0, 0, 20,
                      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,
                      900, -750, 0, 900, -750, 0, 900, -750, 0,
                      0, 450, -900, 0, 450, -900, 0, 450, -900,
                      -450, 0, 750, -450, 0, 750, -450, 0, 750),
                    ncol = 9, byrow = T)
```

```
cstraints.dir <- c('<=', '<=', '<=', '<=', '<=', '<=', '<=', '<=', '<=',
                   '=', '=', '=')
cstraints.rhs <- c(750, 900, 450, 13000, 12000, 5000, 750, 1200, 900, 0, 0, 0)

# Solve LP
prob.solLP <- lp('max', objective.func, cstraints, cstraints.dir, cstraints.rhs,
                 compute.sens = T)
prob.solLP
```

```
## Success: the objective function is 696000
```

#RESULT

```
# LP solution
prob.solLP$objval
```

```
## [1] 696000
```

```
prob.solLP$solution
```

```
## [1]   0.0000 166.6667 416.6667 177.7778 666.6667   0.0000 516.6667   0.0000
## [9]   0.0000
```

Interpretation

Maximum Profit

The gross profit of 696,000$ represents the maximum profit possible for the new product, taking into account the performance of all the facilities involved in its production. This yield is determined under various constraints, such as the production capacity of each plant, available storage space, estimated sales and the need for equal utilization of production capacity in all plants. Thus, 696,000$ represents the best possible outcome under these constraints.

Plan for Production to maximize the Profit

1.Plant 1 should produce Medium=178 Units & Large=516 Units

2.Plant 2 should produce Small=167 units & Medium=667 Units.

3.Plant 3 should produce Small=417 Units.