Gp

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##Given that the Research and Development Division of the Emax Corporation has developed three new products. A decision now needs to be made on which mix of these products should be produced. Management wants primary consideration given to three factors: total profit, stability in the workforce, and achieving an increase in the company's earnings next year from the $75 million achieved this year.

#importing libraries

```
library(lpSolve)
```

```
## Warning: package 'lpSolve' was built under R version 4.1.2
```

```
library(lpSolveAPI)
```

```
## Warning: package 'lpSolveAPI' was built under R version 4.1.2
```

```
library(goalprog)
```

##objective function

Maximize Z = P - 6C - 3D, where

P = total (discounted) profit over the life of the new products,

C = change (in either direction) in the current level of employment,

D = decrease (if any) in next year's earnings from the current year's level.

There is given that C = change (in either direction) in the current level of employment, where the y1m, y1p are taken as increase or decrease in value of deviation.

As -6y1m, -6y1p

##The decrease in next year's earnings from the current year's level suggests the value to be y2m as it is -3y2m

##(Tabulation)The data given is expressed in the tabular form

```
Goal<- matrix(c("Total Profit", "Employment Level", "Earnings Next Year",

                        20,6,8,
```

```
                        15,4,7,

                        25,5,5,

                        "Maximize","=50",">=75",

                        "Millions of Dollars", "Hundreds of Employees", "Millions of Dollars"), ncol=6, b
colnames(Goal) <- c("Factor","Product 1", "Product 2", "Product 3", "Goal", "Units")

as.table(Goal)
```

```
##   Factor              Product 1 Product 2 Product 3 Goal
## A Total Profit        20        15        25        Maximize
## B Employment Level    6         4         5         =50
## C Earnings Next Year  8         7         5         >=75
##   Units
## A Millions of Dollars
## B Hundreds of Employees
## C Millions of Dollars
```

```
Goal <-read.lp("Downloads/goal set obj.lp")

Goal
```

```
## Model name:
##             x1    x2    x3   y1m   y1p   y2m   y2p
## Maximize    20    15    25    -6    -6    -3     0
## R1           6     4     5     1    -1     0     0  =  50
## R2           8     7     5     0     0     1    -1  =  75
## Kind       Std   Std   Std   Std   Std   Std   Std
## Type      Real  Real  Real  Real  Real  Real  Real
## Upper      Inf   Inf   Inf   Inf   Inf   Inf   Inf
## Lower        0     0     0     0     0     0     0
```

#goal programming model

```
solve(Goal)
```

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

the return value of 0 indicates that the model was successfully solved.

Remarks:

Obtaining results as x1 =0,

x2 =0 , x3=15 which is product 3

Applying the simplex method to this formulation yields an optimal solution of y1m = 0, y1p = 25, y2m = 0, y2p = 0, x1 = 0, x2 = 0, x3 = 15 , y1m = 0, y2m = 0. Note that the solution is given in the order in which the variables appear in the formulation. This implies that y1m = 0 and y2p = 0, so the first and third goals are fully satisfied, but the employment goal is decreased by 15 units.

#-objective

```
get.objective(Goal)
```

```
## [1] 225
```

#-variable value

```
get.variables(Goal)
```

```
## [1]  0  0 15  0 25  0  0
```

#interpretation

Goal programming requires establishing goals for all objectives. What if some objectives were open ended?

* In open-ended objectives, there is no minimum (standard) goal. As such, we want to make progress on all objectives simultaneously.

* Thus, the appropriate objective is to maximize the minimum progress toward all objectives.

Findings

1). There are X1, X2, X3 are the units of combination which maximize the objective function. X1=Product1, X2=Product2, X3=Product3

But there is a change to X3. Product 3 is the only product which the firm can produce i.e. 15 Units of Product 3 to thereby maximize the profit.

2)Note that the solution is given in the order in which the variables appear in the formulation. This implies that y1m = 0 and y2p = 0, so the first and third goals are fully satisfied, but the product 3 is decreased by 15 units.

3. So,the goal was to attain an equilibrium in the employment level greater than 50 Hundred Employees.(Employee level>50)

but here in this case the firm exceeded the employment levels 25 Hundred Employees for penalised for the excess/rise in the employees count.

4)The goal of y2p and y2m was to see the deviation either in positive or negetive in the next years earnings from the current level.

This solution is exactly as what we achieved. First priority goals are met, and the optimal solution falls short of the second-priority goals with respect to Employment.

##Conclusion:

We found that the objective of profit that the firm maximizing is 225 Million Dollars.