Assignment 5 - Goal Programming

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```
#Three new products have been created by the Emax Corporation's Research and Development division. Whic
#1. Overall Profit,
#2. Stability in the workforce and
#3. Achieving an increase in the company's earnings next year from the $75 million achieved this year.
#Objective Function
#Maximize Z = P - 6C - 3D, where
#P = Overall discounted profit over the course of the new products,
#C = Change in either direction relative to the present employment level,
#D = Decrease if any in next year's earnings from the current year's level.
```

Setting default values to get a clean output

```
knitr::opts_chunk$set(message = FALSE)
knitr::opts_chunk$set(warning = FALSE)
```

Loading the required packages

```
library(lpSolve)
library(lpSolveAPI)
```

```
#Loading the LP file from the present directory and producing the model.
#Y1plus and Y1minus are defined as the amounts over and below the employment level goal, respectively,
#Defining y2plus and y2minus similarly for the objective of earnings the following year.
#Assign the production rates of Products 1, 2, and 3 to the variables x1, x2, and x3, respectively.
#Additionally expressing P in terms of x1, x2 and x3 and the objective function in terms of x1, x2, x3,
```

```
emax.1 <- read.lp("emax.lp", type = c("lp"))
print(emax.1)
```

```
## Model name:
##             X1    X2    X3   Y1P   Y1M   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
```

```
#The following table displays the effects of each of the new products (per unit rate of production) on
```

```
emax.tab <- 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(emax.tab) <- c("Factor","Product 1", "Product 2", "Product 3", "Goal", "Units")
as.table(emax.tab)
```

```
##   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
```

```
#Solving the goal programming model to obtain the objective and variable values
solve(emax.1)
```

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

```
get.objective(emax.1)
```

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

```
get.variables(emax.1)
```

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

```
#Interpretation:
#1. The units of combination that the company must use in order to optimize the #objective function are
#2. The intention was to stabilize employment levels with a cap of 50 hundred #employees as the maximum
#3. The objective of y2plus and y2minus was to measure the rise or fall in the earnings #for the follow
#4. The objective function value, in this case 225 million dollars, calls out the #profit that the comp
```