Assignment 5

Kiran Kour

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Formulating the Goal Linear Programming model

Objective Function:

$$\text{Max Z= } 20x_1 + 15x_2 + 25x_3 - 6y_{1-} - 6y_{1+} - 3y_{2-}$$

Subject to :

Employment Level

$$6x_1 + 4x_2 + 5x_3 + y_{1-} - y_{1+} = 50$$

Earnings Next Year

$$8x_1 + 7x_2 + 5x_3 + y_{2-} - y_{2+} = 75$$

Non-negativity contraint

$$xj \geq 0, where\ j = 1, 2, 3$$

$$y_{i+} \geq 0, where\ i = 1,2$$

$$y_{i-} \geq 0, where\ i = 1,2$$

- Defining y1+ and y1- as the amount over (if any) and amount under (if any) the employment level goal.
- Defining y2+ and y2- in the same way for the goal regarding earnings next year.
- Defining x1, x2, and x3 as the production rates of Products 1, 2, and 3, respectively.

```
# Load the library needed
library(lpSolveAPI)
library(lpSolve)

# Load the data
GP <- read.lp("emax.lp")
GP

## 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

# Solving the Goal Programming
solve(GP)

## [1] 0
```

As we can confirm, the solver is giving 0 which means it is finding a solution.

```
#To get the objective solution
get.objective(GP)

## [1] 225
```

Here, we are maximizing the profit while minimizing other business goals like workforce and earnings. As this value shows, the penalty for not satisfying the goals on the objective function is 225.

```
# To get the variables solution
get.variables(GP)

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

This order is from how the variables were written in the objective function. In our case, the results are as follows: x1 = 0, x2 = 0, x3 = 15, y1− = 0, y1+ = 25, y2− = 0, y2+ = 0, which means that the earnings (y2) expectations are fully satisfied. Regarding the workforce, the goal projected is exceeded by 25 and based on the total profit of product 3, it has a negative result on its profit by 15.