Assignment 5- QMM

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### Goal Programming

1. 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.

Since management is primarily focused on attaining some rise to appease the owners, the quantity of any gain in earnings does not factor into Z.(It is ambivalent about a significant gain that would be hard to top in coming years.)

The impact of each of the new products (per unit rate of production) on each of these factors is shown in the following table:

According on the problem statement, the goal is to:

Maximize Z = P - 6*C - 3*D

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.

Subject to:

Total Profit: Maximize P = 20*X1 + 15*X2 + 25\*X3

Employment Level: 6*X1 + 4*X2 + 5\*X3 = 50

Earnings Next Year: 8*X1 + 7*X2 + 5\*X3 >= 75

As a result, the auxillery variables becomes:

Y1 = 6*X1 + 4*X2 + 5*X3 - 50 Y2 = 8*X1 + 7*X2 + 5*X3 - 75

Which means:

(Y1P - Y1M) = 6*X1 + 4*X2 + 5*X3 - 50 (Y2P - Y2M) = 8*X1 + 7*X2 + 5*X3 - 75

Therefore, the final problem statement would be like:

Maximize Z = 20*X1 + 15*X2 + 25*X3 - 6*Y1P - 6*Y1M - 3*Y2M

Subject to the following:

6*X1 + 4*X2 + 5*X3 - (Y1P - Y1M) = 50 8*X1 + 7*X2 + 5*X3 - (Y2P - Y2M) = 75

And:

X1, X2, X3 >= 0 Y1P, Y1M, Y2P, Y2M >= 0

finally, I am going to run linear programming model in R

# Here we will require the "lpSolveAPI" library  
require(lpSolveAPI)

## Loading required package: lpSolveAPI

## Warning: package 'lpSolveAPI' was built under R version 4.2.1

# Importing the .lp file for this problem  
gp\_model <- read.lp("C:/Users/kramr/Downloads/Max.lp")  
# Returning the linear programming model  
gp\_model

## 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

# Solving the linear programming model  
solve(gp\_model)

## [1] 0

# Getting the objectives of linear programming model  
get.objective(gp\_model)

## [1] 225

# Getting the variables of linear programming model  
get.variables(gp\_model)

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

We can conclude a number of conclusions from the linear programming model’s output.

X1 = 0, X2 = 0, X3 = 15, Y1P = 25, Y1M = 0, Y2M = 0, Y2P = 0