Assignment_4

Yashwanth k

2023-11-26

Summary:

- I replaced y1+ with a1, y1- with a2, y2+ with b1, and y2- with b2 in the context of the products x1, x2, and x3 as specified. All the defined terms are outlined below.

  Sure, here's a rephrased version:

a1 represents a positive deviation, indicating an excess of employees.

a2 signifies a negative deviation, indicating a shortage of employees.

b1 represents a positive deviation in earnings.

b2 signifies a negative deviation in earnings.

x1, x2, and x3 denote the production rates of Product1, Product2, and Product3, respectively.

The primary objective is to maximize the equation:

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

- P = the total (discounted) profit over the life of the new products. P = 20x1 + 15x2 + 25x3
- C = the change (in either direction) in the current employment level. C = 6a1 - 6a2
- D = the potential decrease in next year's earnings compared to the current year's level. D = 3b2

Thus, the final equation for optimization becomes:

Maximize Z = 20x1 + 15x2 + 25x3 - 6a1 - 6a2 - 3b2.

- Now let us consider the constraints of the problem.
  - Employee factor Constraint: 6x1 + 4x2 + 5x3 - a1 + a2 = 50;
  - Earning factor Constraint : 8x1 + 7x2 + 5x3 - b1 + b2 <= 75;
  - Decision variables Constraint: x1, x2, x3, a1, a2, b1, b2 >0;(Non-Negativity)

Observations:

The objective function value, representing the profit the corporation seeks to maximize, stands at $225 million in our case.

The primary aim is to stabilize employment within 50 Hundred workers, but the company exceeded this limit by 25 Hundred Employees (a1), necessitating a penalty for the surplus in employee count.

The company needs to optimize its production units, focusing on x1, x2, and x3. Unfortunately, x1 and x2 cannot be produced as planned due to a final solution of "0" for 20 units of x1 and 15 units of x2. However, x3 (Product 3) remains viable, allowing the creation of 15 units to maximize profit.

Variables b1 and b2 were intended to forecast next year's profits compared to the present level, both resulting in a "0," indicating no change in future earnings from the current year. Thus, next year's profits remain unchanged.

```
library(lpSolveAPI)
```

```
company <- read.lp("Goal.lp")
company
```

```
## Model name:
##             x1    x2    x3    a1    a2    b1    b2
## Maximize    20    15    25    -6    -6     0    -3
## 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
```

```
employ_max <- matrix(c("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, l

colnames(employ_max) <- c("Factor","x1", "x2", "x3", "Goal", "Units")

as.table(employ_max)
```

```
##   Factor             x1 x2 x3 Goal     Units
## A Profit             20 15 25 Maximize Millions of Dollars
## B Employment Level   6  4  5  =50      Hundreds of Employees
## C Earnings Next Year 8  7  5  >=75     Millions of Dollars
```

#Formulate and solve the linear programming model. What are your findings?

```r
solve(company)
```

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

```r
get.objective(company)
```

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

```r
get.variables(company)
```

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