Goal_programming

Srujana

This notebook contains Assignment- 5

SUMMARY

The values 50 and 75 indicate that these are the LHS values for the respective constraints when the decision variables take their optimal values.

1. Producing 0 units of Product 1, 0 units of Product 2, and 15 units of Product 3 is the ideal production plan. Profit is maximized given the constraints.

2)The company employed 2,550 more people than it had planned. Even though exceeding the objective resulted in penalties, the expenses were mitigated by the production plan that maximized profits.

3)The optimization model solution indicates that the corporation can make up to $225 million in profit. This is the maximum profit level that can be achieved within the given constraints and business environment.

```r
library(lpSolveAPI)
```

PROBLEM STATEMENT

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. In particular, using the units given in the following table, they want to

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.

The amount of any increase in earnings does not enter into Z, because management is concerned primarily with just achieving some increase to keep the stockholders happy.

Questions:

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

programming technique to express y1+, y1- , y2+ and y2- algebraically in terms of x1, x2, and x3. Also express P in terms of x1, x2 and x3.

2. Express management's objective function in terms of x1, x2, x3, y1+, y1- , y2+ and y2-.
3. Formulate and solve the linear programming model. What are your findings

---

SOLUTION

The main objective of this problem is to maximize the profits made from previous years.So the considering the y+ and y- ,below is the objective.

max: 20 x1 + 15 x2 + 25 x3 - 6 y1p - 6 y1n - 3 y2p - 3 y2n

CONSTRAINTS

6 x1 + 4 x2 + 5 x3 - y1p + y1n = 50;

8 x1 + 7 x2 + 5 x3 + y2n - y2p = 75; y1a >= 0;

y1b >= 0;

y2a >= 0;

y2b >= 0;

x1 >= 0;

x2 >= 0;

x3 >= 0;

where,

x1 = Production rate of Product 1

x2 = Production rate of Product 2

x3 = Production rate of Product 3

y1p = Variable representing the amount over the goal.(positive)

y1n = Variable representing the amount under the goal.(negative)

y2p = variable for the earnings representing amount over the goal.(positive)

y2n = variable for the earnings representing amount over the goal.(negative)

Representing P in terms of x1,x2,x3

P = 20 x1 + 15 x2 + 25 x3

Now, solving the LP Model.

```
x <- read.lp("goal.lp") #Reading the LP file
x
```

```
## Model name:
##   a linear program with 11 decision variables and 2 constraints
```

```
solve(x)
```

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

#Solving the objective

```
get.objective(x) #get objective value
```

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

```
get.variables(x)   # get values of decision variables
```

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

```
get.constraints(x) #get constraint RHS values
```

```
## [1] 50 75
```