

Assignment Instructions: Module 9 - Goal Programming

Purpose

The purpose of this assignment is to explore goal programming formulations and solutions. In addition, this will help you master the following module outcomes:

- Formulate multi-objective models.
- Model multi-objective models.
- Categorize the type and importance of goals.

Directions

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 \$60 million achieved this year. In particular, using the units given in the following table, they want to Maximize $Z = P - 5C - 2D$, 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. (It has mixed feelings about a large increase that then would be difficult to surpass in subsequent 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:

Factor	Unit contribution			Goal	Units
	Products				
	1	2	3		
Total profit	15	12	20	Maximize	Millions of dollars
Employment level	8	6	5	= 70	Hundreds of workers
Earning next year	6	5	4	≥ 60	Millions of dollars

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?

Submit both Rmd file and the knitted file on Canvas.