**Assignment 6**

1. **Solution for DEA Analysis problem:**

Model Formulation

Decision variables:

Xik=ith input quantity for DMU(k), where k = The number of DMUs (k = 1,2,3,4,5,6)

I = Inputs index (I = 1, 2)

Yjk=jth output quantity for DMU(k), where J = Outputs index (j = 1, 2)

vi=Weight for ith input

uj=Weight for the jth output

where . Vi and uj represent the weights, that our model will calculate, for the inputs and outputs, respectively.

XK=Sum(xik\*vi)= Weighted input

YK=Sum(yjk\*uj)= Weighted output

Efficiency = Ek = Yk / Xk

Maximise Yij

Subject to Xij =1 scaling of the input value

-Xi + Yj ≤0 efficiency not greater than 1, for each DMU (k)

Where Efficiency is calculated as the ratio of Weighted Output to Weighted Input.

1. Formulate and perform DEA analysis under all DEA assumptions of FDH, CRS, VRS, IRS, DRS, and FRH.

Response: Done! R output: Please see RMD AND HTML file for complete code and complete outputs

1. Determine the Peers and Lambdas under each of the above assumptions

Response: Done! : Please see RMD AND HTML file for complete code and complete outputs

1. Summarize your results in a tabular format

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Model | FDH/lambda | CRS/lambda | VRS/lambda | IRS/lambda | DRS/lambda | FRH/lambda |
|  |  |  |  |  |  |  |
| FDH | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 |
| CRS | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 0.978, 0.805 | 0.8675, 0.13 |
| VRS | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 0.8963, 0.26 |
| IRS | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 0.896, 0.256 |
| DRS | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 0.896, 0.131 |
| FRH | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 | 1, 1 |

1. Compare and contrast the above results

Response:

The FDH model indicates that CRS, VRS, IRS, DRS, FRH are all efficient.

The CRS model indicates that all except DRS and FRH are efficient with relative weights of 0.805 and 0.131 respectively. On the other hand DMU3 to DMU 5 are all efficient except for except the peer VRS and FRH, IRS and FRH, DRS and FRH with weighted average of 0.26, 0.256, and 0.131 respectively. Finally, FRH model is all efficient.

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.

Response:

With M = 1000, mutiply 2 in '2 y2n' with 1000 to give 2000

the same goes for '3 y3p'

min: 5 y1n + 2000 y2p + 4 y2n + 3000 y3p;

12 x1 + 9 x2 + 15 x3 - y1p + y1n = 125;

5 x1 + 3 x2 + 4 x3 - y2p + y2n = 40;

5 x1 + 7 x2 + 8 x3 - y3p + y3n = 55;

x1 >= 0;

x2 >= 0;

x3 >= 0;

y1p >= 0;

y2p >= 0;

y3p >= 0;

y1n >= 0;

y2n >= 0;

y3n >= 0;

get.objective(gp) = 43.75

1. Express management’s objective function in terms of x1, x2, x3, y1+, y1- , y2+ and y2-.

Response:

vars <- get.variables(gp)

names(vars) <- c("y1n", "y2p", "y2n", "y3p", "x1" ,"x2", "x3", "y1p", "y3n")

vars = y1n y2p y2n y3p x1 x2 x3 y1p y3n

8.75 0.00 0.00 0.00 5.00 0.00 3.75 0.00 0.00

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

Response: Please see RMD and HTML file for formulation and findings.