Module 8 Assignment - Quantitative Management Modeling

Julia Thacker

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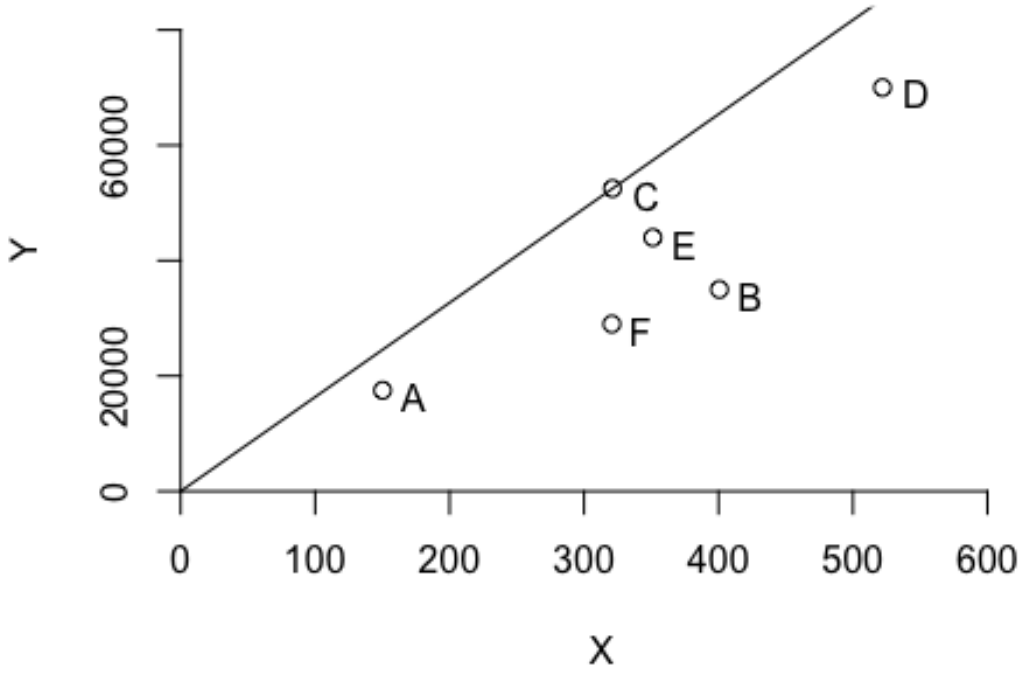
```
library(lpSolveAPI)
library(Benchmarking)

## Loading required package: ucminf

## Loading required package: quadprog

x<-matrix(c(150,400,320,520,350,320,0.2,0.7,1.2,2,1.2,0.7),ncol = 2)
colnames(x)<-c("StaffHours","Supplies")

y<-
matrix(c(14000,14000,42000,28000,19000,14000,3500,21000,10500,42000,25000,150
00),ncol = 2)
colnames(y)<-c("ReimbursedPatientDays","PrivatelyPaidPatientDays")
```

Created matrix x for the two inputs and martix y for the two outputs. Then performed DEA analysis under the assumptions of CRS, FDH, VRS, IRS, DRS and FRH. Also determined the Peers and Lambdas for each.

```
e<-dea(x,y,RTS="CRS")
e

## [1] 1.0000 1.0000 1.0000 1.0000 0.9775 0.8675

peers(e)

##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
## [5,]     1     2     4
## [6,]     1     2     4

lambda(e)

##             L1         L2 L3        L4
## [1,] 1.0000000 0.00000000  0 0.0000000
## [2,] 0.0000000 1.00000000  0 0.0000000
## [3,] 0.0000000 0.00000000  1 0.0000000
## [4,] 0.0000000 0.00000000  0 1.0000000
## [5,] 0.2000000 0.08048142  0 0.5383307
## [6,] 0.3428571 0.39499264  0 0.1310751
```

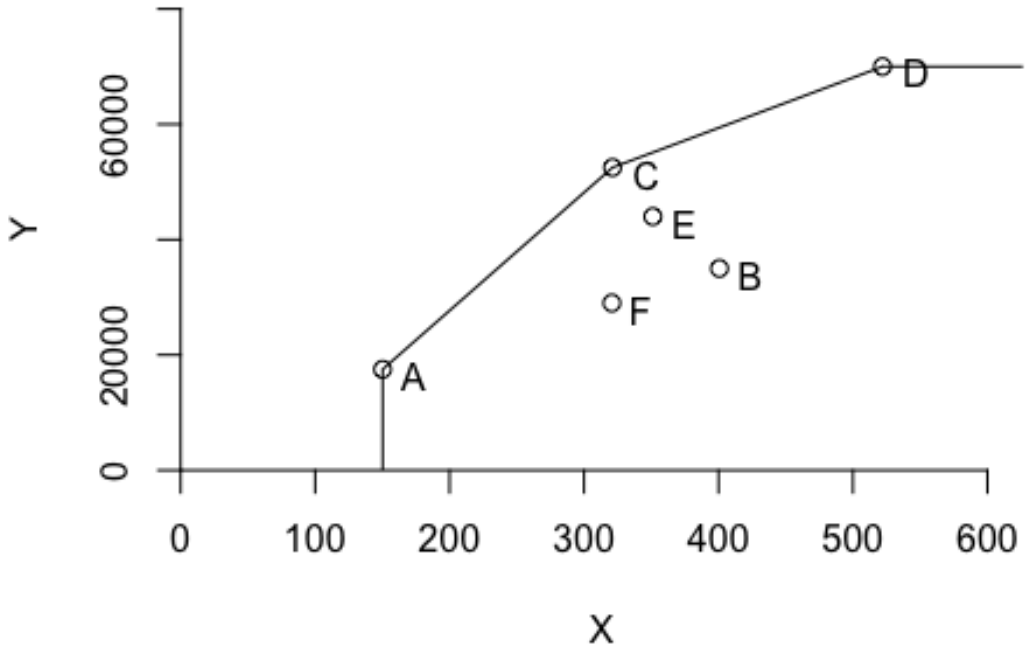
```
dea.plot(x,y,RTS="CRS",ORIENTATION = "in-out",txt=LETTERS[1:6])
```



The CRS plot shows only facility 3 as efficient and the other 5 facilities are inefficient. This is the only formulation that resulted in only one facility being efficient. The CRS method would likely not be chosen by a firm because it produces results with the lowest performance.

```
v<-dea(x,y,RTS="VRS")
v

## [1] 1.0000 1.0000 1.0000 1.0000 1.0000 0.8963

peers(v)

##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
## [5,]     5    NA    NA
## [6,]     1     2     5

lambda(v)
```

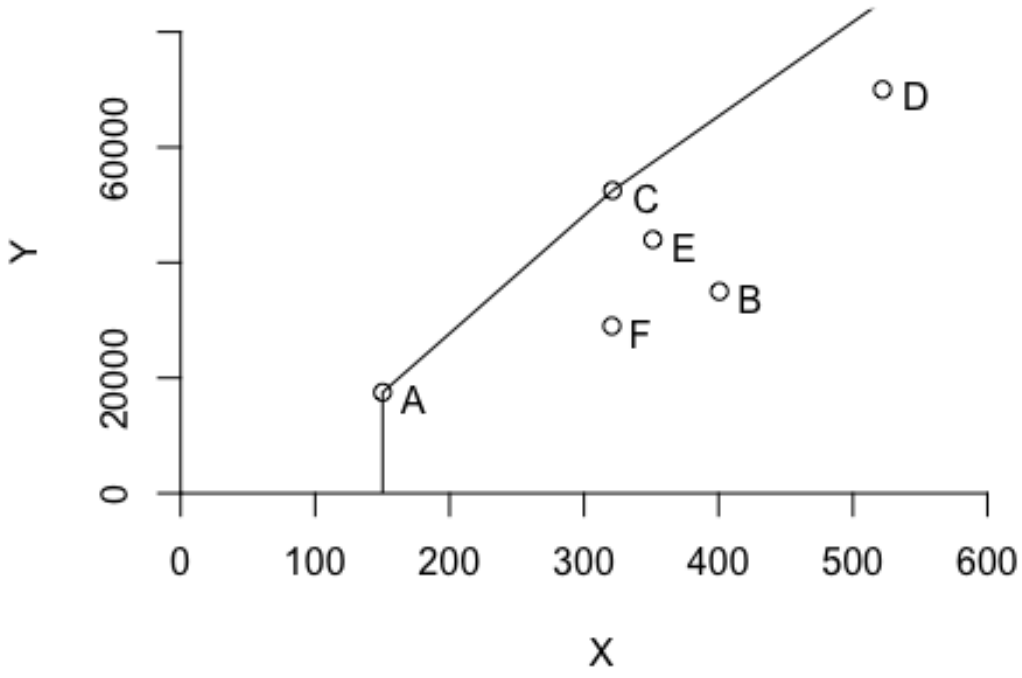
```
##             L1        L2 L3 L4        L5
## [1,] 1.0000000 0.0000000  0  0 0.0000000
## [2,] 0.0000000 1.0000000  0  0 0.0000000
## [3,] 0.0000000 0.0000000  1  0 0.0000000
## [4,] 0.0000000 0.0000000  0  1 0.0000000
## [5,] 0.0000000 0.0000000  0  0 1.0000000
## [6,] 0.4014399 0.3422606  0  0 0.2562995

dea.plot(x,y,RTS="VRS",ORIENTATION = "in-out",txt=LETTERS[1:6])
```



The VRS plot shows that facilities 1, 3, and 4 are efficient and 2, 5, and 6 are not.

```
i<-dea(x,y,RTS="IRS")
i

## [1] 1.0000 1.0000 1.0000 1.0000 1.0000 0.8963

peers(i)

##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
```

```
## [5,]     5    NA    NA
## [6,]     1     2     5

lambda(i)

##             L1        L2 L3 L4        L5
## [1,] 1.0000000 0.0000000  0  0 0.0000000
## [2,] 0.0000000 1.0000000  0  0 0.0000000
## [3,] 0.0000000 0.0000000  1  0 0.0000000
## [4,] 0.0000000 0.0000000  0  1 0.0000000
## [5,] 0.0000000 0.0000000  0  0 1.0000000
## [6,] 0.4014399 0.3422606  0  0 0.2562995

dea.plot(x,y,RTS="IRS",ORIENTATION = "in-out",txt=LETTERS[1:6])
```



The IRS plot shows that only facilities 1 and 3 are efficient.

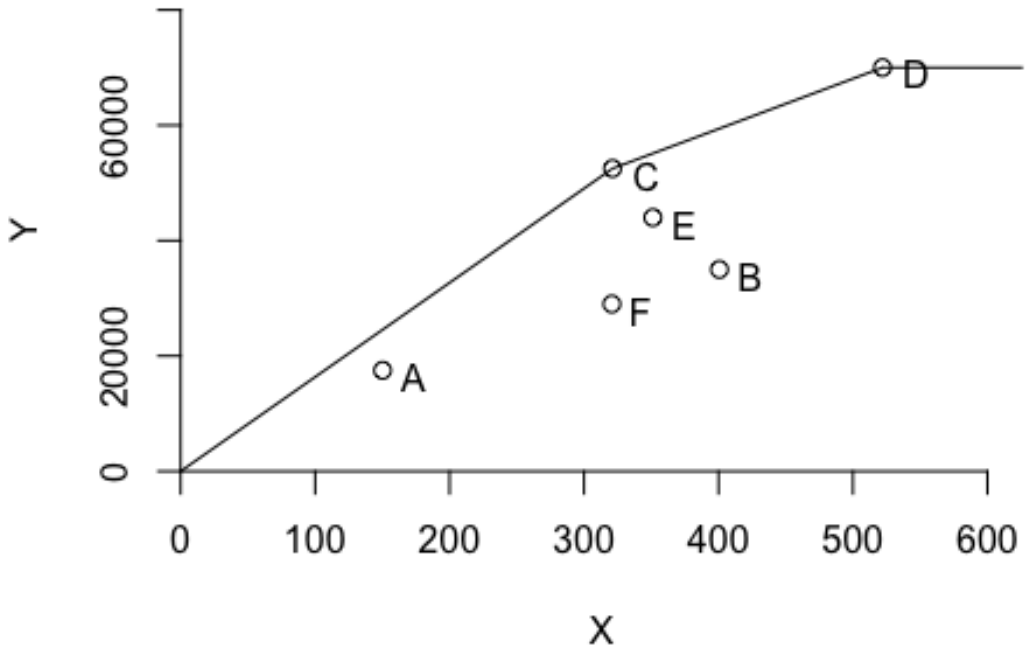
```
d<-dea(x,y,RTS="DRS")
d

## [1] 1.0000 1.0000 1.0000 1.0000 0.9775 0.8675

peers(d)
```

```
##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
## [5,]     1     2     4
## [6,]     1     2     4
```

```
lambda(d)
```

```
##             L1         L2 L3        L4
## [1,] 1.0000000 0.00000000  0 0.0000000
## [2,] 0.0000000 1.00000000  0 0.0000000
## [3,] 0.0000000 0.00000000  1 0.0000000
## [4,] 0.0000000 0.00000000  0 1.0000000
## [5,] 0.2000000 0.08048142  0 0.5383307
## [6,] 0.3428571 0.39499264  0 0.1310751
```

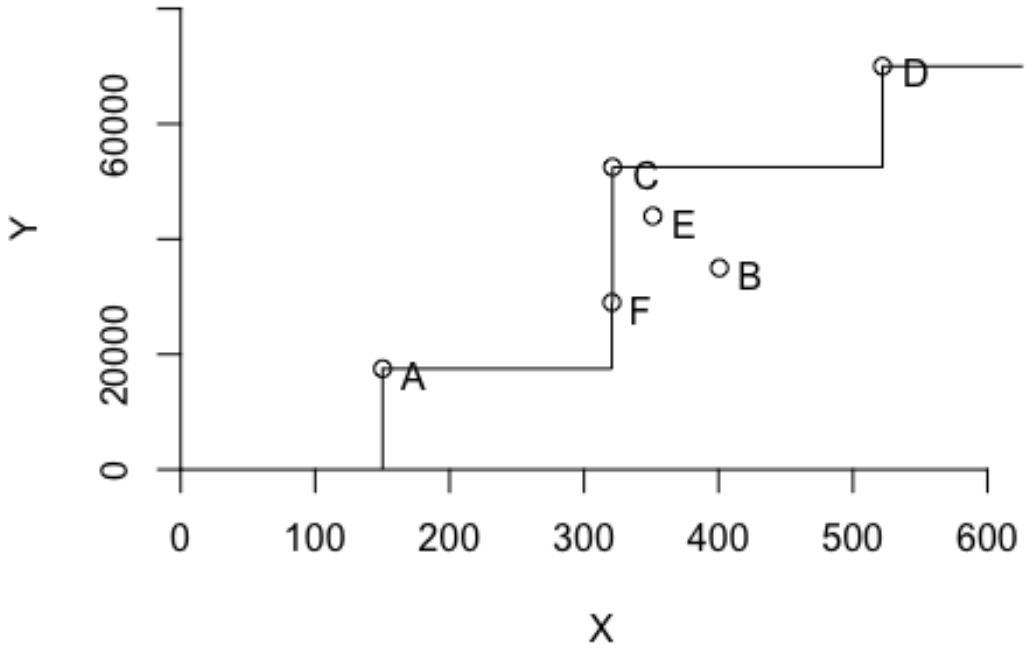
```
dea.plot(x,y,RTS="DRS",ORIENTATION = "in-out",txt=LETTERS[1:6])
```



The DRS plot shows that facilities 3, and 4 are efficient and 1, 2, 5, and 6 are not efficient.

```
f<-dea(x,y,RTS="FDH")
f
```

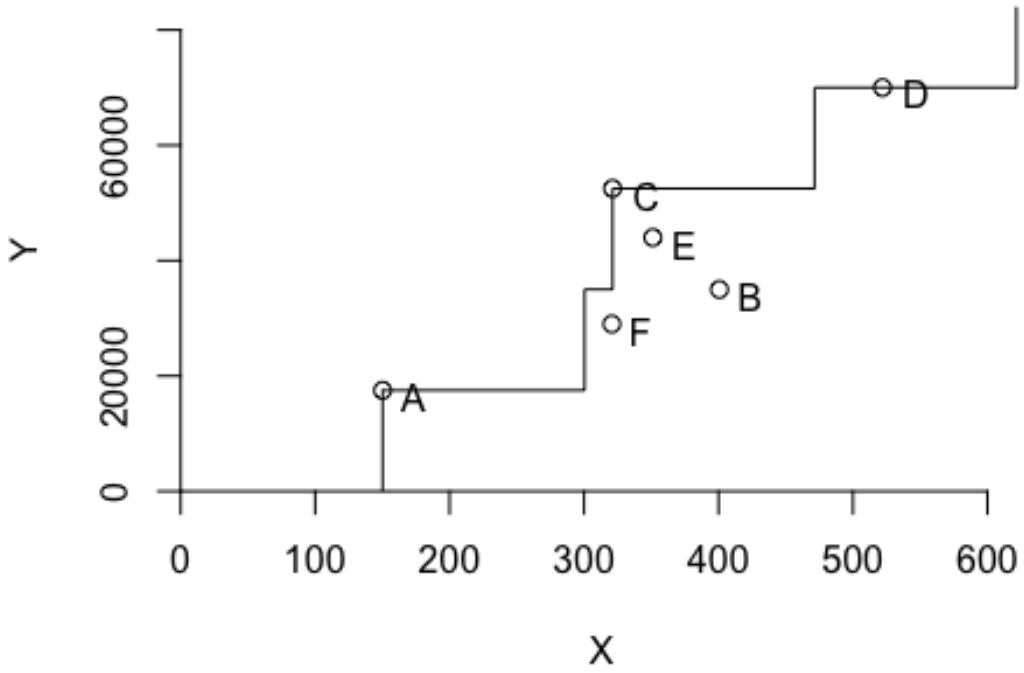
```
## [1] 1 1 1 1 1 1

peers(f)

##      peer1
## [1,]     1
## [2,]     2
## [3,]     3
## [4,]     4
## [5,]     5
## [6,]     6

lambda(f)

##      L1 L2 L3 L4 L5 L6
## [1,]  1  0  0  0  0  0
## [2,]  0  1  0  0  0  0
## [3,]  0  0  1  0  0  0
## [4,]  0  0  0  1  0  0
## [5,]  0  0  0  0  1  0
## [6,]  0  0  0  0  0  1

dea.plot(x,y,RTS="FDH",ORIENTATION = "in-out",txt=LETTERS[1:6])
```



The FDH plot shows that facilities 1, 3, 4, and 6 are efficient while facilities 2 and 5 are not. This formulation resulted in the highest number of efficient facilities.

```
g<-dea(x,y,RTS="add")
g

## [1] 1 1 1 1 1 1

peers(g)

##      peer1
## [1,]     1
## [2,]     2
## [3,]     3
## [4,]     4
## [5,]     5
## [6,]     6

lambda(g)

##      L1 L2 L3 L4 L5 L6
## [1,]  1  0  0  0  0  0
## [2,]  0  1  0  0  0  0
## [3,]  0  0  1  0  0  0
## [4,]  0  0  0  1  0  0
```

```
## [5,]  0  0  0  0  1  0
## [6,]  0  0  0  0  0  1

dea.plot(x,y,RTS="add",ORIENTATION = "in-out",txt=LETTERS[1:6])
```



The add/FRH plot is similar to the FDH output, except now facility 6 is also shown as not efficient, along with facilities 2 and 5.

Facility 3 is the only facility that was shown as efficient under each of the assumptions. This means that facility 3 is the most efficient among the six facilities. Facilities 2 and 5 were not efficient under any of the assumptions.