Transportation Assignment

2022-10-11

##set transportation matrix

library(lpSolve)  
library(lpSolveAPI)  
cost1<- matrix(c(22,14,30,600,100,  
 16,20,24,625,120,  
 80,60,70,"-","-"),ncol=5,byrow= TRUE)  
colnames(cost1)<- c("Ware1","Ware2","Ware3","ProdnCost","ProdnCapacity")  
rownames(cost1)<-c("P.A","P.B"," Demand")  
cost1

## Ware1 Ware2 Ware3 ProdnCost ProdnCapacity  
## P.A "22" "14" "30" "600" "100"   
## P.B "16" "20" "24" "625" "120"   
## Demand "80" "60" "70" "-" "-"

#Objective function = Minimize the Transportation Cost Min TC = 622x11 + 614x12 + 630x13 + 0x14 + 641x21 + 645x22 + 649x23 + 0x24

#Subject to constraints : Supply X11 + X12 + X13 + X14 <= 100 X21 + X22 + X23 + X24 <= 120

#Subject to constraints : Demand X11 + X21 >= 80 X12 + X22 >= 60 X13 + X23 >= 70 X14 + X24 >= 10

#Non-Negativity Constraints Xij >= 0 Where i = 1,2 and j= 1,2,3,4 #The capacity = 220 and Demand = 210. We will add a “Dummy” row for Warehouse\_4.

transportation.cost.1<- matrix(c(622,614,630,0,  
 641,645,649,0),ncol =4, byrow=TRUE)  
transportation.cost.1

## [,1] [,2] [,3] [,4]  
## [1,] 622 614 630 0  
## [2,] 641 645 649 0

##Constraints of r.h.s(supply side)

rsigns<- rep("<=",2)  
rrhs<- c(100,120)

#Supply func. cannot be greater than the specified units ##Demand Side

csigns<- rep(">=",4)  
crhs<- c(80,60,70,10)

##demand function can be greater

library(lpSolve)  
lptransmodel<-lp.transport(transportation.cost.1,"min",rsigns,rrhs,csigns,crhs)  
lptransmodel$solution

## [,1] [,2] [,3] [,4]  
## [1,] 0 60 40 0  
## [2,] 80 0 30 10

#80 AEDs in Plant2 - Warehouse1 #60 in Plant1 - Warehouse2 #40 AEDs in Plant1 - Warehouse3 #30 AEDs in Plant2 - Warehouse3

#Warehouse capacity is 220 which is distributed bewtween 3 warehouses Plant2 is producing 80 products in Warehouse1, plant1 is producing 60products in Warehosue2. Plant1 is producing 40 products in Warehouse3.

##Value of nvariables

lptransmodel$objval

## [1] 132790

#Cost of production and shipping for the defibrilators is $132,790

lptransmodel$duals

## [,1] [,2] [,3] [,4]  
## [1,] 0 0 0 0  
## [2,] 0 0 0 0

#2. Dual of transportation problem - The primal was to minimize the transportation cost the dual of it would be to maximize the valueadded(VA). a and b will be the variables for the dual.

cost2<-matrix(c(622,614,630,100,"x1",  
 641,645,649,120,"x2",  
 80,60,70,220,"-","y1","y2","y3","-","-"),ncol = 5,nrow=4,byrow=TRUE)  
  
colcost.2 <- c("W1", "W2","W3","Production Capacity","Supply(Dual)")  
rowcost.2 <- c("A","B","Demand","Demand(Dual)")

#Objective function

f.obj <- c(100,120,80,60,70)

#Transposed from the constraints matrix in the primal

f.con <- matrix(c(1,0,1,0,0,  
1,0,0,1,0,  
1,0,0,0,1,  
0,1,1,0,0,  
0,1,0,1,0,  
0,1,0,0,1), nrow = 6, byrow = TRUE)  
f.dir <- c("<=",  
"<=",  
"<=",  
"<=",  
"<=",  
"<=")  
f.rhs <- c(622,614,630,641,645,649)  
lp("max",f.obj,f.con,f.dir,f.rhs)

## Success: the objective function is 139120

## Success: the objective function is 139120

lp("max",f.obj,f.con,f.dir,f.rhs)$solution

## [1] 614 633 8 0 16

#Z=139,120 and variables are: #x1 = 614 x2 = 633 y1 = 8 y3 = 16

#3. Economic Interpretation of the dual

#Economic Interpretation of the dual is, the minimal Z(Primal) = 132790 and the maximum Z(Dual) = 139120. We should not be shipping from Plant(A/B) to all the three Warehouses. We should be shipping from:

#60X12 which is 60 Units from Plant A to Warehouse 2. #40X13 which is 40 Units from Plant A to Warehouse 3. #80X13 which is 60 Units from Plant B to Warehouse 1. #30X13 which is 60 Units from Plant B to Warehouse 3. #We will Max the profit from each distribution to the respective capacity.

rrhs1 <- c(101,120)  
rsigns1 <- rep("<=",2)  
crhs1 <- c(80,60,70,10)  
csigns1 <- rep(">=",4)  
rrhs2 <- c(100,121)  
rsigns2 <- rep("<=",2)  
crhs2 <- c(80,60,70,10)  
csigns2 <- rep(">=",4)  
lp.transport(transportation.cost.1,"min",rsigns,rrhs,csigns,crhs)

## Success: the objective function is 132790

lp.transport(transportation.cost.1,"min",rsigns1,rrhs1,csigns1,crhs1)

## Success: the objective function is 132771

lp.transport(transportation.cost.1,"min",rsigns2,rrhs2,csigns2,crhs2)

## Success: the objective function is 132790

lp("max", f.obj,f.con, f.dir,f.rhs)$solution

## [1] 614 633 8 0 16