assignment_2

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```r
library(lpSolve)
```

```r
Problem <- matrix(c(22,14,30,600,100,
                16,20,24,625,120,
                80,60,70,"-","-"),ncol = 5,byrow = TRUE)
colnames(Problem)<- c("Warehouse1","Warehouse2","Warehouse3","Production Cost","Production Capacity")
rownames(Problem)<-c("Plant A","Plant B","Monthly Demand")
Problem <-as.table(Problem)
Problem
```

```
##                Warehouse1 Warehouse2 Warehouse3 Production Cost
## Plant A        22         14         30         600
## Plant B        16         20         24         625
## Monthly Demand 80         60         70         -
##                Production Capacity
## Plant A        100
## Plant B        120
## Monthly Demand -
```

```r
# Since production and demand is unbalanced, Dummy column is created
#
# Name of the column and rows:
costs <- matrix(c(622,614,630,0,
                641,645,649,0),ncol = 4,byrow = TRUE)
colnames(costs)<- c("Warehouse1","Warehouse2","Warehouse3","Dummy")
rownames(costs)<-c("Plant A","Plant B")
costs <-as.table(costs)
costs
```

```
##         Warehouse1 Warehouse2 Warehouse3 Dummy
## Plant A        622        614        630     0
## Plant B        641        645        649     0
```

```r
# Setting up the row signs and production capacity values
row.signs <- rep("<=",2)
row.rhs<- c(100,120)
# Setting up the column sign and demand values
col.signs <- rep(">=",4)
col.rhs <- c(80,60,70,10)
```

```r
# Running lptrans to find minimum cost
lptrans <- lp.transport(costs,"min",row.signs,row.rhs,col.signs,col.rhs)
# Values of all variables
lptrans$solution
```

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

```r
# Objective function
lptrans$objval
```

```
## [1] 132790
```

Therefore

x12 = 60

x13 = 40

x21 = 80

x23 = 30

Objective function is 132790.

$$2. \ formulate \ the \ transportation \ problem.$$

#Since the primal was to be minimized so that the transportation cost the dual of it would be to maximize the value added(VA).

$$\text{Maximize VA} \quad = 80W_1 + 60W_2 + 70W_3 - 100P_A - 120P_B$$
$$Subject \ to \ the \ following \ constraints$$

$$Total \ Profit \ Constraints$$

$$MR_1 - MC_1 \geq= 622$$
$$MR_2 - MC_1 \geq= 614$$
$$MR_3 - MC_1 \geq= 630$$
$$MR_1 - MC_2 \geq= 641$$
$$MR_2 - MC_2 \geq= 645$$
$$MR_3 - MC2 \geq= 649$$

$$Where\ \ MR_1 = Marginal\ \ Revenue\ \ from\ \ Warehouse1$$

$$MR_2 = Marginal\ \ Revenue\ \ from\ \ Warehouse2$$

$$MR_3 = Marginal\ \ Revenue\ \ from\ \ Warehouse3$$

$$MC_1 = Marginal\ \ Cost\ \ from\ \ Plant1$$

$$MC_2 = Marginal\ \ Cost\ \ from\ \ Plant2$$

3. *Economic Interpretation of the dual*

#Reduced production and shipping costs are the aim of AED's business. #In order to accomplish this, the company will need to employ a logistics firm to handle the transportation, which will involve buying the AEDs and shipping them to multiple warehouses in an effort to cut the cost of production and shipping overall.

$$MR_1 <= MC_1 + 622$$

$$MR_2 <= MC_1 + 614$$

$$MR_3 <= MC_1 + 630$$

$$MR_1 <= MC_2 + 641$$

$$MR_2 <= MC_2 + 645$$

$$MR_3 <= MC_2 + 649$$

$$MR_1 <= MC_1 + 621 \quad i.e. \quad MR_1 >= MC_1$$

#"Based on above interpretation,we can conclude that,profit maximization takes place if MC is equal to MR."