Assignment - Module 6

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library(lpSolve)

## Warning: package 'lpSolve' was built under R version 4.2.3

# Formulate and solve the transportation Problem   
  
# Set up problem matrix  
Prob <- matrix(c(22, 14, 30, 600, 100,  
 16, 20, 24, 625, 120,  
 80, 60, 70, "-", "-"), nrow=3, byrow=TRUE)  
  
colnames(Prob)=c("Warehouse 1","Warehouse 2","Warehouse 3","Production Cost","Production Capacity")  
  
rownames(Prob)=c("Plant A","Plant B","Demand")  
  
Prob

## Warehouse 1 Warehouse 2 Warehouse 3 Production Cost Production Capacity  
## Plant A "22" "14" "30" "600" "100"   
## Plant B "16" "20" "24" "625" "120"   
## Demand "80" "60" "70" "-" "-"

# Minimize Z = 22X11 + 14X12 + 30X13 + 16X21 + 20X22 + 24X23  
  
# supply Constraints  
 # X11 + X12 + X13 <= 100  
 # X21 + X22 + X23 <= 120  
  
# Demand Constraints  
 # X11 + X21 >= 80  
 # X12 + X22 >= 60  
 # X13 + X23 >= 70  
  
# Non-negativity of the decision variables  
# Xij >= 0 where i=1,2 and j=1,2,3  
  
  
  
# Set up cost matrix  
  
costs = matrix(c(622, 614, 630, 0,  
 641, 645, 649, 0), nrow=2, byrow= TRUE)  
  
# Production monthly Capacity = 100 + 120 = 220  
# Demand (monthly) = 80 + 60 + 70 = 210  
# Since Production capacity > Demand i.e.unbalanced, we are creating a dummy column of the value 10.  
  
#Set up column names and row names   
colnames(costs) = c("Warehouse 1","Warehouse 2","Warehouse 3","Dummy")  
rownames(costs) = c("Plant A","Plant 2")  
  
costs

## Warehouse 1 Warehouse 2 Warehouse 3 Dummy  
## Plant A 622 614 630 0  
## Plant 2 641 645 649 0

#Setting up constraint signs and right-hand sides  
row.signs <- rep("<=",2)  
row.rhs <- c(100,120)  
col.signs <- rep(">=",4)  
col.rhs <- c(80,60,70,10)  
  
#Run  
lptrans <- lp.transport(costs, "min", row.signs, row.rhs, col.signs, col.rhs)  
  
#Variables for the given Problem  
lptrans$solution

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

# As per the above chart, to minimize the transportation cost, 80 units should be shipped from Plant B to Warehouse 1, 60 units from Plant A to Warehouse 2, 40 units from Plant A to Warehouse 3, 30 units from Plant B to Warehouse 3, and 10 units from Plant B to Dummy(storage).  
# Min value = (80\*641) + (60\*614) + (40\*630) + (30\*649) + (10\*0) = 132,790  
  
# Objective function is  
lptrans$objval

## [1] 132790