Assignment 6 (Module 6)

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#Answers: First, when formulating the objective function, #Each 𝑥𝑖𝑗 represents the amount of shipment from the source, plants 𝑖, to the destination, warehouse 𝑗, for 𝑖 = 1, 2 and 𝑗 = 1, 2, 3.

#I want to minimize total cost, which includes production cost + shipping cost. #Production costs: Plant A: $600 per unit × number produced, Plant B: $625 per unit × number produced

#Then, Minimum Z = (600+22)𝑥A1 +(600+14)𝑥A2 + (600+30)𝑥A3 +(625+16)𝑥B1 + (625+20)𝑥B2 + (625+24)𝑥B3

#1.There are constraints from Supply side (i.e., production capacity) #A1+ 𝑥A2+ 𝑥A3 ≤ 100 (which is the capacity of Plant A) #B1+ 𝑥B2+ 𝑥B3 ≤ 120 (which is the capacity of Plant B)

#2.There are constraints from Demand side (i.e., monthly demand) #A1+ 𝑥B1 =80 (demand of the warehouse 1) #A2+ 𝑥B2 =60 (demand of the warehouse 2) #A3+ 𝑥B3 =70 (demand of the warehouse 3)

#3.Non-negativity xij≥0

#next, when we solve this with R

# Install lpSolve if not installed  
# install.packages("lpSolve")  
  
library(lpSolve)

## Warning: package 'lpSolve' was built under R version 4.4.2

# Cost matrix (production + shipping)  
costs <- matrix(c(  
 600+22, 600+14, 600+30, # Plant A to W1,W2,W3  
 625+16, 625+20, 625+24 # Plant B to W1,W2,W3  
), nrow=2, byrow=TRUE)  
  
# Supply (production capacity)  
supply <- c(100, 120)  
  
# Demand (warehouse)  
demand <- c(80, 60, 70)  
  
# Solve transportation problem  
result <- lp.transport(  
 cost.mat = costs,  
 direction = "min",  
 row.signs = rep("<=", 2), #plant side constraints  
 row.rhs = supply,  
 col.signs = rep("=", 3), #warehouse side constraints  
 col.rhs = demand  
)

# Show optimal shipping plan  
result$solution

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

# Show total minimum cost  
result$objval

## [1] 132790

#Answer: Minimum Total Cost: $132,790

#Explanation: Plant A produces 100 units and ships 60 to W2 and 40 to W3. Plant B produces 110 units and ships 80 to W1 and 30 to W3. All warehouse demands are met, and total production + shipping cost is minimized.