Assignment_4

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R Markdown

###Assignment 4

Q1 - Answer - To get the Minimum cost function, Add the Unit shipping cost and the Unit Production cost

Since there is a difference of 10 units between Supply and Demand, we will need to create a dummy warehouse to store the excess. This means we create a 4th Warehouse and it creates two dummy variables

So now, we have 6 decision variables and 2 dummy variables

Objective Function:

Z min = 622 XA1 + 614 XA2 + 630 XA3 + 0 XA4 + 641 XB1 + 645 XB2 + 649 XB3 + 0 XB4

Constraints

Supply Constraints: XA1 + XA2 + XA3 + XA4 = 100 XB1 + XB2 + XB3 + XB4 = 120

Demand Constraints: XA1 + XB1 = 80 XA2 + XB2 = 60 XA3 + XB3 = 70 XA4 + XB4 = 10

Non Negative constraints: XIJ >=0 where I= Plant (I=A, B) and J=Warehouse (J=1,2,3,4)

```
setwd("D:\\Study\\Assignments\\QMM\\Assignment 4")

library(lpSolveAPI)
lprec<-make.lp(0,8)
lp.control(lprec,sense='min')
```

```
## $anti.degen
## [1] "fixedvars" "stalling"
##
## $basis.crash
## [1] "none"
##
## $bb.depthlimit
## [1] -50
##
## $bb.floorfirst
## [1] "automatic"
##
```

```
## $bb.rule
## [1] "pseudononint" "greedy"       "dynamic"      "rcostfixing"
##
## $break.at.first
## [1] FALSE
##
## $break.at.value
## [1] -1e+30
##
## $epsilon
##       epsb       epsd      epsel     epsint epsperturb   epspivot
##      1e-10      1e-09      1e-12      1e-07      1e-05      2e-07
##
## $improve
## [1] "dualfeas" "thetagap"
##
## $infinite
## [1] 1e+30
##
## $maxpivot
## [1] 250
##
## $mip.gap
## absolute relative
##    1e-11    1e-11
##
## $negrange
## [1] -1e+06
##
## $obj.in.basis
## [1] TRUE
##
## $pivoting
## [1] "devex"    "adaptive"
##
## $presolve
## [1] "none"
##
## $scalelimit
## [1] 5
##
## $scaling
## [1] "geometric"   "equilibrate" "integers"
##
## $sense
## [1] "minimize"
##
## $simplextype
## [1] "dual"   "primal"
##
```

```
## $timeout
## [1] 0
##
## $verbose
## [1] "neutral"

#objective function
set.objfn(lprec,c(622,614,630,0,641,645,649,0))

#constraints
add.constraint(lprec,rep(1,4),"=",100,indices =c(1,2,3,4))
add.constraint(lprec,rep(1,4),"=",120,indices =c(5,6,7,8))
add.constraint(lprec,rep(1,2),"=",80,indices =c(1,5))
add.constraint(lprec,rep(1,2),"=",60,indices =c(2,6))
add.constraint(lprec,rep(1,2),"=",70,indices =c(3,7))
add.constraint(lprec,rep(1,2),"=",10,indices=c(4,8))

solve(lprec)

## [1] 0

get.objective(lprec)

## [1] 132790

get.constraints(lprec)

## [1] 100 120  80  60  70  10

get.variables(lprec)

## [1]  0 60 40  0 80  0 30 10
```

Q2- Answer A - Since there is a difference between supply and demand, we will introduce a dummy variable on demand side because demand is smaller that supply.

Objective Function: Z(min) = 1.52 X1A + 1.60 X1B + 1.40 X1C + 1.70 X2A + 1.63 X2B + 1.55 X2C + 1.45 X3A+ 1.57 X3B + 1.30 X3C + 5.15 XAR1 + 5.69 XAR2 + 6.13 XAR3 + 5.63 XAR4 + 5.80 XAR5 + 0 XAR6 + 5.12 XBR1 + 5.47 XBR2 + 6.05 XBR3 + 6.12 XBR4 + 5.71 XBR5 + 0XBR6 + 5.32XCR1 + 6.16 XCR2 + 6.25 XCR3 + 6.17 XCR4 + 5.87 XCR5 + 0 XCR6

Constraints

Supply Constraints:

X1A + X1B + X1C=93

X2A + X2B + X2C=88

X3A + X3B + X3C=95

Demand Constraints:

XAR1+XBR1+XCR1=30

XAR2+XBR2+XCR2=57

XAR3+XBR3+XCR3=48

XAR4+XBR4+XCR4=91

XAR5+XBR5+XCR5=48

XAR6+XBR6+XCR6=2

Constraints from pumps to the refineries:

X1A + X2A + X3A = XAR1 + XAR2 + XAR3 + XAR4 + XAR5 + XAR6

X1B+ X2B + X3B = XBR1 + XBR2 + XBR3 + XBR4 + XBR5 + XBR6

X1C + X2C + X3C = XCR1 + XCR2 + XCR3+ XCR4 + XCR5 + XCR6

Xij>=0; (i= wells (1,2,3) and j=pumps (A, B, C)

Xjk>=0 where j=pumps (P, Q, R) and k=refineries (R1, R2, R3, R4, R5, R6)

A- **The optimal solution (minimum cost) is 1966.68$**

A- **The well that is used to capacity is Well 3**

Q2 - Answer B- Network Diagram

```
knitr::include_graphics("Capture-min.png")
```