Untitled

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Objective Function

These are subject to the following constraints

these are the supply constraints

library(Matrix)   
library("lpSolve")   
display <- matrix(c(22,14,30,600,100,   
16,20,24,625,120,   
80,60,70,"-","210/220"),ncol=5,nrow=3,byrow=TRUE)   
colnames(display) <- c("Warehouse1","Warehouse2","Warehouse3","Prod Cost","Prod Capacity")   
rownames(display) <- c("PlantA","PlantB","Monthly Demand")   
display <- as.table(display)   
display

## Warehouse1 Warehouse2 Warehouse3 Prod Cost Prod Capacity  
## PlantA 22 14 30 600 100   
## PlantB 16 20 24 625 120   
## Monthly Demand 80 60 70 - 210/220

## Warehouse1 Warehouse2 Warehouse3 Prod Cost Prod Capacity

## PlantA 22 14 30 600 100

## PlantB 16 20 24 625 120

## Monthly Demand 80 60 70 - 210/220

Being the capacity is equal to 220 and Demand is equal to 210 we need to add a “dummy” row where a Warehouse4 would be. It will contain 0 and 0 for each of the plants and the dummy will add to the total up to 220. The table would then look like this:

display1 <- matrix(c(622,614,630,0,100,   
641,645,649,0,120,   
80,60,70,10,220),ncol=5,nrow=3,byrow=TRUE)   
colnames(display1) <- c("Warehouse1","Warehouse2","Warehouse3","Dummy","Production Capacity")   
rownames(display1) <- c("PlantA","PlantB","Monthly Demand")   
display1 <- as.table(display1)   
display1

## Warehouse1 Warehouse2 Warehouse3 Dummy Production Capacity  
## PlantA 622 614 630 0 100  
## PlantB 641 645 649 0 120  
## Monthly Demand 80 60 70 10 220

This table now satisfies the need for a balanced problem. Now we are ready to solve within R. First we want to

costs <- matrix(c(622,  
614,630,0,   
641,645,649,0),nrow=2, byrow = TRUE)

Next we will identify the Production Capacity in the row of the matrix:

row.rhs <- c(100,120)   
row.signs <- rep("<=", 2)

Then we will identify the Monthly Demand with double variable of 10 at the end. Above we added the 0,0 in at the end of each of the columns:

col.rhs <- c(80,60,70,10)   
col.signs <- rep(">=", 4)

Now we are ready to run LP Transport command:

lp.transport(costs,"min",row.signs,row.rhs,col.signs,col.rhs)

## Success: the objective function is 132790

Here is the solution matrix:

lp.transport(costs, "min", row.signs, row.rhs, col.signs, col.rhs)$solution

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

This gives us the following that dollars. This gives us the following results for each of the variables:

which is Warehouse 2 from Plant A.

which is Warehouse 3 from Plant A.

which is Warehouse 1 from Plant B.

which is Warehouse 3 from Plant B.and because “10” shows up in the 4th variable

it is a “throw-away variable” This would complete the answer for question 1. We know that number of variables in primal is equal to the number of constants in dual. The first question is the primal of the LP. Since we took the minimization in the primal we will maximize in the dual. Let’s use the variables u and v for the dual problem

display2 <- matrix(c(622,614,630,100,"u\_1",   
641,645,649,120,"u\_2",   
80,60,70,220,"-",   
"v\_1","v\_2","v\_3","-","-"),ncol=5,nrow=4,byrow=TRUE)   
colnames(display2) <- c("W1","W2","W3","Prod Cap","Supply (Dual)")   
rownames(display2) <- c("PlantA","PlantB","Monthly Demand","Demand (Dual)")   
display2 <- as.table(display2)   
display2

## W1 W2 W3 Prod Cap Supply (Dual)  
## PlantA 622 614 630 100 u\_1   
## PlantB 641 645 649 120 u\_2   
## Monthly Demand 80 60 70 220 -   
## Demand (Dual) v\_1 v\_2 v\_3 - -

From here we are going to create our objective function based on the constraints from the primal. Then use the objective function from the primal to find the constants of the dual. Maximize Z =

this objective function is subject to the following constraints

These constants are taken from the transposed matrix of the Primal of Linear Programming function. An easy way to check yourself is to transpose the f.con into the matrix and match to the constants above in the Primal. These are unrestricted where where u=1,2 and v=1,2,3

#Constants of the primal are now the objective function variables.   
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)   
  
#these change because we are MAX the dual not min   
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

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

## [1] 614 633 8 0 16

The minimal Z=132790 (Primal) and the maximum Z=139120(Dual). What are we trying to max/min in this problem. We found that we should not be shipping from Plant(A/B) to all three Warehouses. We should be shipping from: 60 Units from Plant A to Warehouse 2. 40 Units from Plant A to Warehouse 3. 60 Units from Plant B to Warehouse 1. 60 Units from Plant B to Warehouse 3. Now we want to Max the profits from each distribution in respect to capacity. Now I have been working very hard to try and get the third question correct from the problem.

row.rhs1 <- c(101,120)   
row.signs1 <- rep("<=", 2)   
col.rhs1 <- c(80,60,70,10)   
col.signs1 <- rep(">=", 4)   
row.rhs2 <- c(100,121)   
row.signs2 <- rep("<=", 2)   
col.rhs2 <- c(80,60,70,10)   
col.signs2 <- rep(">=", 4)   
lp.transport(costs,"min",row.signs,row.rhs,col.signs,col.rhs)

## Success: the objective function is 132790

lp.transport(costs,"min",row.signs1,row.rhs1,col.signs1,col.rhs1)

## Success: the objective function is 132771

lp.transport(costs,"min",row.signs2,row.rhs2,col.signs2,col.rhs2)

## Success: the objective function is 132790

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

## [1] 614 633 8 0 16

CONCLUSION: from the primal:

which is 60 Units from Plant A to Warehouse 2.

which is 40 Units from Plant A to Warehouse 3.

which is 60 Units from Plant B to Warehouse 1.

which is 60 Units from Plant B to Warehouse 3. from the dual We want the MR=MC. Five of the six MR<=MC. The only equation that does not satisfy this requirement is Plant B to Warehouse 2. We can see that from the primal that we will not be shipping any AED device there.