# Assignment 4

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10/22/2021

# Transportation problem and Network Model

## Loading the necessary libraries

```
setwd("C:/Users/Fabrizio/Desktop/MyBlackBoard/MIS 64018 - Quant. Management Modeling/Module 7 -  Network Models/Assignment 4")
library(lpSolveAPI)
```

## Introduction

Heart Start produces automated external defibrillators (AEDs) in each of two different plants (A and B)The AEDs are sold through three wholesalers. How many AEDs should be produced in each plant, and how should they be distributed to each of the three wholesaler warehouses so as to minimize the combined cost of production and shipping?

## Solve the LP Model

In this assignment, we chose to write the problem formulation in the lp format, a text file created specifically for this problem, that includes all the information.

```
x <- read.lp("Heart_Start.lp")
x
```

```
## Model name:
##            xa1   xa2   xa3   xb1   xb2   xb3   xa4   xb4
## Minimize   622   614   630   641   645   649     0     0
## R1           1     1     1     0     0     0     1     0  =  100
## R2           0     0     0     1     1     1     0     1  =  120
## R3           1     0     0     1     0     0     0     0  =   80
## R4           0     1     0     0     1     0     0     0  =   60
## R5           0     0     1     0     0     1     0     0  =   70
## R6           0     0     0     0     0     0     1     1  =   10
## Kind       Std   Std   Std   Std   Std   Std   Std   Std
## Type      Real  Real  Real  Real  Real  Real  Real  Real
## Upper      Inf   Inf   Inf   Inf   Inf   Inf   Inf   Inf
## Lower        0     0     0     0     0     0     0     0
```

Now that the file has been read by R, we can solve it.

```
solve(x)
```

```
## [1] 0
```

Here, zero means that R found an optimal solution.

```
get.objective(x)
```

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

```
get.variables(x)
```

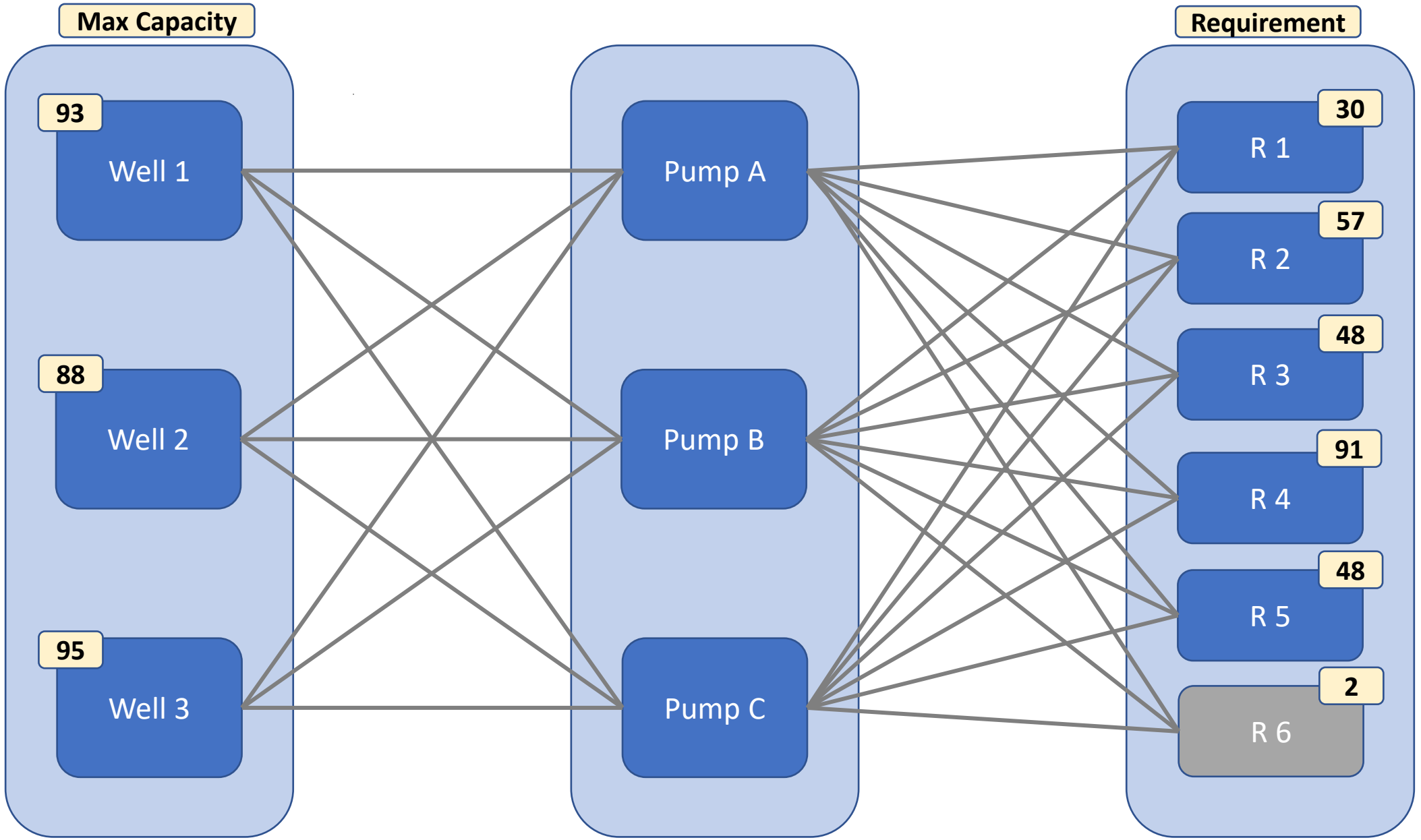
```
## [1]  0 60 40 80  0 30  0 10
```

From the results we know that the optimal solution is reach with a minimum total cost of $132,790 with 60 AEDs to be produced by plant A and sent to Warehouse 2, 40 in plant A and sent to warehouse 3, 80 in plant B and sent to warehouse 1, and 30 in plant B and sent to warehouse 3.

```
get.constraints(x)
```

```
## [1] 100 120  80  60  70  10
```

These are the RHS values for our 6 constraints.


Max Capacity
93
Well 1
88
Well 2
95
Well 3
Pump A
Pump B
Pump C
Requirement
30
R 1
57
R 2
48
R 3
91
R 4
48
R 5
2
R 6

$$\min Z = \sum_i^n \sum_j^n c_{ij} * x_{ij}$$
$$\text{subject to } \sum_j^n x_{ij} - \sum_j^n x_{ji} = b_i$$

$$\min \quad Z = 0.52x_{W1Pa} + 0.6x_{W1Pb} + 0.4x_{W1Pc} + \cdots + 0.3_{W3Pc} + 5.15_{PaR1} + \cdots + 5.87_{PcR5}$$

subject to

$$-x_{W1Pi} - x_{W2Pi} - x_{W3Pi} + x_{PiR1} + x_{PiR2} + x_{PiR3} + x_{PiR4} + x_{PiR5} = 0$$

(for i = a, b, c)

$x_{W1Pa} + x_{W1Pb} + x_{W1Pc} = 93$ (max capacity W1)
$x_{W2Pa} + x_{W2Pb} + x_{W2Pc} = 88$ (max capacity W2)
$x_{W3Pa} + x_{W3Pb} + x_{W3Pc} = 95$ (max capacity W3)
$x_{PaR1} + x_{PbR1} + x_{PcR1} = 30$ (requirement R1)
$x_{PaR2} + x_{PbR2} + x_{PcR2} = 57$ (requirement R2)
$x_{PaR3} + x_{PbR3} + x_{PcR3} = 48$ (requirement R3)
$x_{PaR4} + x_{PbR4} + x_{PcR4} = 91$ (requirement R4)
$x_{PaR5} + x_{PbR5} + x_{PcR5} = 48$ (requirement R5)
$x_{PaR6} + x_{PbR6} + x_{PcR6} = 2$ (requirement R6)