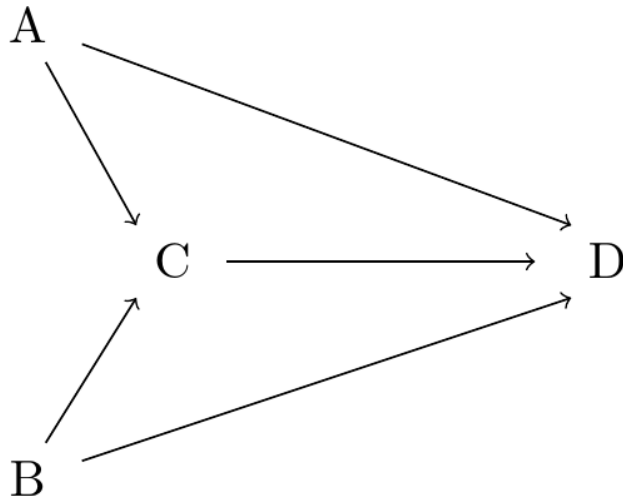


Homework 5: Network Assignment and Validation

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Given a network of



and link travel time equations of

$$\begin{aligned}t_{AD} &= 20 + 0.01q_{AD} \\t_{AC} &= 10 + 0.005q_{AC} \\t_{CD} &= 12 + 0.005q_{CD} \\t_{BC} &= 7.25 + 0.005q_{BC} \\t_{BD} &= 20 + 0.01q_{BD},\end{aligned}$$

with 7000 trips from A to D and 500 from B to D:

5.1

We set up a matrix to solve the system of equations:

$$\begin{pmatrix} q_{AD} & q_{AC} & q_{CD} & q_{BC} & q_{BD} & t_{AD} & t_{AC} & t_{CD} & t_{BC} & t_{BD} & = \\ 0.01 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & -20 \\ 0 & 0.005 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & -10 \\ 0 & 0 & 0.005 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & -12 \\ 0 & 0 & 0 & 0.005 & 0 & 0 & 0 & 0 & -1 & 0 & -7.25 \\ 0 & 0 & 0 & 0 & 0.01 & 0 & 0 & 0 & 0 & -1 & -20 \\ 0 & 0 & 0 & 0 & 0 & -1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & -1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 7000 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 5000 \\ 0 & 1 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

```
matrix(c(0.01,0,0,0,0,-1,0,0,0,0,-20,
0,0.005,0,0,0,0,-1,0,0,0,-10,
0,0,0.005,0,0,0,0,-1,0,0,-12,
0,0,0,0.005,0,0,0,0,-1,0,-7.25,
0,0,0,0,0.01,0,0,0,0,-1,-20,
0,0,0,0,0,-1,1,1,0,0,0,
0,0,0,0,0,0,1,1,-1,0,
1,1,0,0,0,0,0,0,0,0,7000,
0,0,0,1,1,0,0,0,0,0,5000,
0,1,-1,1,0,0,0,0,0,0,0
),
byrow = T, ncol = 11) %>%
rref()
```

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11]
## [1,]    1    0    0    0    0    0    0    0    0    0 4050.00
## [2,]    0    1    0    0    0    0    0    0    0    0 2950.00
## [3,]    0    0    1    0    0    0    0    0    0    0 4750.00
## [4,]    0    0    0    1    0    0    0    0    0    0 1800.00
## [5,]    0    0    0    0    1    0    0    0    0    0 3200.00
## [6,]    0    0    0    0    0    1    0    0    0    0   60.50
## [7,]    0    0    0    0    0    0    1    0    0    0   24.75
## [8,]    0    0    0    0    0    0    0    1    0    0   35.75
## [9,]    0    0    0    0    0    0    0    0    1    0   16.25
## [10,]   0    0    0    0    0    0    0    0    0    1   52.00
```