

Systems of Linear Equation practice questions

Question 1 Solve the following using Gauss elimination

A)

$$\begin{aligned} 2x_1 + x_2 - x_3 &= 0 \\ x_1 &+ x_3 = 4 \\ x_1 + x_2 + x_3 &= 0 \end{aligned}$$

B)

$$\begin{aligned} x_1 - x_2 + x_3 &= 1 \\ -x_1 &+ x_3 = 1 \\ x_1 + x_2 - x_3 &= 0 \end{aligned}$$

C)

$$\begin{aligned} x_1 + x_2 + x_3 &= 2 \\ 2x_1 + 3x_2 + 4x_3 &= 3 \\ x_1 - 2x_2 - x_3 &= 1 \end{aligned}$$

D)

$$\begin{aligned} x_1 - 2x_2 - 3x_3 &= -1 \\ 3x_1 + x_2 + x_3 &= 4 \\ 11x_1 - x_2 - 3x_3 &= 10 \end{aligned}$$

Question 2 The LU decomposition of a matrix \mathbf{A} is given as follows:

$$L = \begin{bmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \\ -3 & 1 & 1 \end{bmatrix} \text{ and } U = \begin{bmatrix} 1 & 4 & 3 \\ 0 & 2 & 6 \\ 0 & 0 & 3 \end{bmatrix}.$$

What is \mathbf{A} ?

Question 3 Solve using LU decomposition method

a. $x_1 - x_2 + 3x_3 = 2,$
 $3x_1 - 3x_2 + x_3 = -1,$
 $x_1 + x_2 = 3.$

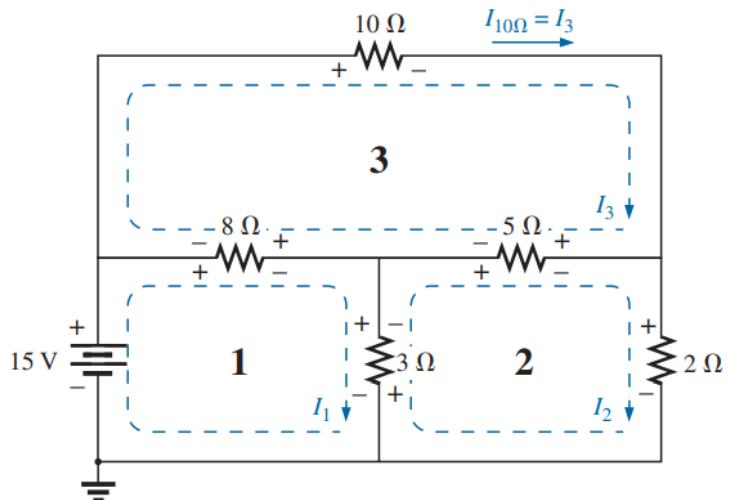
c. $2x_1 = 3,$
 $x_1 + 1.5x_2 = 4.5,$
 $-3x_2 + 0.5x_3 = -6.6,$
 $2x_1 - 2x_2 + x_3 + x_4 = 0.8.$

b. $2x_1 - 1.5x_2 + 3x_3 = 1,$
 $-x_1 + 2x_3 = 3,$
 $4x_1 - 4.5x_2 + 5x_3 = 1.$

d. $x_1 + x_2 + x_4 = 2,$
 $2x_1 + x_2 - x_3 + x_4 = 1,$
 $4x_1 - x_2 - 2x_3 + 2x_4 = 0,$
 $3x_1 - x_2 - x_3 + 2x_4 = -3.$

e. $7x_1 - 2x_2 + x_3 = 12$
 $14x_1 - 7x_2 - 3x_3 = 17$
 $-7x_1 + 11x_2 + 18x_3 = 5$

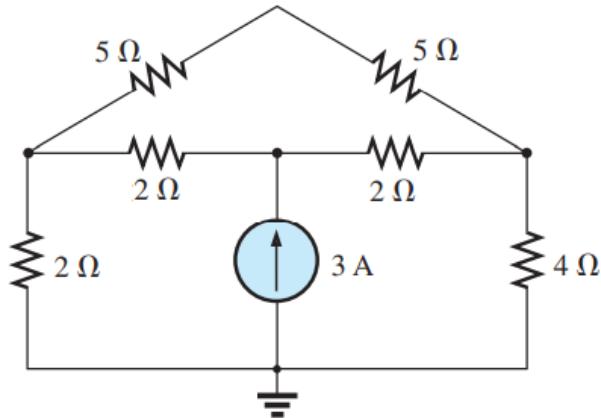
Question 4 Find the current through the 10Ω resistor of the network shown.



The system equations of this network are given by:

$$\begin{aligned} 11I_1 - 3I_2 - 8I_3 &= 15 \text{ V} \\ -3I_1 + 10I_2 - 5I_3 &= 0 \\ -8I_1 - 5I_2 + 23I_3 &= 0 \end{aligned}$$

Question 5 determine the potential across the 4Ω resistor of the network shown.

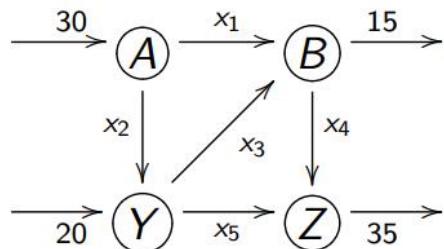


The system equations of this network are given by:

$$\begin{aligned} 1.1V_1 - 0.5V_2 - 0.1V_3 &= 0 \\ V_2 - 0.5V_1 - 0.5V_3 &= 3 \\ \underline{0.85V_3 - 0.5V_2 - 0.1V_1 = 0} \end{aligned}$$

Question 6

The flow of traffic through a network of telephone towers is shown in the following figure:



- ▶ Solve this system for x_1, x_2, x_3, x_4, x_5 .
- ▶ Find the traffic flow when $x_2 = 20$ and $x_3 = 5$.
- ▶ Find the traffic flow when $x_2 = 15$ and $x_3 = 0$.