

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 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 A ?

Question 3 Solve using LU decomposition method

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

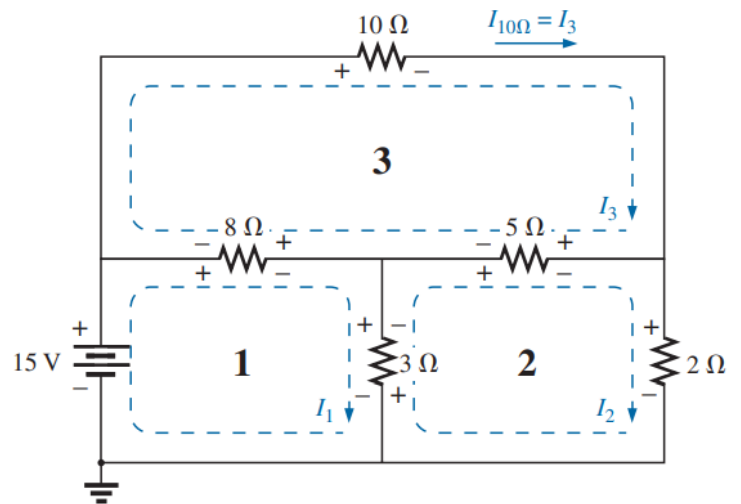
c.
$$\begin{aligned} 2x_1 &= 3, \\ x_1 + 1.5x_2 &= 4.5, \\ -3x_2 + 0.5x_3 &= -6.6, \\ 2x_1 - 2x_2 + x_3 + x_4 &= 0.8. \end{aligned}$$

b.
$$\begin{aligned} 2x_1 - 1.5x_2 + 3x_3 &= 1, \\ -x_1 + 2x_3 &= 3, \\ 4x_1 - 4.5x_2 + 5x_3 &= 1. \end{aligned}$$

d.
$$\begin{aligned} x_1 + x_2 + x_4 &= 2, \\ 2x_1 + x_2 - x_3 + x_4 &= 1, \\ 4x_1 - x_2 - 2x_3 + 2x_4 &= 0, \\ 3x_1 - x_2 - x_3 + 2x_4 &= -3. \end{aligned}$$

e.
$$\begin{aligned} 7x_1 - 2x_2 + x_3 &= 12 \\ 14x_1 - 7x_2 - 3x_3 &= 17 \\ -7x_1 + 11x_2 + 18x_3 &= 5 \end{aligned}$$

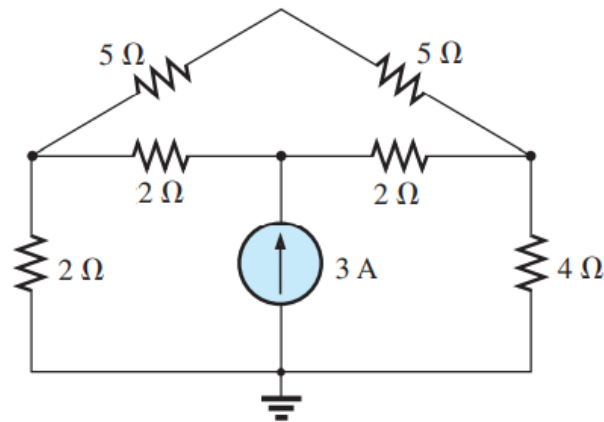
Question 4 Find the current through the $10\ \Omega$ resistor of the network shown.



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 $4\ \Omega$ resistor of the network shown.

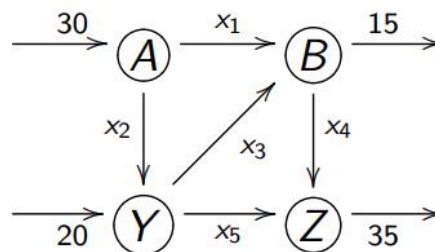


The system equations of this network are given by:

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

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 $x_3 = 0$.