

Date:.....

Name:

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Roll No.:

2021-SE_04

Subject :

LADE

Discipline:

Software-Engineering (SE)

$$Q_1 = \text{Sol} =$$

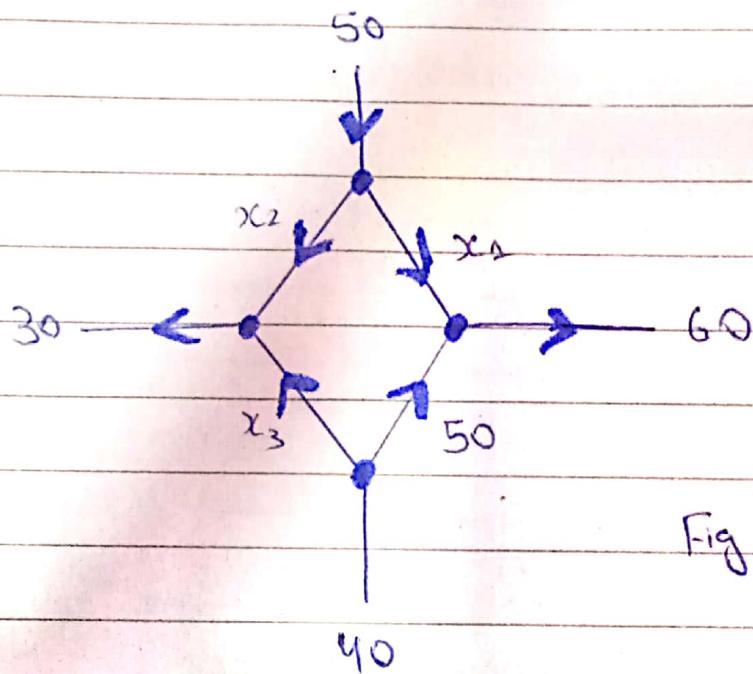


Fig A

Draw Arbitrarily Answers and label them with variables as shown in Fig A

Linear System

$$x_2 + 50 = 60 \quad \text{--- ①}$$

$$x_1 + x_2 = 50 \quad \text{--- (1)}$$

$$x_2 + x_3 = 30 \quad \text{--- (11)}$$

$$x_3 + 50 = 40 \quad - \textcircled{14}$$

$$x_1 = 10$$

$$x_2 = 40$$

$$x_3 = -10$$

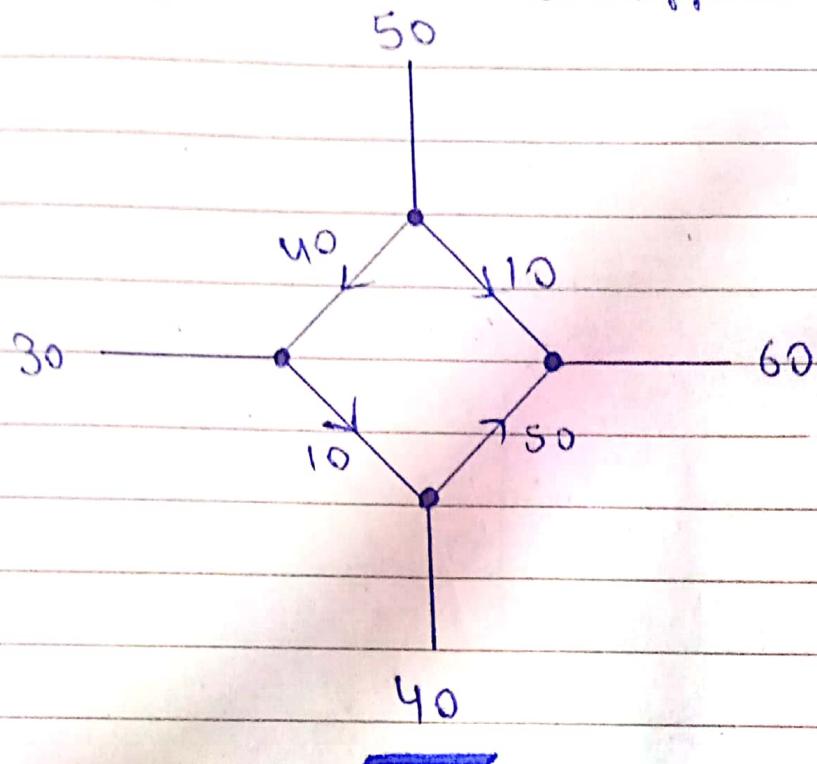
$$x_2 = 50 - 10 = 40; \quad x_2 + x_3 = 30$$

$$40 + 2(3) = 30$$

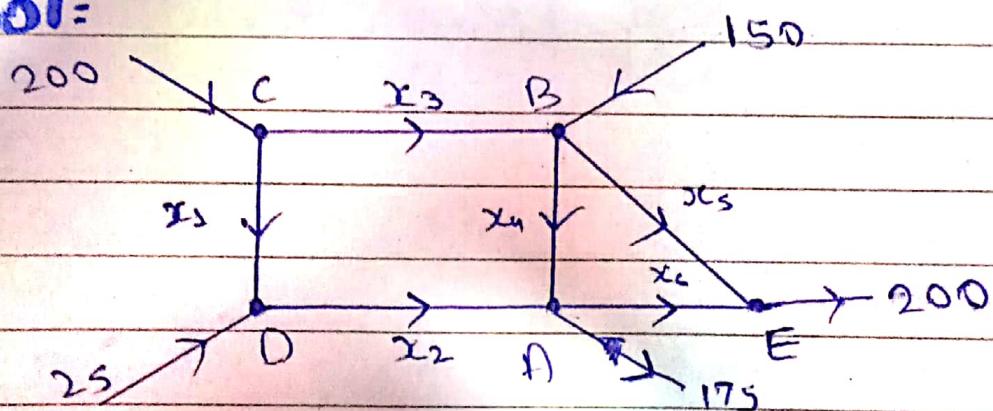
$$x_3 = -30$$

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x_3 indicates that the direction in fig A
is incorrect, Its ^{direction} is reverse (opposite as shown in fig A)



Q=2 : Sol:



a) Linear System

$$x_1 + x_3 = 200 \quad -\textcircled{1}$$

$$x_1 + 25 = x_2 \quad -\textcircled{2}$$

$$x_2 + x_4 = x_6 + 175 \quad -\textcircled{3}$$

$$x_5 + x_6 = 200 \quad -\textcircled{4}$$

$$x_4 + x_5 = 150 + x_3 \quad -\textcircled{5}$$

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$$\left[\begin{array}{cccc} 1 & 0 & 1 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & -1 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{array} \begin{array}{c} 0 \\ 0 \\ 0 \\ -1 \\ 1 \end{array} \right] \begin{array}{l} 200 \\ 25 \\ 150 \\ 175 \\ 200 \end{array}$$

$\underline{R_2 - R_1}, \underline{(-R_3)}$

$$\left[\begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & -1 & -1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{array} \begin{array}{c} 0 \\ 0 \\ -1 \\ 0 \\ 1 \end{array} \right] \begin{array}{l} 200 \\ -225 \\ -150 \\ 175 \\ 200 \end{array}$$

$\underline{R_4 + R_1}$

$$\left[\begin{array}{cccc} 1 & 0 & 1 & 0 \\ 0 & -1 & -1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & -1 & 1 \\ 0 & 0 & 0 & 1 \end{array} \begin{array}{c} 0 \\ 0 \\ 0 \\ -1 \\ 1 \end{array} \right] \begin{array}{l} 200 \\ -225 \\ -150 \\ -150 \\ 200 \end{array}$$

$\underline{R_4 + R_3}$

$$\left[\begin{array}{cccc} 1 & 0 & 1 & 0 \\ 0 & -1 & -1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 \end{array} \begin{array}{c} 0 \\ 0 \\ 0 \\ -1 \\ 1 \end{array} \right] \begin{array}{l} 200 \\ -225 \\ -150 \\ -205 \\ 200 \end{array}$$

$$\left[\begin{array}{cccc} 1 & 0 & 1 & 0 \\ 0 & +1 & +1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & +1 \\ 0 & 0 & 0 & 0 \end{array} \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{array} \right] \begin{array}{l} 200 \\ +225 \\ -150 \\ 200 \\ 200 \end{array}$$

$\underline{R_5 + R_4}, \underline{(-R_2)}, \underline{(-R_3)}$

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$$x_1 + x_3 = 200$$

$$x_2 + x_3 = 225$$

$$x_3 - x_1 - x_5 = -150$$

$$x_5 + x_6 = 200$$

Let $x_5 = u$, $x_4 = t$

$$x_5 = u$$

$$x_6 = 200 - u$$

$$x_4 = t$$

$$x_3 = -150 + u + t$$

$$x_2 = 375 + u + t$$

$$x_1 = 350 + u + t$$

Infinitely Many Solutions.

Q)

$$\text{IF } x_4 = 50 \quad x_5 = 0 \quad x_4 = 50 = t \quad t = 50$$



$$x_6 = 0$$

$$x_5 = 0$$

$$\Rightarrow 0 = 200 - u \Rightarrow u = 200$$



$$x_4 = 50$$

$$x_3 = -150 + 200 + 50 = 100$$



$$x_3 = 100$$

$$x_2 = 375 - 200 - 50 = 125$$



$$x_2 = 125$$

$$x_1 = 350 - 200 - 50 = 100$$



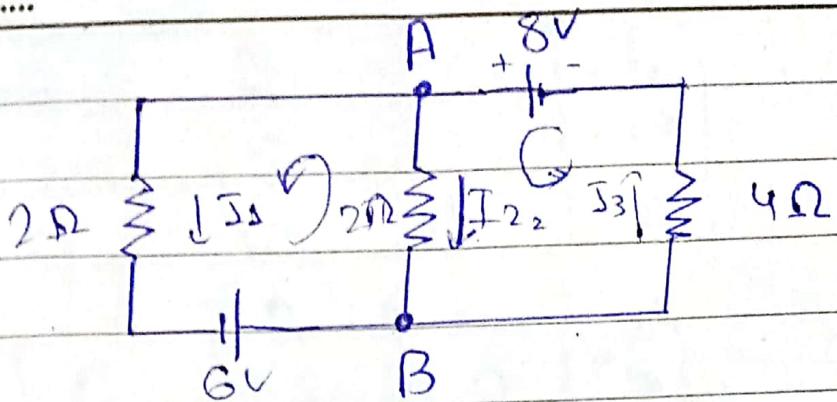
$$x_1 = 100$$

Thus if $x_4 = 50$ and $x_6 = 0$ then

$$x_1 = 100, x_2 = 125, x_3 = 100 \text{ and } x_5 = 200$$

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Q5 :



⇒ Kirchoff's Current Law:

Node	Current In	Current Out
A	I_3	$I_1 + I_2$
B	I_1, I_2	I_3

As these eqs are same the can be expressed as
as ~~thus if they~~
 $I_1 + I_2 - I_3 = 0$

⇒ Kirchoff's Voltage Law

	Voltage Rises	Voltage Drops
Left Inside Loop	$2I_2 + 6$	$2I_3$
Right Inside Loop	8	$2I_2 + 4I_3$
Outside Loop	$6 + 8$	$4I_3 + 2I_1$

$$2I_1 + 4I_3 = 14$$

$$2I_2 + 4I_3 = 8$$

$$-2I_1 + 2I_2 = -6$$

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$$\left[\begin{array}{ccc|c} -2 & 2 & 0 & -6 \\ 2 & 0 & 4 & 14 \\ 0 & 2 & 4 & 8 \end{array} \right]$$

$$\xrightarrow{R_2 + R_1}$$
$$\left[\begin{array}{ccc|c} -2 & 2 & 0 & -6 \\ 0 & 2 & 4 & 14 \\ 0 & 2 & 4 & 8 \end{array} \right] \quad \text{Row 2 has a circled 0}$$

$$\xrightarrow{R_3 - R_2}$$
$$\left[\begin{array}{ccc|c} -2 & 2 & 0 & -6 \\ 0 & 2 & 4 & 8 \\ 0 & 0 & 0 & 0 \end{array} \right] \quad -\frac{1}{2}R_2, \frac{1}{2}R_2$$

$$\left[\begin{array}{ccc|c} 1 & -1 & 0 & 3 \\ 0 & 1 & 2 & 4 \\ 0 & 0 & 0 & 0 \end{array} \right]$$

\Rightarrow
 \Rightarrow

$$\boxed{I_1 - I_2 = 3} \quad \text{--- (2)}$$

$$\boxed{I_2 + 2I_3 = 4} \quad \text{--- (3)}$$

$$(I_1 + I_2 - I_3 = 0) \quad \text{From eq 1}$$

$$\therefore I_1 + I_2 = I_3 \quad \text{Put in eq (3)}$$

eq (3) becomes

$$I_2 + 2I_1 + 2I_2 = 4$$

$$3I_2 + 2I_1 = 4 \quad \text{--- (4)}$$

$$I_1 - I_2 = 3$$

$$\boxed{I_3 = 3 + I_2}$$

Put this in eq (2)

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$$3I_2 + 2(B + I_2) = 4$$

$$3I_2 + 6 + 2I_2 = 4$$

$$3I_2 + 2I_2 = -2$$

$$5I_2 = -2$$

$$\boxed{I_2 = -\frac{2}{5}}$$

Solve eq ②

$$I_1 - I_2 = 3$$

$$I_1 + \frac{2}{5} = 3$$

$$\boxed{I_1 = \frac{13}{5}}$$

Solve eq ③

$$I_2 + 2I_3 = 4$$

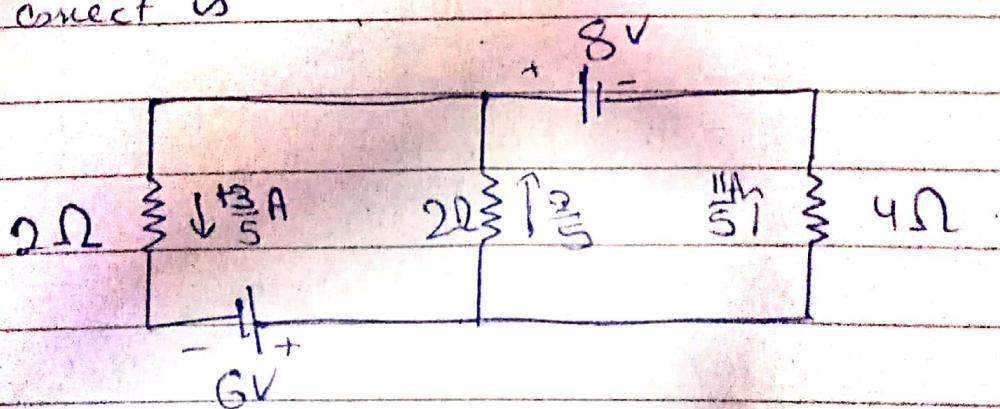
$$2I_3 = 4 - I_2 = 4 + \frac{2}{5} = \frac{22}{5}$$

$$\boxed{I_3 = \frac{11}{5}}$$

$$I_1 = \frac{13}{5}, I_2 = -\frac{2}{5}, I_3 = \frac{11}{5}$$

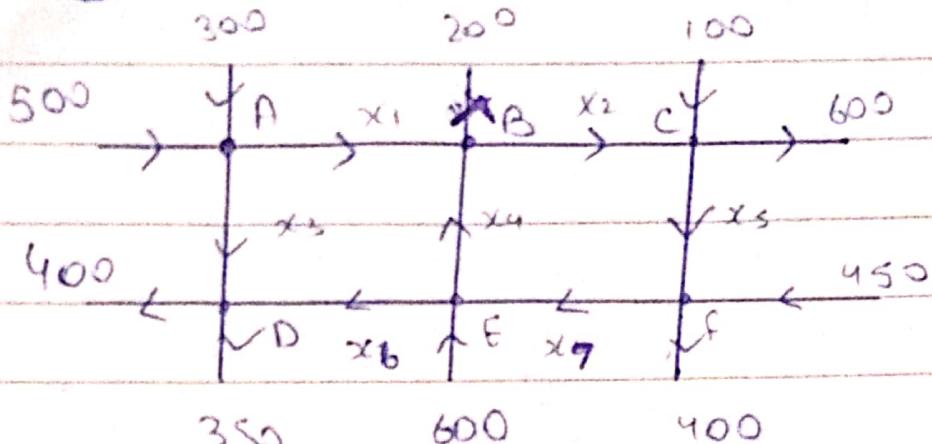
$I_2 = -\frac{2}{5}$ indicates its direction is opposite as shown.

Thus the correct is



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Q4, Sol.



(A) Linear System:

Intersection	Flow In.	Flow Out
A	$300 + 500$	$x_1 + x_3 \Rightarrow x_1 + x_3 = 800$
B	$x_1 + x_4$	$200 + x_2 \Rightarrow x_1 - x_2 + x_4 = 200$
C	$x_2 + 100$	$x_5 + 600 \Rightarrow x_2 + x_5 = 700$
D	$x_3 + x_6$	$400 + 350 \Rightarrow x_3 + x_6 = 750$
E	$600 + x_7$	$x_4 + x_6 \Rightarrow x_4 + x_6 - x_7 = 600$
F	$x_5 + 450$	$x_7 + 400 \Rightarrow x_5 - x_7 = -50$

$$\left[\begin{array}{ccccccc|c} 1 & 0 & 1 & 0 & 0 & 0 & 0 & 800 \\ 1 & -1 & 0 & 1 & 0 & 0 & 0 & 200 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 700 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 750 \\ 0 & 0 & 0 & 1 & 0 & 1 & -1 & 600 \\ 0 & 0 & 0 & 0 & 1 & 0 & -1 & -50 \end{array} \right]$$

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 $R_2 - R_1$

1	0	1	0	0	0	0	800
0	-1	-1	1	0	0	0	-600
0	1	0	0	1	0	0	700
0	0	1	0	0	1	0	750
0	0	0	1	0	1	-1	600
0	0	0	0	1	0	-1	-50

 $R_3 + R_2$

1	0	1	0	0	0	0	800
0	-1	-1	1	0	0	0	-600
0	0	-1	1	1	0	0	100
0	0	1	0	0	1	0	750
0	0	0	1	0	1	-1	600
0	0	0	0	1	0	-1	-50

 $R_4 + R_3$

1	0	1	0	0	0	0	800
0	-1	-1	1	0	0	0	-600
0	0	-1	1	1	0	0	100
0	0	0	1	1	1	0	850
0	0	0	1	0	1	-1	600
0	0	0	0	1	0	-1	-50

 $R_5 - R_4$

1	0	1	0	0	0	0	800
0	-1	-1	1	0	0	0	-600
0	0	-1	1	1	0	0	100
0	0	0	1	1	1	0	850
0	0	0	0	-1	0	-1	-250
0	0	0	0	1	0	-1	-50

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$$R_b + R_s$$

$$\left[\begin{array}{ccccccc|c} 1 & 0 & 1 & 0 & 0 & 0 & 0 & 800 \\ 0 & -1 & -1 & 1 & 0 & 0 & 0 & -600 \\ 0 & 0 & -1 & 1 & 1 & 0 & 0 & 100 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 850 \\ 0 & 0 & 0 & 0 & -1 & 0 & -1 & -250 \\ 0 & 0 & 0 & 0 & 0 & 0 & -2 & -300 \end{array} \right]$$

$$x_1 + x_3 = 800$$

$$-x_2 - x_3 + x_4 = -600$$

$$-x_3 + x_4 + x_5 = 100$$

$$x_4 + x_5 + x_6 = 850$$

$$-x_5 - x_7 = -250$$

$$x_7 = 150$$

$$x_7 = 150$$

$$x_4 + x_5 + x_6 = 850$$

$$x_4 + 100 + x_6 = 850$$

$$x_5 + 150 = 250$$

$$x_5 = 100$$

$$x_4 + x_6 = 750$$

$$\text{let } x_6 = t$$

$$x_4 = 750 - t$$

$$-x_3 + 750 - t + x_5 = 100$$

$$-x_3 + 750 - t = 0$$

$$750 - t = x_3$$

$$x_5 + 750 - t = 800$$

$$x_5 = 50 + t$$

$$-x_2 - 750 + t + 750 - t = -600$$

$$x_2 = 600$$

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$$x_1 = 50+t$$

$$x_2 = 60 \text{ } \square$$

$$x_3 = 750-t$$

$$x_4 = 750-t$$

$$x_5 = 100$$

$$x_6 = t$$

$$x_7 = 150$$

Infinitely Many Solns:

$$\Rightarrow x_1 - 50 = x_3 - 750 = x_4 - 750 = x_6$$

c)

If $A \rightarrow B$ road is else $x_1 = 0$

$$50+t=0$$

$$t = -50$$

$$x_1 = 0$$

$$x_2 = 60 \text{ } \square$$

$$x_3 = 800$$

$$x_4 = 800$$

$$x_5 = 100$$

$$x_6 = -50$$

$$x_7 = 150$$

Yes it is possible and it will look alike this

