3.5

Solution:

$$\begin{cases} -15 + 15\bar{I}_1 - 10\bar{I}_2 + 10 = 0 \\ -10 + 20\bar{I}_2 - 10\bar{I}_1 = 0 \end{cases}$$

$$\begin{cases} 3\bar{I}_1 - 2\bar{I}_2 = 1 \\ \bar{I}_1 - 2\bar{I}_2 = -1 \end{cases}$$

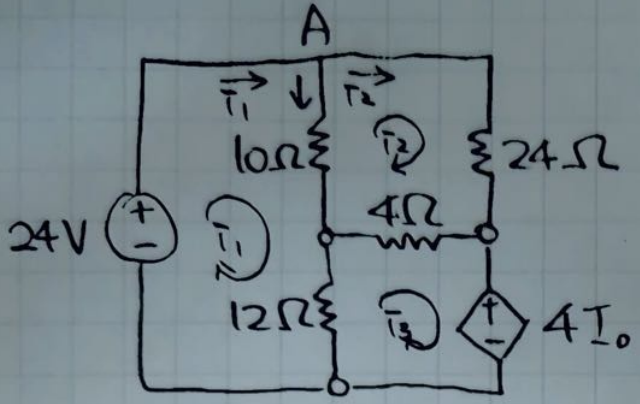
$$2\bar{I}_1 = 2$$

$$\bar{I}_1 = 1 \quad \bar{I}_2 = 1$$

Answer:

$$I_1 = 1A, \; I_2 = 1A, \; I_3 = 0A$$

3.6



$$-24 + (10+12)\bar{I}_1 - 10\bar{I}_2 - 12\bar{I}_3 = 0$$

$$\begin{cases} 38\bar{I}_2 - 10\bar{I}_1 - 4\bar{I}_3 = 0 \\ 16\bar{I}_3 + 4I_0 - 12\bar{I}_1 - 4\bar{I}_2 = 0 \end{cases}$$

$$\Rightarrow \begin{cases} 11\bar{I}_1 - 5\bar{I}_2 - 6\bar{I}_3 = 12 \\ 5\bar{I}_1 - 19\bar{I}_2 + 2\bar{I}_3 = 0 \\ 3\bar{I}_1 + \bar{I}_2 - 4\bar{I}_3 = I_0 \end{cases}$$

$$\Rightarrow \begin{cases} 13\bar{I}_1 - 13\bar{I}_2 = 24 - 3I_0 \\ 13\bar{I}_1 - 37\bar{I}_2 = I_0 \end{cases}$$

$$24\bar{I}_2 = 24 - 4I_0$$

$$\bar{I}_2 = 1 - \frac{1}{6}I_0$$

$$\bar{I}_1 = \frac{37}{13} - \frac{31}{78}\bar{I}_0$$

$$\bar{I}_3 = \frac{259}{13} - \frac{217}{78}\bar{I}_0$$

$$\frac{111}{13} - \frac{93}{78}I_0 + 1 - \frac{1}{6}I_0 - \frac{1036}{13} + \frac{868}{78}\bar{I}_0 = \bar{I}_0$$

$$-\frac{912}{13} + \frac{1762}{78}\bar{I}_0 = I_0$$

$$I_0 = \frac{912}{13} \times \frac{78}{1762 - 78}$$

$$= 8\,A$$

3.17

Solution:

$$2\bar{I}_1 + 12\bar{I}_2 + 6\bar{I}_2 - 8\bar{I}_4 = 0$$

$$\begin{cases} \bar{I}_2 = \bar{I}_1 + 5 \\ \bar{I}_2 = \bar{I}_3 + 3\bar{I}_0 \\ 10\bar{I}_4 - 10 - 8\bar{I}_3 = 0 \\ \bar{I}_0 = -I_4 \end{cases}$$

$$\Rightarrow \begin{cases} \bar{I}_1 + 3\bar{I}_2 + 6\bar{I}_3 - 4\bar{I}_4 = 0 \\ \bar{I}_1 - \bar{I}_2 = -5 \\ \bar{I}_2 - \bar{I}_3 + 3\bar{I}_4 = 0 \\ 4\bar{I}_3 - 5\bar{I}_4 = -5 \end{cases}$$

$$\Rightarrow \begin{cases} 4\bar{I}_2 + 6\bar{I}_3 - 4\bar{I}_4 = 5 \\ \bar{I}_2 - \bar{I}_3 + 3\bar{I}_4 = 0 \\ 4\bar{I}_3 - 5\bar{I}_4 = -5 \end{cases}$$

$$\Rightarrow \begin{cases} 10\bar{I}_2 + 14\bar{I}_4 = 5 \\ 4\bar{I}_2 + 7\bar{I}_4 = -5 \end{cases}$$

$$\Rightarrow \bar{I}_2 = \frac{15}{2}$$

$$\bar{I}_4 = -5 \qquad \bar{I}_0 = 5$$

$$\bar{I}_1 = \frac{5}{2}$$

$$\bar{I}_3 = \frac{-15}{2}$$

Answer:

$$\bar{I}_1 = \frac{5}{2}A,\ \bar{I}_2 = \frac{15}{2}A,\ \bar{I}_3 = \frac{-15}{2}A,\ \bar{I}_4 = -5A$$

3.8

Solution :

$$\begin{bmatrix} \frac{1}{5}+\frac{1}{10} & -\frac{1}{5} & 0 & 0 \\ -\frac{1}{5} & \frac{1}{5}+\frac{1}{8}+1 & -\frac{1}{8} & -1 \\ 0 & -\frac{1}{8} & \frac{1}{8}+\frac{1}{8}+\frac{1}{4} & -\frac{1}{8} \\ 0 & -1 & -\frac{1}{8} & \frac{1}{8}+1+\frac{1}{2} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix} = \begin{bmatrix} 3 \\ -2-1 \\ 0 \\ 4+2 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} \frac{3}{10} & -\frac{1}{5} & 0 & 0 \\ -\frac{1}{5} & \frac{53}{40} & -\frac{1}{8} & -1 \\ 0 & -\frac{1}{8} & \frac{1}{2} & -\frac{1}{8} \\ 0 & -1 & -\frac{1}{8} & \frac{13}{8} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix} = \begin{bmatrix} 3 \\ -3 \\ 0 \\ 6 \end{bmatrix}$$

3.9

$$\begin{bmatrix} 5+2+2 & -2 & -2 & 0 & 0 \\ -2 & 2+4+1+1+2 & -4 & -1 & -1 \\ -2 & -4 & 2+3+4 & 0 & 0 \\ 0 & -1 & 0 & 1+3+4 & -3 \\ 0 & -1 & 0 & -3 & 1+3 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \end{bmatrix} = \begin{bmatrix} 4 \\ -4+10 \\ -12 \\ 0 \\ -6 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 9 & -2 & -2 & 0 & 0 \\ -2 & 10 & -4 & -1 & -1 \\ -2 & -4 & 9 & 0 & 0 \\ 0 & -1 & 0 & 8 & -3 \\ 0 & -1 & 0 & -3 & 4 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \\ -12 \\ 0 \\ -6 \end{bmatrix}$$