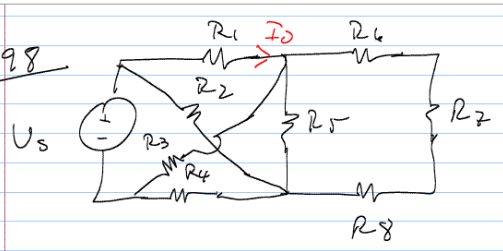
INEL 3105 Lecture 6.0 (ejercicios de práctica)

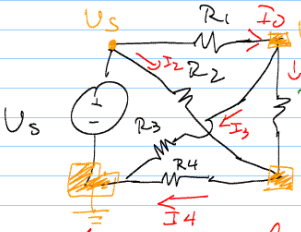
Note Title 8/28/2009

2.98



Halle I_0.

Primer paso: Reducir el circuito:



$R_\alpha = (R_6 + R_7 + R_8) // R_5$

Segundo paso: Análisis de nodos

Step 1: Identify

Step 2: Label all voltages

Step 3: Write KCL's

KCL @ V_3

$$I_0 - \frac{V_3}{R_3} - \left(\frac{V_3 - V_4}{R_\alpha}\right) = 0$$

$$I_0 = \frac{V_s - V_3}{R_1}$$

KCL @ V_4:

$$\left(\frac{V_3 - V_4}{R_\alpha}\right) + \frac{V_s - V_4}{R_2} - \frac{V_4}{R_4} = 0$$

Combinando términos:

$$V_3\left(\frac{-1}{R_3} - \frac{1}{R_\alpha} - \frac{1}{R_1}\right) + V_4\left(\frac{1}{R_\alpha}\right) = \frac{-V_s}{R_1}$$

$$V_3\left(\frac{1}{R_\alpha}\right) + V_4\left(\frac{-1}{R_\alpha} - \frac{1}{R_2} - \frac{1}{R_4}\right) = \frac{-V_s}{R_2}$$

Step 4: En forma de matriz:

$$\begin{bmatrix} \frac{-1}{R_3} - \frac{1}{R_\alpha} - \frac{1}{R_1} & \frac{1}{R_\alpha} \\ \frac{1}{R_\alpha} & \frac{-1}{R_\alpha} - \frac{1}{R_2} - \frac{1}{R_4} \end{bmatrix} \begin{bmatrix} V_3 \\ V_4 \end{bmatrix} = \begin{bmatrix} \frac{-V_s}{R_1} \\ \frac{-V_s}{R_2} \end{bmatrix}$$

$R_\alpha = 6\,\Omega$; $V_s = 36\,V$, $R_1 = 2\,\Omega$, $R_2 = 9\,\Omega$, $R_3 = 12\,\Omega$, $R_4 = 18\,\Omega$

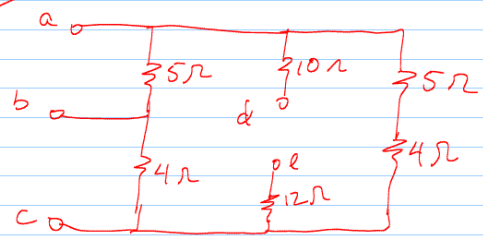
$$-\frac{3}{4}\begin{bmatrix} -\frac{1}{12}-\frac{1}{6}-\frac{1}{2} & \frac{1}{6} \\ \frac{1}{6} & -\frac{1}{6}-\frac{1}{9}-\frac{1}{18} \end{bmatrix}\begin{bmatrix} V_3 \\ V_4 \end{bmatrix} = \begin{bmatrix} -18 \\ -4 \end{bmatrix} \qquad -\frac{1}{3}$$

$V_3 = 30$

$V_4 = 27$

Ecuación auxiliar: $I_0 = \frac{V_s - V_3}{R_1} = \frac{36-30}{2} = \frac{6}{2} = 3\,A$

2.57



$R_{ab} = 5 // (5+4+4) =$

$R_{bc} = 4 // (5+4+5) =$

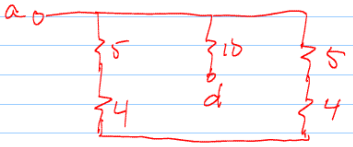
$R_{ac} = (5+4) // (5+4) =$

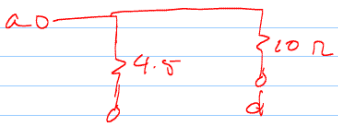
$R_{de} = \left[(5+4) // (5+4)\right] + 10 + 12 =$

$R_{ae} = \left[(5+4) // (5+4)\right] + 12 =$

$R_{cd} = \left[(5+4) // (5+4)\right] + 10 =$

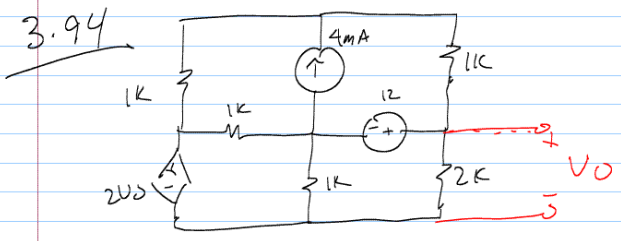
$R_{ad} =$

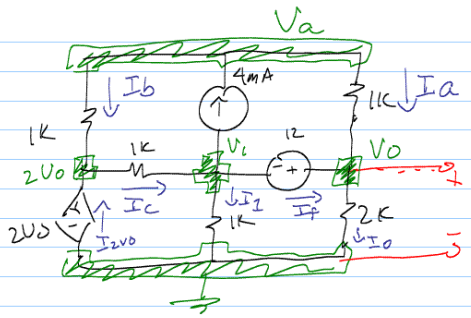




$R_{ad} = 10\,\Omega$

3.94





Analysis by nodes:

Step 1: Identify

Step 2: Label all voltages.

Step 3: Write KCL's

KCL @ Va: $4mA - \left(\frac{Va - Vo}{1K}\right) - \left(\frac{Va - 2Vo}{1K}\right) = 0$

KCL @ Vi: $-4mA - If - \frac{Vi}{1K} + \left(\frac{2Vo - Vi}{1K}\right) = 0$

KCL @ 2Vo: $\left(\frac{Va - 2Vo}{1K}\right) + I_{2Vo} - \left(\frac{2Vo - Vi}{1K}\right) = 0$

5 variables; 3 ecuaciones:

Ecuaciones auxiliares:

1. $Vo - Vi = 12$; $Vi = Vo - 12$

2. $\frac{Vo}{2K} + \frac{Vi}{1K} = I_{2Vo} = \frac{Vo}{2K} + \frac{Vo - 12}{1K} = Vo\left(\frac{1}{2K} + \frac{1}{1K}\right) - \frac{12}{1K}$

$I_{2Vo} = Vo\left(\frac{3}{2K}\right) - \frac{12}{1K}$

Re-write KCL's:

Va: $-\left(\frac{Va - Vo}{1K}\right) - \left(\frac{Va - 2Vo}{1K}\right) = -4mA$

Vi: $-If - \left(\frac{Vo - 12}{1K}\right) + \left(\frac{2Vo}{1K}\right) - \left(\frac{Vo - 12}{1K}\right) = 4mA$

2Vo: $\left(\frac{Va - 2Vo}{1K}\right) + Vo\left(\frac{3}{2K}\right) - \left(\frac{2Vo - (Vo - 12)}{1K}\right) = \frac{12}{1K}$

3 ecuaciones, 3 desconocidos

Combining terms:

Va: $Va\left(\frac{-1}{1K} - \frac{1}{1K}\right) + Vo\left(\frac{1}{1K} + \frac{2}{1K}\right) + If(0) = -4mA$

Vi: $Va(0) + Vo\left(\frac{2}{1K} - \frac{1}{1K} - \frac{1}{1K}\right)^{0} + If(-1) = -20mA$

2Vo: $Va\left(\frac{1}{1K}\right) + Vo\left(\frac{3}{2K} - \frac{2}{1K} - \frac{1}{1K}\right) + If(0) = \frac{12}{1K}$

In matrix form

$$\begin{bmatrix} \frac{-1}{2K} & \frac{3}{1K} & 0 \\ 0 & 0 & -1 \\ \frac{1}{1K} & \frac{-3}{2K} & 0 \end{bmatrix} \begin{bmatrix} V_a \\ V_o \\ I_f \end{bmatrix} = \begin{bmatrix} -4mA \\ -20mA \\ \frac{12}{1K} \end{bmatrix}$$

$V_a = 13.33$; $V_o = 0.888\ V$;
$I_f = 20mA$

El solucionario dice que el sistema no tiene solución ... ¿dónde está el error?