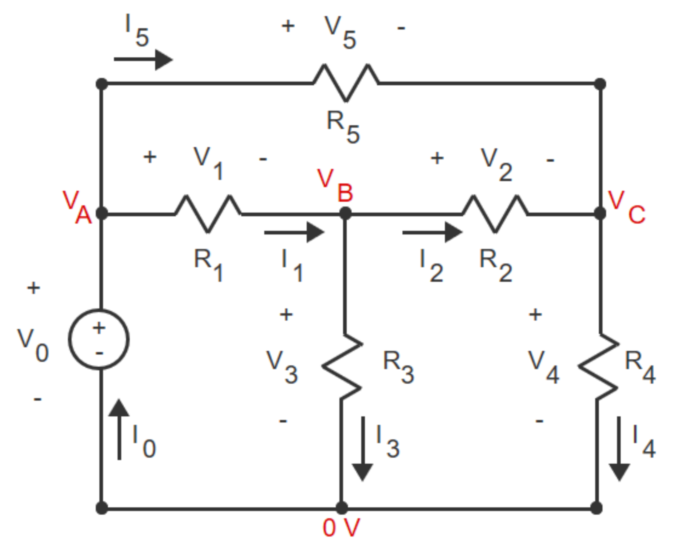

1.) label all nodes with letter subscripts
2.) lavel resistors, thier voltage drops and branch currents with current subscripts

knowns:

$R_1 := 1000$

$R_2 := 2000$

$R_3 := 3000$

$R_4 := 4000$

$R_5 := 5000$

$V_0 := 1200$

3.) first set of equations is describing voltage drops in terms of node voltages... source minus destination as described by arbitrary

$V_1 := V_A - V_B$ $\quad\quad V_A := V_0$

$V_2 := V_B - V_C$

$V_3 := V_B - 0$

$V_4 := V_C - 0$

$V_5 := V_A - V_C$

4.) ohms law to describe currents.

$$I_1 := \frac{V_1}{R_1} \xrightarrow{factor} \frac{V_A - V_B}{1000} \qquad I_2 := \frac{V_2}{R_2} \xrightarrow{factor} \frac{V_B - V_C}{2000} \qquad I_3 := \frac{V_3}{R_3} \xrightarrow{factor} \frac{V_B}{3000}$$

$$I_4 := \frac{V_4}{R_4} \xrightarrow{factor} \frac{V_C}{4000} \qquad I_5 := \frac{V_5}{R_5} \xrightarrow{factor} -\frac{V_C - 1200}{5000}$$

5.) nodal conservation equations

Do the conservation equations here because you need the bold equal sign to put more than one term on the left hand side of any equation should it be called for.

$$\begin{bmatrix} I_0 = I_1 + I_5 \\ I_1 = I_2 + I_3 \\ I_4 = I_2 + I_5 \end{bmatrix} \rightarrow \begin{bmatrix} I_0 = \frac{36}{25} - \frac{V_C}{5000} - \frac{V_B}{1000} \\ \frac{6}{5} - \frac{V_B}{1000} = \frac{V_B}{1200} - \frac{V_C}{2000} \\ \frac{V_C}{4000} = \frac{V_B}{2000} - \frac{7 \cdot V_C}{10000} + \frac{6}{25} \end{bmatrix}$$

why won't it solve?

the simultaneous equations apparently substitute in variables properly so what's the problem?

$$\begin{bmatrix} I_0 = I_1 + I_5 \\ I_1 = I_2 + I_3 \\ I_4 = I_2 + I_5 \end{bmatrix} \xrightarrow{solve, I_0, V_B, V_C} \begin{bmatrix} \frac{408}{895} & \frac{151200}{179} & \frac{124800}{179} \end{bmatrix} = \begin{bmatrix} 0.456 & 844.693 & 697.207 \end{bmatrix}$$

<u>Troubleshooting:</u>

Mathcad prime apparently doesn't like me variables, even after clearing them.

$\text{clear}(V_C)$ $\text{clear}(V_B)$ $\text{clear}(I_0)$

$V_C \rightarrow V_C$ $V_B \rightarrow V_B$ $I_0 \rightarrow I_0$

$V_C = ?$ $V_B = ?$ $I_0 = ?$

$$\begin{bmatrix} I_0 = \frac{36}{25} - \frac{V_C}{5000} - \frac{V_B}{1000} \\ \frac{6}{5} - \frac{V_B}{1000} = \frac{V_B}{1200} - \frac{V_C}{2000} \\ \frac{V_C}{4000} = \frac{V_B}{2000} - \frac{7 \cdot V_C}{10000} + \frac{6}{25} \end{bmatrix} \xrightarrow{solve, I_0, V_B, V_C} ?$$

I assume it is the variables becuase after using more generic ones the solution is forthcoming

$$\begin{bmatrix} x = \frac{36}{25} - \frac{z}{5000} - \frac{y}{1000} \\ \frac{6}{5} - \frac{y}{1000} = \frac{y}{1200} - \frac{z}{2000} \\ \frac{z}{\ } = \frac{y}{\ } - \frac{7 \cdot z}{\ } + \frac{6}{\ } \end{bmatrix} \xrightarrow{solve, x, y, z, float, 3} \begin{bmatrix} 0.456 & 845.0 & 697.0 \end{bmatrix}$$

$$\left[\ 4000 \quad 2000 \quad 10000 \quad 25\ \right]$$

<u>Known good solutions:</u>

My Casio calculator eats these simultaneous equations right up, as usual...

$$\left\{\begin{array}{l} I_0=\frac{36}{25}-\frac{V_3}{5000}-\frac{V_2}{1000} \\ \frac{6}{5}-\frac{V_2}{1000}=\frac{V_2}{1200}-\frac{V_3}{2000} \\ \frac{V_3}{4000}=\frac{V_2}{2000}-\frac{7*V_3}{10000}+\frac{6}{25} \end{array}\right|_{I_0,\, V_2,\, V_3}$$

$$\{I_0=0.4558659218,\ V_2=844.6927374,\ V_3=697.2067039\}$$

Which matches the simulation