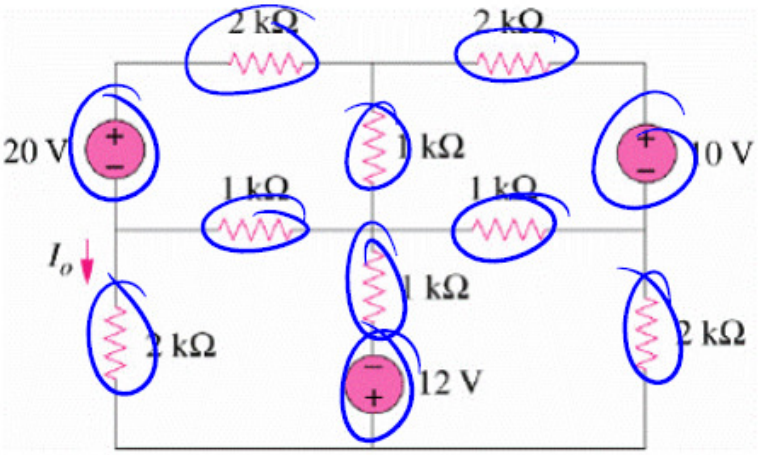
Homework Set #10
DUE Friday, March 31, 2017

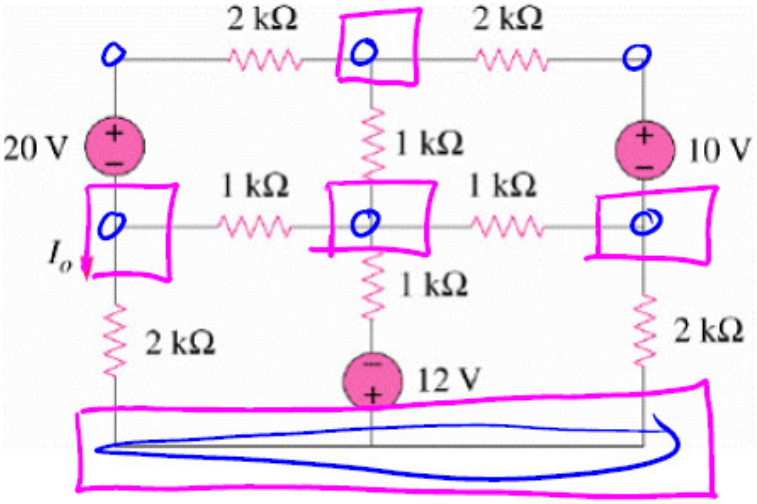
1. In the circuit:
a. how many circuit elements are there?
b. how many nodes are in the circuit?
c. how many essential nodes are in the circuit?
d. how many branches are there?
e. how many loops are in the circuit?
f. how many meshes are in the circuit?



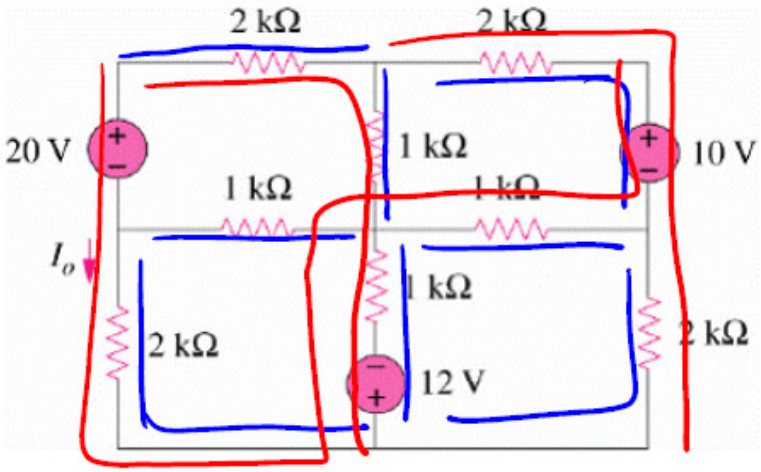
B Nodes circled = 7

C essential nodes squared = 5

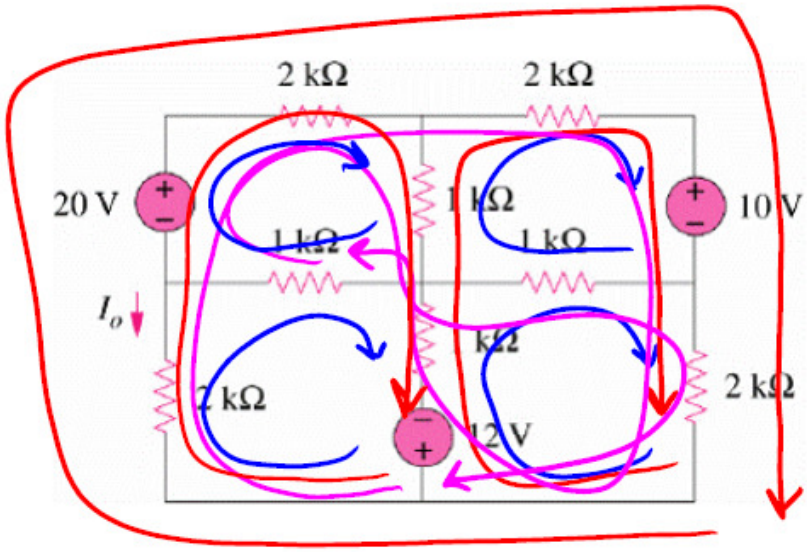
essential nodes are those connecting 3 or more elements



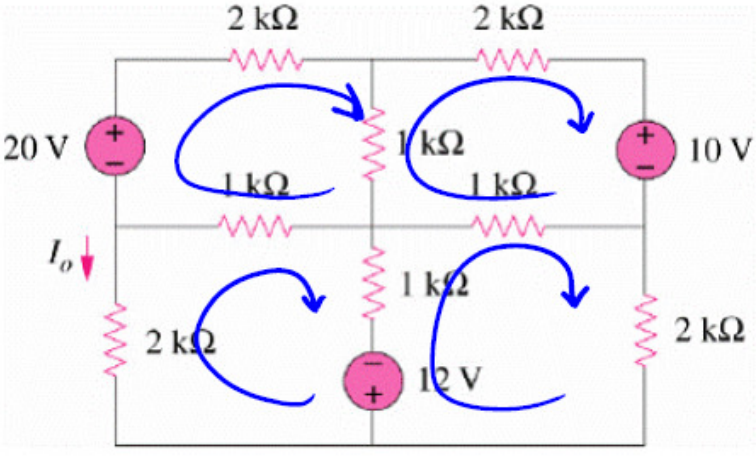
D Branches are traced - too many to count..



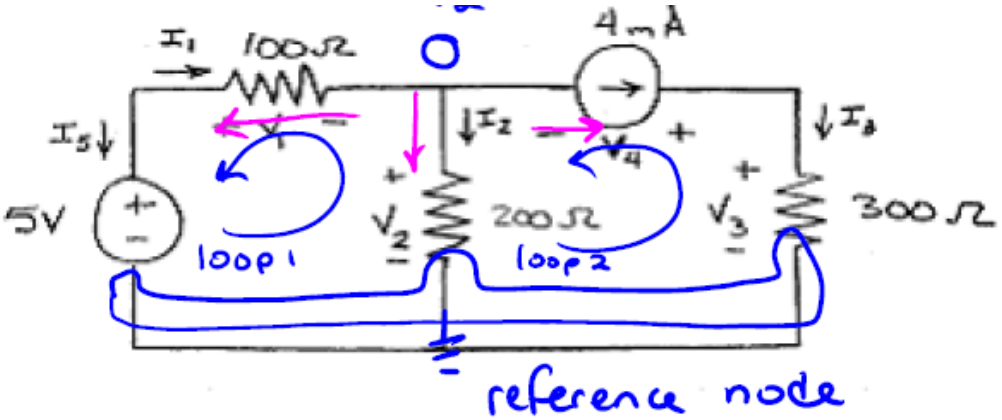
E Loops circled = 4 + 3 + 4 = 11



F meshes are loops that don't enclose other loops = 4



2. For the following circuit, identify the node voltages and solve for the values using the node voltage method to solve for the values of V_1-V_4, I_1-I_5. . Make it clear which node you are using as the reference node.



Node-Voltage method

KCL V_2: $\frac{V_2 - 5}{100} + \frac{V_2}{200} + 4m = 0$

$$V_2 = 3.067\ V$$

KVL loop 1: $-V_2 - V_1 + 5 = 0$

$$V_1 = 1.933\ V$$

Ohms Law: $V_3 = (4mA)(300)$

$$V_3 = 1.2V$$

KVL loop 2: $-V_3 + V_4 + V_2 = 0$

$$V_4 = -1.867\ V$$

Solve for currents!

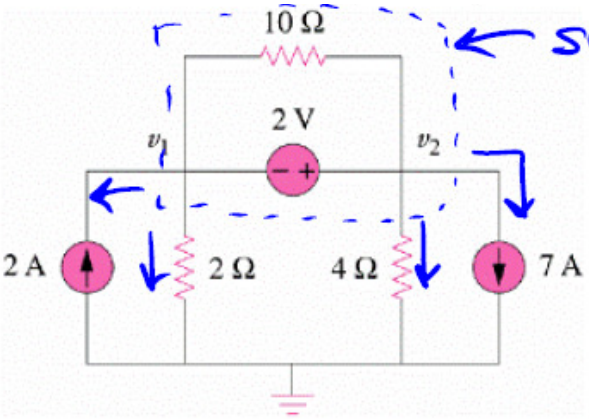
$$I_1 = \frac{5 - V_2}{100} \Rightarrow \boxed{I_1 = 19.33\,mA}$$

$$I_2 = \frac{V_2}{200} \Rightarrow \boxed{I_2 = 15.34\,mA}$$

$$\boxed{I_3 = 4\,mA}$$

$$\boxed{I_5 = -I_1 = -19.33\,mA}$$

3. Use nodal-voltage analysis to find v_1 and v_2 in the following circuit
(Note: the 2V source between nodes makes a supernode.)



KCL $V_1 + V_2$) $\quad -2 + \frac{V_1}{2} + \frac{V_2}{4} + 7 = 0$

supernode) $\quad -V_1 - 2 + V_2 = 0$

$V_1 = -7.33\text{V}$

$V_2 = -5.33\text{V}$