Dr. Mohamed Bakr, EE2CI5, 2007

Note Title 9/24/2007

Lecture 8

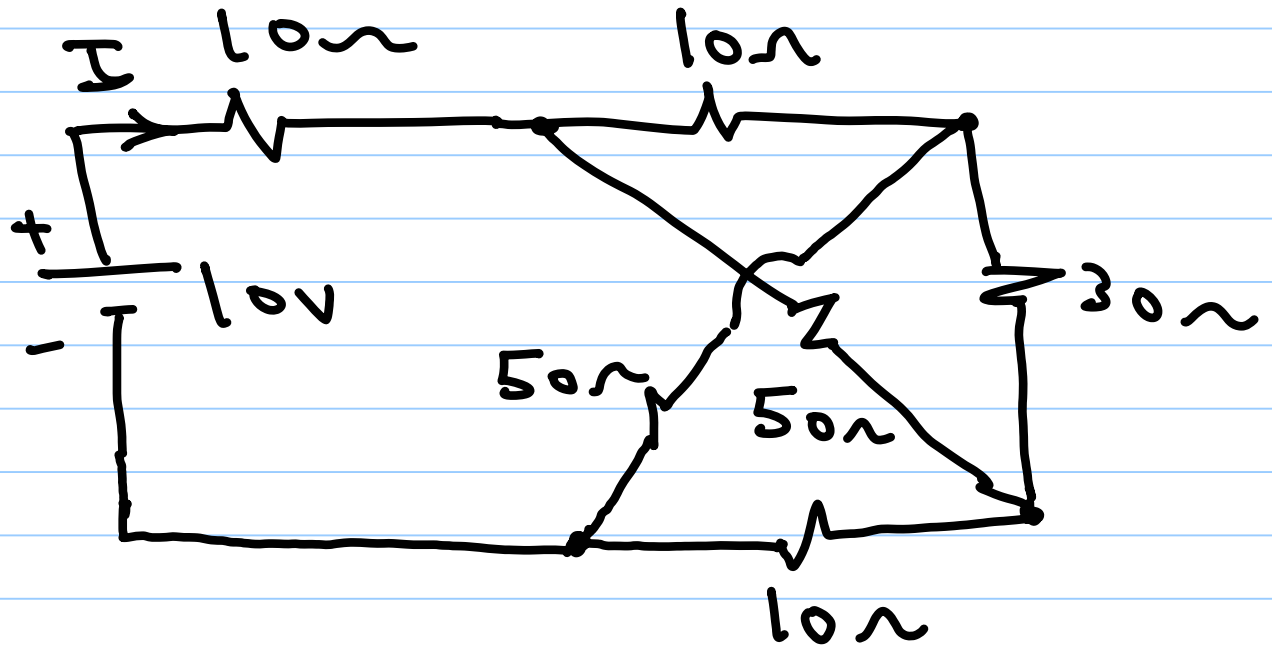
From Section 3.2 of Textbook

Solve: E3.8, 3.62, 3.64, 3.67, 3.70

Loop analysis

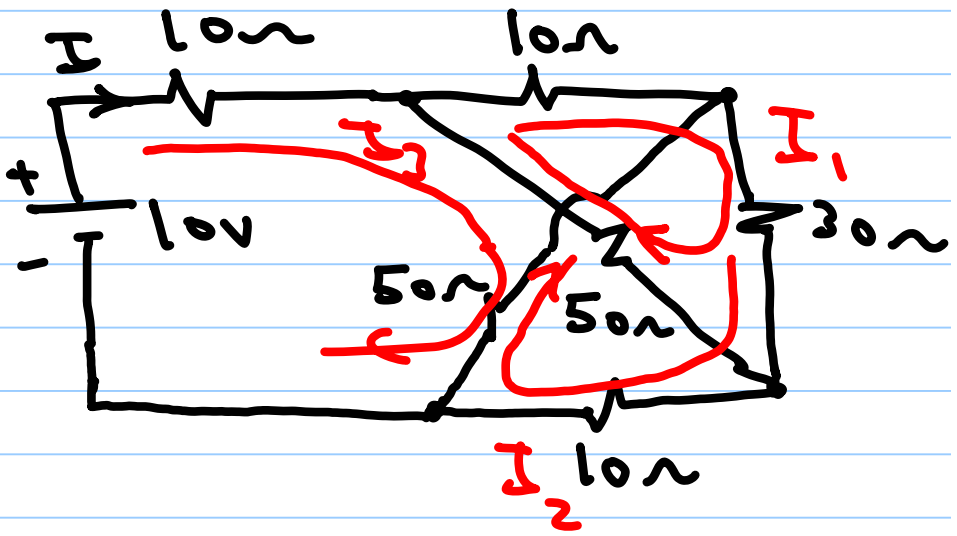
* Loop analysis solves for the current in each loop (mesh) of the circuit
* For each loop, we write KVL to get one equation
* For a circuit with B branches and N nodes, there are B-N+1 linearly independent KVL equations

Example



Determine the current I supplied by the source

Example (Cont'd)

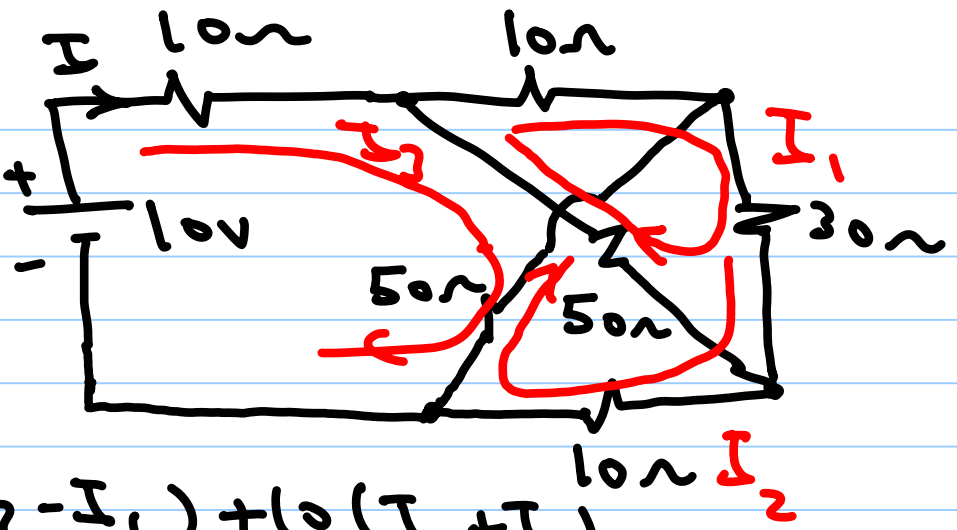


* This Circuit Contains 4 nodes and 6 branches

* We need 6 - 4 + 1 = 3 equations to solve for the 3 unknown currents

* We choose these currents to be I_1, I_2 and I_3 in the shown direction

Example (Cont'd)



* For Loop 3

$$10V = 10I_3 + 50(I_3 - I_1) + 10(I_3 + I_2).$$

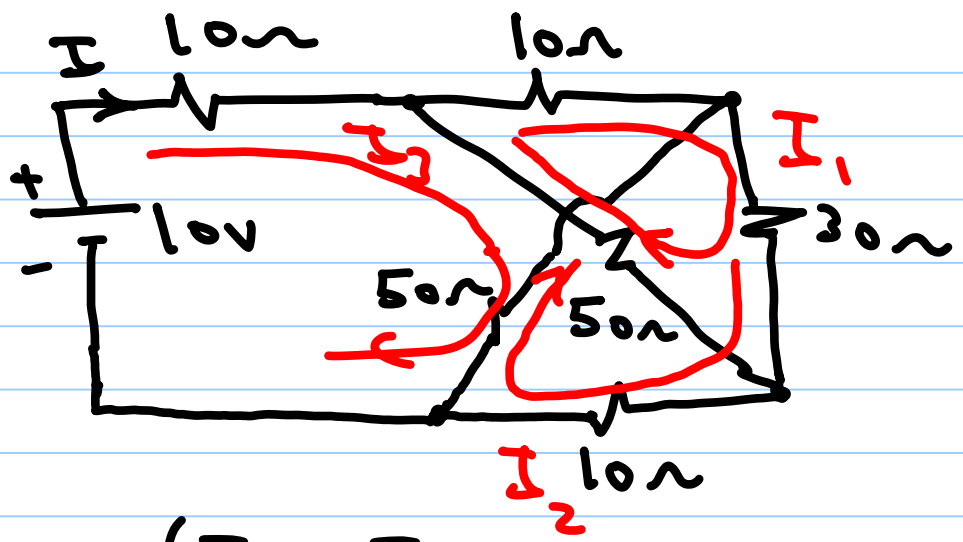
$$\Rightarrow -50I_1 + 10I_2 + 70I_3 = 10 \Rightarrow$$

$$-5I_1 + I_2 + 7I_3 = 1 \leftarrow (1)$$

For loop 2: $50I_2 + 30(I_1 + I_2) + 10(I_2 + I_3) = 0$

$$\Rightarrow 3I_1 + 9I_2 + I_3 = 0 \leftarrow (2)$$

Example (Cont'd)



For loop 1, we have -

$$10I_1 + 30(I_1 + I_2) + 50(I_1 - I_3) = 0$$

$$9I_1 + 3I_2 - 5I_3 = 0 \quad \leftarrow (2)$$

Example (cont'd)

$$-5I_1 + I_2 + 7I_3 = 16 \quad \leftarrow (1)$$

$$3I_1 + 9I_2 + I_3 = 0 \quad \leftarrow (2)$$

$$9I_1 + 3I_2 - 5I_3 = 0 \quad \leftarrow (3)$$

3 equations in 3 unknowns

Example (cont'd)

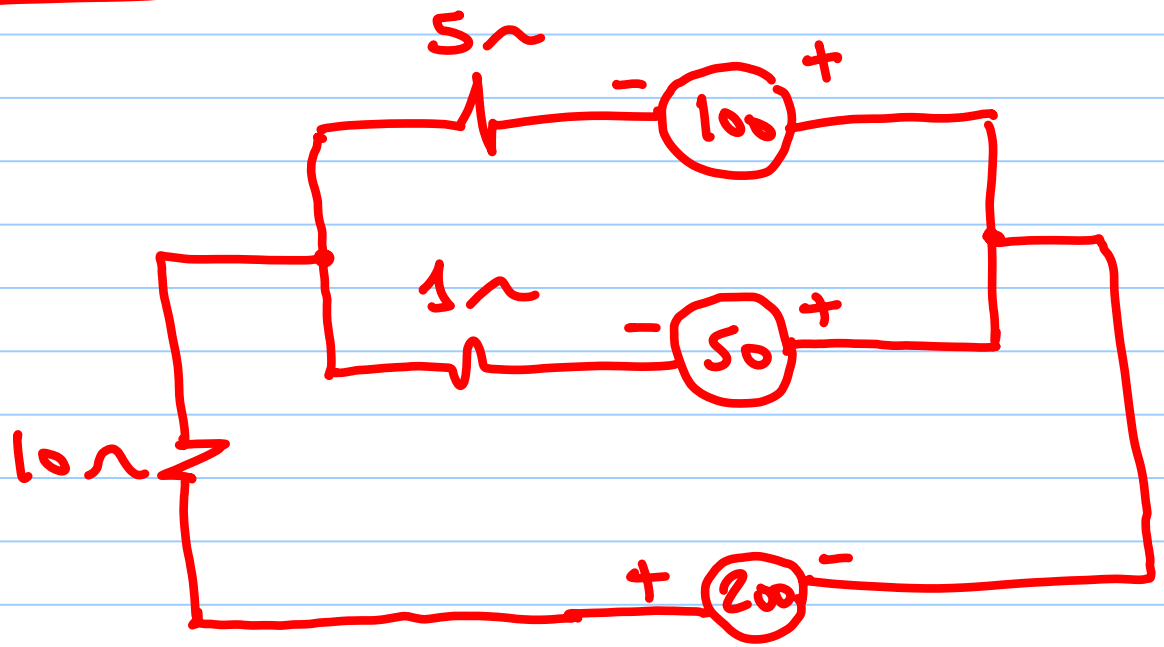
(-5)	1	7	1
3	9	1	0
9	3	-5	0
1	$-1/5$	$-7/5$	$-1/5$
0	(48/5)	24/5	3/5
0	$\frac{24}{5}$	$\frac{36}{5}$	9/5
1	$-1/5$	$7/5$	$-1/5$
0	1	$\frac{26}{48}$	1/16
0	0	25/5	15/10

$$\frac{25}{5} I_3 = \frac{15}{10}$$

$$I_3 = \frac{3}{10} = 0.3\,A$$

$$I = I_3 = 0.3\,A$$

Example



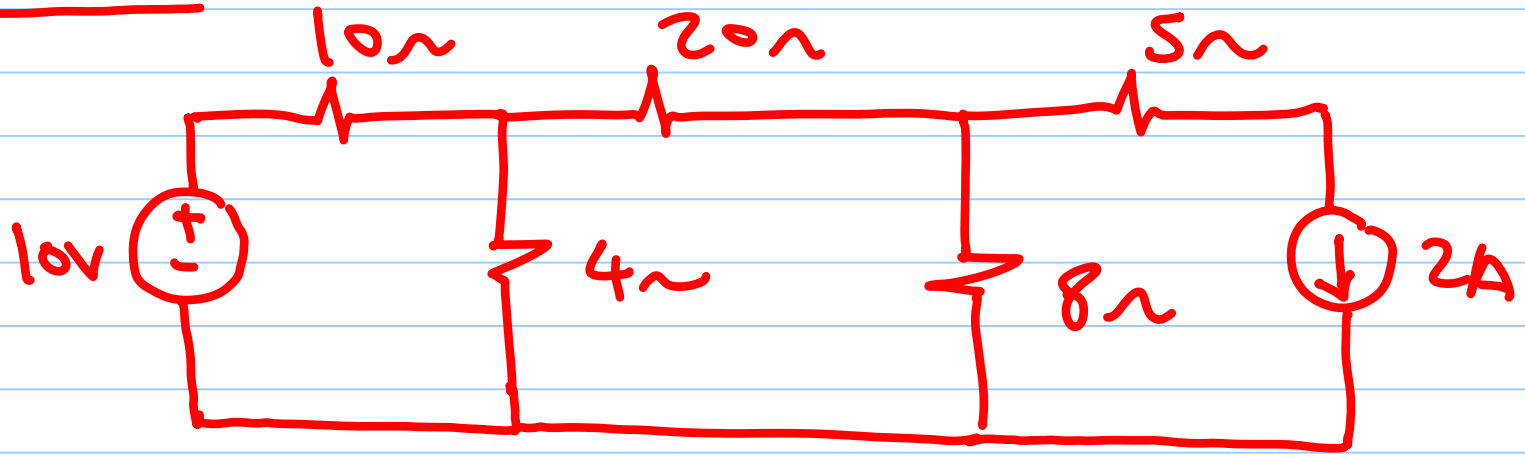
For the shown circuit find the power supplied by each voltage source

Circuits with independent CSs

* The presence of current sources usually simplifies loop analysis

* Some of the unknown loop currents are expressed in terms of the known current sources

Example



Find the power dissipated in the 10Ω resistor using loop analysis