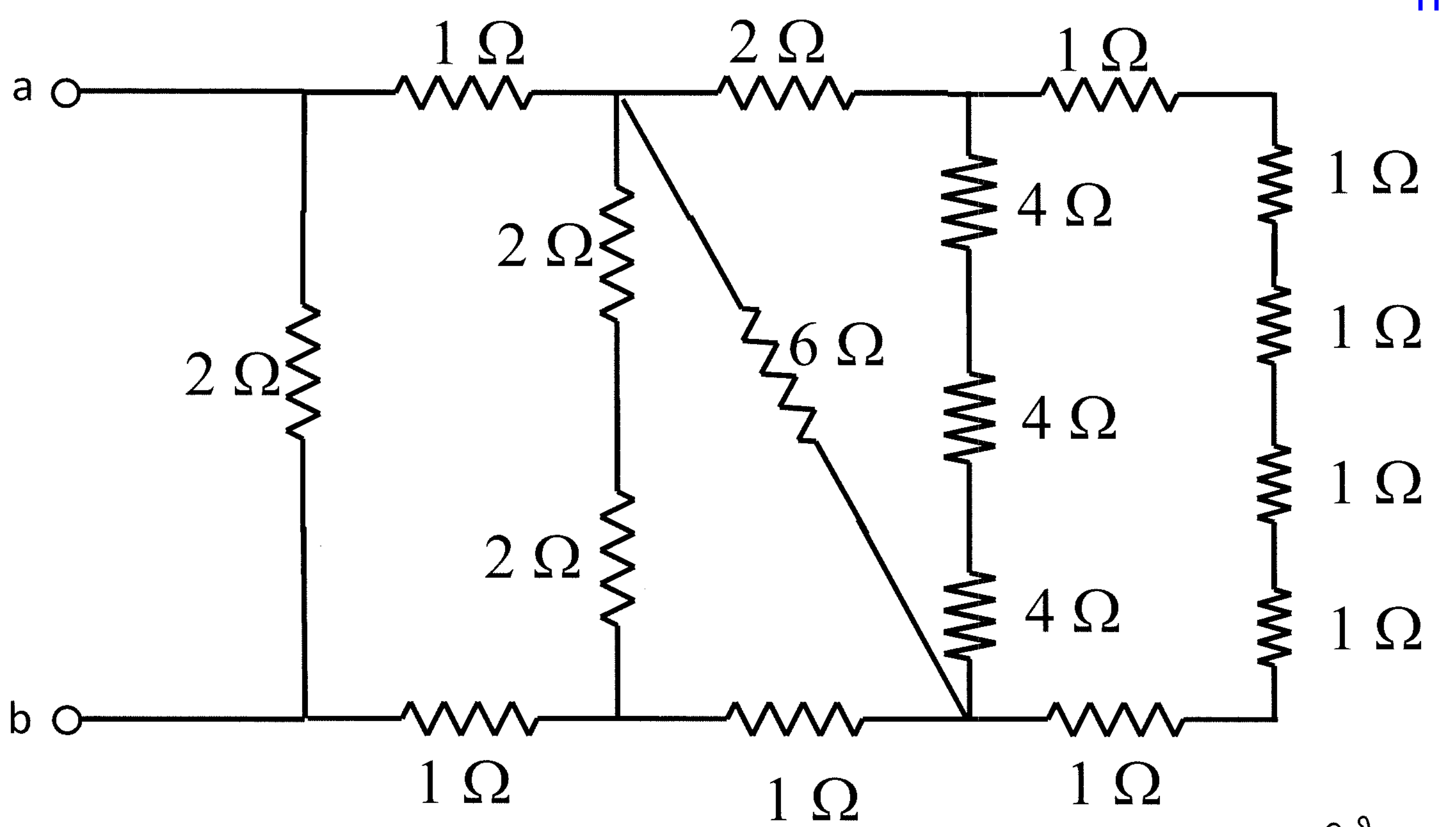
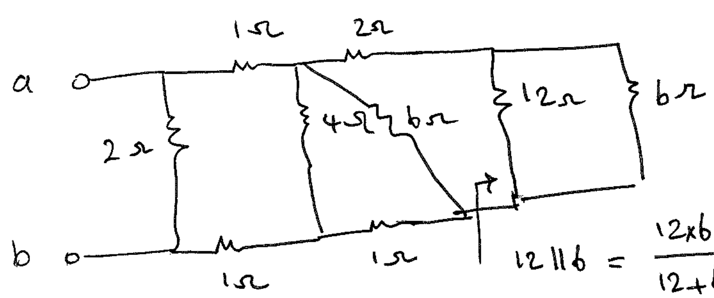
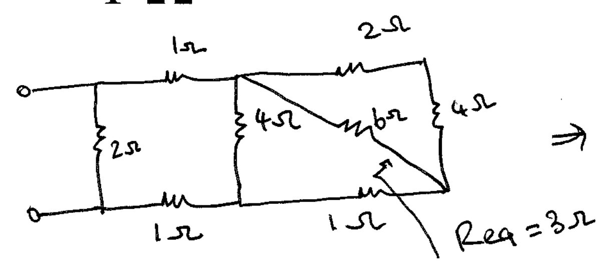
Problem 1: Solve for R_{eq}. ~~You may use the parallel notation discussed in class~~ You cannot use parallel notation





$12 \| 6 = \frac{12 \times 6}{12+6} = \frac{12}{3} = 4\Omega$



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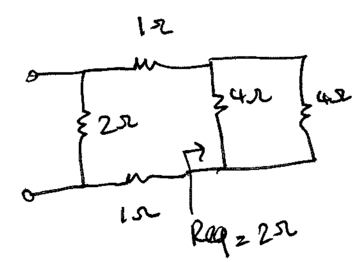

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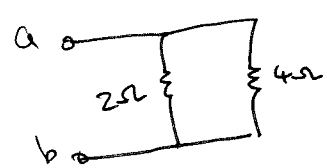
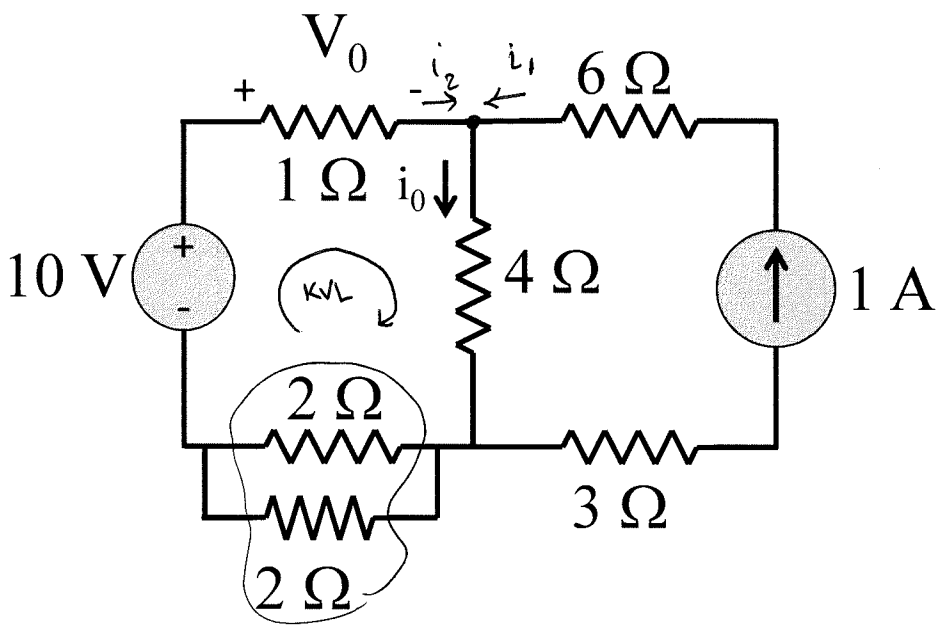


→ $R_{eq_{a-b}} = \frac{2 \times 4}{2+4} = \frac{8}{6} = \frac{4}{3}\Omega$

Problem 2: Find V_0 and i_0 in the circuit below.



$2 \| 2 = 1\Omega$

$1 \times i_2$

KVL: $-10 + V_0 + 4i_0 + 1 \times i_2 = 0$

$\Rightarrow \quad 4i_0 + 2i_2 = 10\,V$

KCL: $i_0 = i_2 + i_1 \quad \Rightarrow \quad i_0 = i_2 + 1$

$i_1 = 1\,A$

$4i_0 + 2(i_0 - 1) = 10\,V$

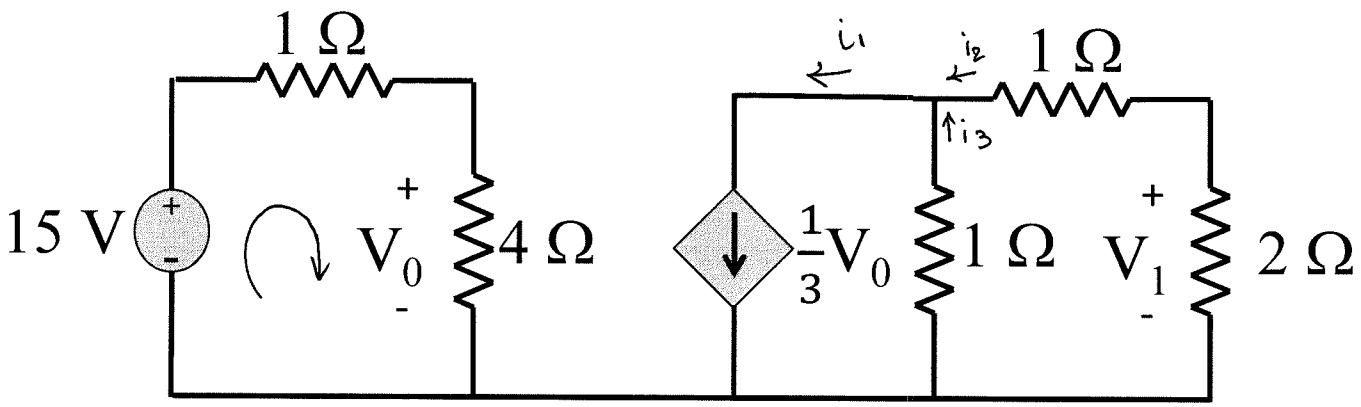
$6i_0 - 2 = 10\,V$

$i_0 = \frac{8}{6}\,A \qquad i_0 = \frac{12}{6} = 2\,A$

$i_2 = i_0 - 1 = 1\,A$

$V_0 = 1\Omega \times 1A = 1\,V$

Problem 3: Find V_1 in the circuit below.



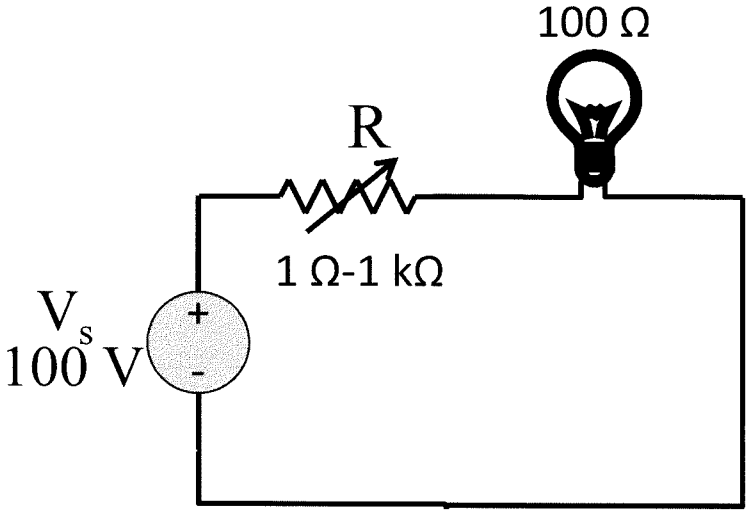
$$V_0 = \frac{4}{4+1} \times 15 = \frac{4 \times 15}{5} = 12\,V$$

$$i_1 = \frac{1}{3} \times V_0 = 4\,A$$

$$i_2 = i_1 \times \frac{1\,\Omega}{1\,\Omega + 3\,\Omega} = 4 \times \frac{1}{4} = 1\,A$$

$$V_1 = -i_2 \times 2\,\Omega = -2\,V$$

Problem 4: Dimmer circuit: the variable resistor can be changed from 1Ω to 1 KΩ to adjust the power delivered to the bulb. Find the power supplied or absorbed by each circuit element for the resistor set to minimum and maximum values. At which limit is the bulb brighter?
(note: you can round up the numbers to simplify the calculations)



at $R = 1\,\Omega$ $\quad i = \frac{100\text{ V}}{101\,\Omega} \simeq 1\text{ A}$

$P_R = i^2 R = 1 \times 1 = 1\text{ W}$

$P_{bulb} = i^2 \times 100 = 100\text{ W}$

$P_{source} = i \times V = 1\text{A} \times 100\text{ V} = 100\text{ W}$

at $R = 1\text{ K}\Omega$ $\quad i = \frac{100\text{ V}}{1100\,\Omega} \simeq 0.1\text{ A}$

$P_R = (0.1)^2 \times 1000 \simeq 10\text{ W}$

$P_{bulb} = (0.1)^2 \times 100 \simeq 1\text{ W}$

$P_{source} = 100 \times 0.1 \simeq 10\text{ W}$

	P_{bulb}	$P_{resistor}$	P_{source}
R=1 Ω	100 W	1 W	100 W
R=1 KΩ	1 W	10 W	100 W