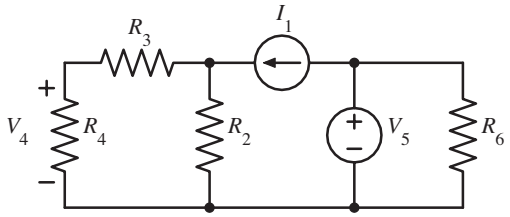
Solution of ECE 300 Test 2 S09

1. In the circuit below find the numerical power in watts absorbed by each element.

$R_2 = 10\ \Omega$, $R_3 = 6\ \Omega$, $R_4 = 20\ \Omega$
$R_6 = 5\ \Omega$, $V_4 = 10\ \text{V}$, $V_5 = 10\text{V}$



$I_4 = 10\text{V} / 20\Omega = 0.5\text{A}$ (downward) $\Rightarrow I_3$ (pointing left) $= I_4 \Rightarrow V_3 = 0.5\text{A} \times 6\Omega = 3\text{V}$ (positive on right)
V_2 (positive on top) $= V_4 + V_3 = 10\text{V} + 3\text{V} = 13\text{V} \Rightarrow I_2$ (downward) $= 13\text{V}/10\Omega = 1.3\text{A}$
$I_1 = I_3 + I_2 = 0.5\text{A} + 1.3\text{A} = 1.8\text{A}$ and V_1(positive on left) $+ V_5 = V_2 \Rightarrow V_1 = 13\text{V} - 10\text{V} = 3\text{V}$
I_6(downward) $= V_5 / R_6 = 10\text{V}/5\Omega = 2\text{A} \Rightarrow I_5$(upward) $= I_1 + I_6 = 1.8\text{A} + 2\text{A} = 3.8\text{A}$

$P_1 = -3\text{V} \times 1.8\text{A} = -5.4\text{W}$, $P_2 = 13\text{V} \times 1.3\text{A} = 16.9\text{W}$, $P_3 = 0.5\text{A} \times 3\text{V} = 1.5\text{W}$
$P_4 = 0.5\text{A} \times 10\text{V} = 5\text{W}$, $P_5 = -3.8\text{A} \times 10\text{V} = -38\text{W}$, $P_6 = 2\text{A} \times 10\text{V} = 20\text{W}$

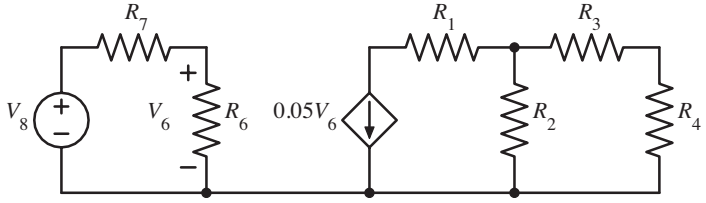
2. In the circuit below find the the following:
(The notation $0.05V_6$ means 0.05 siemens $\times V_6$ (in volts) = a current in amps)

   (a) The voltage across R_6

   (b) The equivalent resistance across the dependent current source

   (c) The power <u>supplied by</u> the dependent source

$V_8 = 24\text{V}$, $R_7 = 50\Omega$, $R_6 = 100\Omega$, $R_1 = 80\Omega$
$R_2 = 30\Omega$, $R_3 = 40\Omega$, $R_4 = 20\Omega$



$$V_6 = \frac{R_6}{R_6 + R_7} V_8 = \frac{100\Omega}{100\Omega + 50\Omega} \times 24\text{V} = 16\text{V}$$

$$R_{eq} = R_1 + R_2 \,\|\, (R_3 + R_4) = 80\Omega + \frac{30\Omega \times (40\Omega + 20\Omega)}{30\Omega + 40\Omega + 20\Omega} = 100\Omega$$

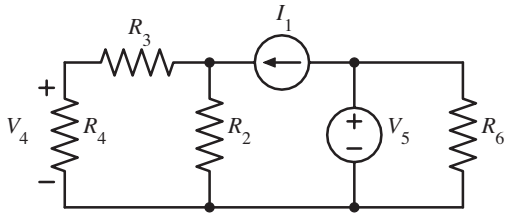
$$0.05V_6 = 0.05\text{S} \times 16\text{V} = 0.8\text{A}$$

The power supplied by the dependent current source equals the power absorbed by the equivalent resistance and that is $P_{ds} = (0.8\text{A})^2 \times 100\Omega = 64\text{W}$.

Solution of ECE 300 Test 2 S09

1. In the circuit below find the numerical power in watts <u>absorbed by</u> each element.

$R_2 = 10\ \Omega$, $R_3 = 6\ \Omega$, $R_4 = 40\ \Omega$
$R_6 = 5\ \Omega$, $V_4 = 10\ \text{V}$, $V_5 = 10\text{V}$



$I_4 = 10\text{V} / 40\Omega = 0.25\text{A}$ (downward) $\Rightarrow I_3$ (pointing left) $= I_4 \Rightarrow V_3 = 0.25\text{A} \times 6\Omega = 1.5\text{V}$ (positive on right)
V_2 (positive on top) $= V_4 + V_3 = 10\text{V} + 1.5\text{V} = 11.5\text{V} \Rightarrow I_2$ (downward) $= 11.5\text{V}/10\Omega = 1.15\text{A}$
$I_1 = I_3 + I_2 = 0.25\text{A} + 1.15\text{A} = 1.4\text{A}$ and V_1(positive on left) $+ V_5 = V_2 \Rightarrow V_1 = 11.5\text{V} - 10\text{V} = 1.5\text{V}$
I_6(downward) $= V_5 / R_6 = 10\text{V}/5\Omega = 2\text{A} \Rightarrow I_5$(upward) $= I_1 + I_6 = 1.4\text{A} + 2\text{A} = 3.4\text{A}$

$P_1 = -1.5\text{V} \times 1.4\text{A} = -2.1\text{W}$, $P_2 = 11.5\text{V} \times 1.15\text{A} = 13.225\text{W}$, $P_3 = 0.25\text{A} \times 1.5\text{V} = 0.375\text{W}$
$P_4 = 0.25\text{A} \times 10\text{V} = 2.5\text{W}$, $P_5 = -3.4\text{A} \times 10\text{V} = -34\text{W}$, $P_6 = 2\text{A} \times 10\text{V} = 20\text{W}$

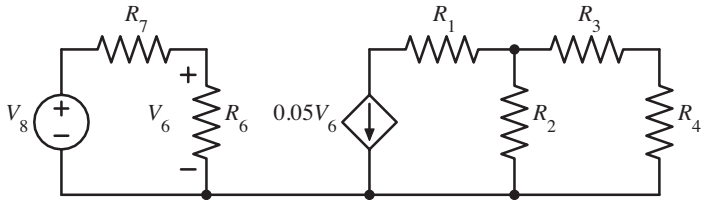
2. In the circuit below find the the following:
(The notation $0.05V_6$ means 0.05 siemens $\times V_6$ (in volts) = a current in amps)

   (a) The voltage across R_6

   (b) The equivalent resistance across the dependent current source

   (c) The power <u>supplied by</u> the dependent source

$V_8 = 24\text{V}$, $R_7 = 50\Omega$, $R_6 = 150\Omega$, $R_1 = 100\Omega$
$R_2 = 30\Omega$, $R_3 = 40\Omega$, $R_4 = 20\Omega$



$$V_6 = \frac{R_6}{R_6 + R_7} V_8 = \frac{150\Omega}{150\Omega + 50\Omega} \times 24\text{V} = 18\text{V}$$

$$R_{eq} = R_1 + R_2 \,\|\, (R_3 + R_4) = 100\Omega + \frac{30\Omega \times (40\Omega + 20\Omega)}{30\Omega + 40\Omega + 20\Omega} = 120\Omega$$

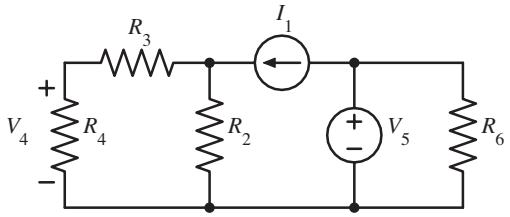
$$0.05V_6 = 0.05\text{S} \times 18\text{V} = 0.9\text{A}$$

The power supplied by the dependent current source equals the power absorbed by the equivalent resistance and that is $P_{ds} = (0.9\text{A})^2 \times 120\Omega = 97.2\text{W}$.

Solution of ECE 300 Test 2 S09

1. In the circuit below find the numerical power in watts absorbed by each element.

$R_2 = 10\ \Omega$, $R_3 = 10\ \Omega$, $R_4 = 20\ \Omega$
$R_6 = 5\ \Omega$, $V_4 = 10\ \text{V}$, $V_5 = 10\text{V}$



$I_4 = 10\text{V} / 20\Omega = 0.5\text{A}$ (downward) $\Rightarrow I_3$ (pointing left) $= I_4 \Rightarrow V_3 = 0.5\text{A} \times 10\Omega = 5\text{V}$ (positive on right)
V_2 (positive on top) $= V_4 + V_3 = 10\text{V} + 5\text{V} = 15\text{V} \Rightarrow I_2$ (downward) $= 15\text{V}/10\Omega = 1.5\text{A}$
$I_1 = I_3 + I_2 = 0.5\text{A} + 1.5\text{A} = 2\text{A}$ and V_1(positive on left) $+ V_5 = V_2 \Rightarrow V_1 = 15\text{V} - 10\text{V} = 5\text{V}$
I_6(downward) $= V_5 / R_6 = 10\text{V}/5\Omega = 2\text{A} \Rightarrow I_5$(upward) $= I_1 + I_6 = 2\text{A} + 2\text{A} = 4\text{A}$

$P_1 = -5\text{V} \times 2\text{A} = -10\text{W}$, $P_2 = 15\text{V} \times 1.5\text{A} = 22.5\text{W}$, $P_3 = 0.5\text{A} \times 5\text{V} = 2.5\text{W}$
$P_4 = 0.5\text{A} \times 10\text{V} = 5\text{W}$, $P_5 = -4\text{A} \times 10\text{V} = -40\text{W}$, $P_6 = 2\text{A} \times 10\text{V} = 20\text{W}$

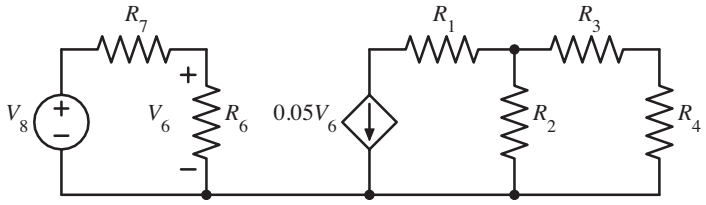
2. In the circuit below find the the following:
(The notation $0.05V_6$ means 0.05 siemens $\times V_6$ (in volts) = a current in amps)

   (a) The voltage across R_6

   (b) The equivalent resistance across the dependent current source

   (c) The power <u>supplied by</u> the dependent source

$V_8 = 24\text{V}$, $R_7 = 100\Omega$, $R_6 = 50\Omega$, $R_1 = 60\Omega$
$R_2 = 30\Omega$, $R_3 = 40\Omega$, $R_4 = 20\Omega$



$$V_6 = \frac{R_6}{R_6 + R_7} V_8 = \frac{50\Omega}{50\Omega + 100\Omega} \times 24\text{V} = 8\text{V}$$

$$R_{eq} = R_1 + R_2 \,\|\, (R_3 + R_4) = 60\Omega + \frac{30\Omega \times (40\Omega + 20\Omega)}{30\Omega + 40\Omega + 20\Omega} = 80\Omega$$

$$0.05V_6 = 0.05\text{S} \times 8\text{V} = 0.4\,\text{A}$$

The power supplied by the dependent current source equals the power absorbed by the equivalent resistance and that is $P_{ds} = (0.4\,\text{A})^2 \times 80\Omega = 12.8\,\text{W}$.