EE 220 Circuits I (Fall 2017) Quiz #2

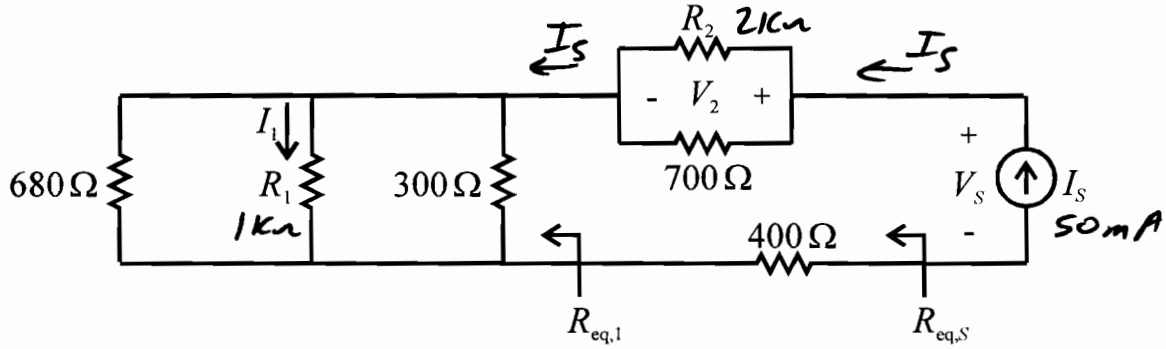
Name Key A

Instructions: **Closed** notes & homework. Place answers in indicated spaces & show all work for credit.

Useful equations:

$$v = iR,\ p = vi = i^2R = v^2/R,\ G = 1/R,\ \text{KVL}: \sum_{i,\text{closed loop}} v_{\text{drops},i} = 0,\ \text{KCL}: \sum_{n,\text{closed surface}} i_n = 0,\ R_{eq,\text{Series}} = \sum R_n,$$

$$v_n = v\left(\frac{R_n}{R_{eq,S}}\right),\quad R_{eq,\text{Parallel}} = \left[\frac{1}{R_1}+\frac{1}{R_2}+\cdots\frac{1}{R_N}\right]^{-1},\quad i_n = i\left(\frac{R_{eq,P}}{R_n}\right) = i\left(\frac{G_n}{G_{eq,P}}\right)$$



Given: I_S = 50 mA, R_1 = 1 kΩ, and R_2 = 2 kΩ.

1) Determine the equivalent resistance $R_{eq,1}$ and $R_{eq,S}$.

$$R_{eq,1} = 680 \,//\, 1000 \,//\, 300 = \left[\frac{1}{680}+\frac{1}{1000}+\frac{1}{300}\right]^{-1} = 172.\overline{297}\ \Omega$$

$$R_{eq,S} = R_2 \,//\, 700 + R_{eq,1} + 400 = \left[\frac{1}{2000}+\frac{1}{700}\right]^{-1} + 172.\overline{297} + 400$$
$$= 518.5185 + 172.297 + 400 = 1090.815816\ \Omega$$

$R_{eq,1}$ = 172.297 Ω $R_{eq,S}$ = 1090.816 Ω

2) Determine the voltage V_s across the current source.

$$V_S = I_S R_{eq,S} = 0.05(1090.816)$$
$$= 54.5408\ \text{V}$$

V_s = 54.5408 V

3) Determine the voltage V_2 across resistor R_2.

$$V_2 = I_S (R_2 \,//\, 700)$$
$$= 0.05(518.5185)$$
$$= 25.925926\ \text{V}$$

V_2 = 25.9259 V

4) Determine the current I_1 through resistor R_1.

$$I_1 = I_S \frac{R_{eq,1}}{R_1} = 50\text{mA}\left(\frac{172.\overline{297}}{1000}\right)$$
$$= 8.614865\ \text{mA}$$

I_1 = 8.6149 mA

EE 220 Circuits I (Fall 2017) Quiz #2

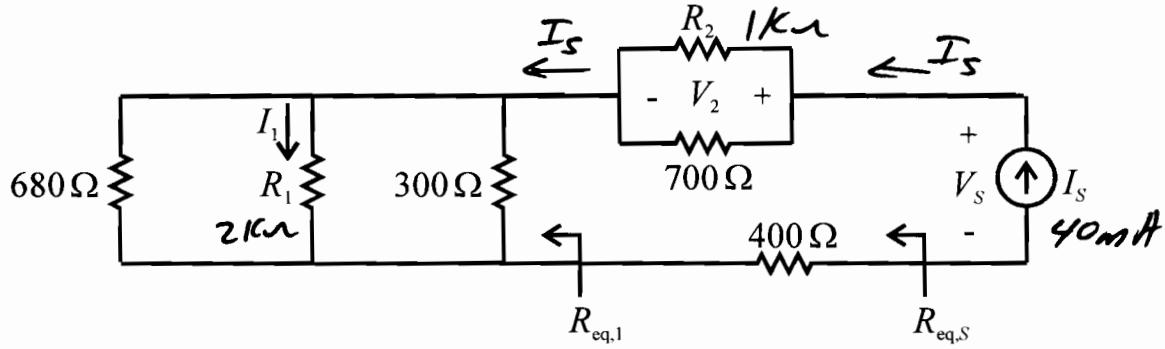
Name Key B

Instructions: **Closed** notes & homework. Place answers in indicated spaces & show all work for credit.

Useful equations:

$$v = iR,\ p = vi = i^2R = v^2/R,\ G = 1/R,\ \text{KVL}: \sum_{i,\text{closed loop}} v_{\text{drops},i} = 0,\ \text{KCL}: \sum_{n,\text{closed surface}} i_n = 0,\ R_{eq,\text{Series}} = \sum R_n,$$

$$v_n = v\left(\frac{R_n}{R_{eq,S}}\right),\quad R_{eq,\text{Parallel}} = \left[\frac{1}{R_1}+\frac{1}{R_2}+\cdots\frac{1}{R_N}\right]^{-1},\quad i_n = i\left(\frac{R_{eq,P}}{R_n}\right) = i\left(\frac{G_n}{G_{eq,P}}\right)$$



Given: I_S = 40 mA, R_1 = 2 kΩ, and R_2 = 1 kΩ.

1) Determine the equivalent resistance $R_{eq,1}$ and $R_{eq,S}$.

$$R_{eq,1} = 680 // R_1 // 300 = \left[\frac{1}{680}+\frac{1}{2000}+\frac{1}{300}\right]^{-1} = 188.53974\,\Omega$$

$$R_{eq,S} = R_2 // 700 + R_{eq,1} + 400 = \left[\frac{1}{1000}+\frac{1}{700}\right]^{-1} + 188.5397 + 400$$

$$= 411.764706 + 188.5397 + 400 = 1000.304447\,\Omega$$

$R_{eq,1}$ = 188.5397 Ω $R_{eq,S}$ = 1000.3044 Ω

2) Determine the voltage V_s across the current source.

$$V_S = I_S R_{eq,S} = 0.04(1000.3044)$$

$$= 40.012177\,88\ \text{V}$$

V_s = 40.0122 V

3) Determine the voltage V_2 across resistor R_2.

$$V_2 = I_S (R_2 // 700) = 0.04(411.7647)$$

$$= 16.470588\,23\ \text{V}$$

V_2 = 16.4706 V

4) Determine the current I_1 through resistor R_1.

$$I_1 = I_S \frac{R_{eq,1}}{R_1}$$

$$= 40\text{mA}\left(\frac{188.5397}{2000}\right) = 3.7708\text{mA}$$

I_1 = 3.7708 mA