Inter American University of Puerto Rico
Bayamón Campus
School of Engineering
Department of Electrical Engineering

ELEN 3301 – Electric Circuits I

Quiz 1 Key

Wednesday, September 29

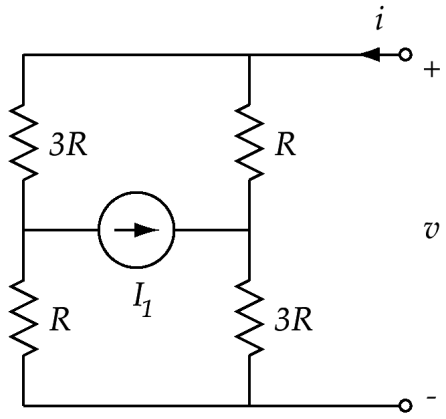
Name: _____

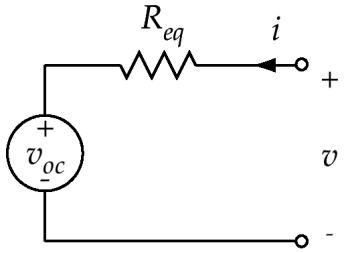
Enter all your work and your answers directly in the spaces provided on the printed pages. Full credit will only be given to answers that you neatly transfer to the spaces on the printed pages. Answers must be derived or explained, not just simply written down. The quiz is closed book, and calculators or notes are **not** allowed.

Problem	Points	Grade
1	50	
2	50	
Total	100	

Problem 1:

(A) (*40 points*) Find the Thevenin equivalent of the circuit shown below looking into the marked terminals.

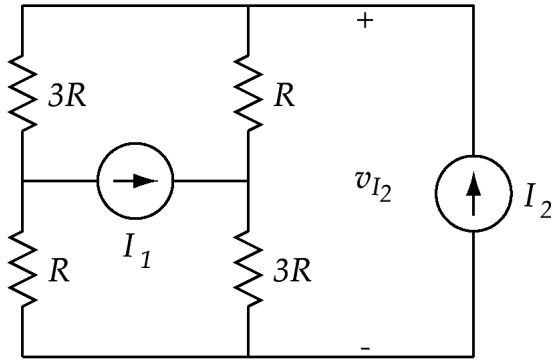




$$R_{eq} = (3R + R)||(R + 3R) = 4R||4R = 2R$$

$$v_{oc} = \frac{3I_1R}{2} - \frac{I_1R}{2} = \frac{I_1R}{2}(3 - 1) = I_1R$$

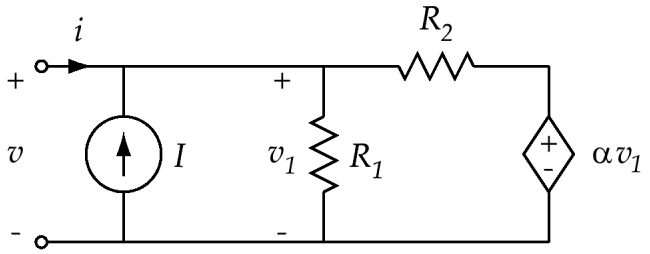
(B) (*10 points*) The circuit is now connected to a current source I_2 as shown below. Find the voltage v_{I_2} across the current source I_2.

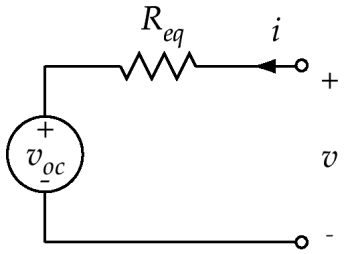


$v_{I_2} = I_1 R + 2I_2 R$

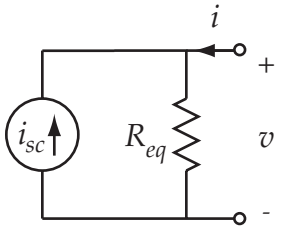
Problem 2:

(A) (*45 points*) Find the Thevenin or Norton equivalent of the circuit shown below looking into the marked terminals.





$$R_{eq} = \frac{R_1 R_2}{R_1(1-\alpha) + R_2} \qquad v_{oc} = \frac{R_1 R_2}{R_1(1-\alpha) + R_2} I$$



$$R_{eq} = \frac{R_1 R_2}{R_1(1-\alpha) + R_2} \qquad i_{sc} = I$$

(B) (*5 points*) Evaluate your results for part (A) if $\alpha = 0$. Interpret this result using the circuit.

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} = R_1 || R_2$$

If $\alpha = 0$, the dependent voltage source can replaced with a short circuit. This leaves R_2 grounded in parallel with R_1.

(C) (*10 bonus points*) Evaluate your results for part (A) if $\alpha = 1$. Interpret this result using the circuit.

$$R_{eq} = \frac{R_1 R_2}{R_2} = R_1$$

If $\alpha = 1$, both ends of R_2 will always be kept at the same potential v_1. The voltage across R_2 will always be zero. By Ohm's law, the current through R_2 must then be zero. If the current through R_2 is always zero, R_2 can be removed from the circuit, leaving only R_1 as the equivalent resistance.