

Name: _____ UT EID: _____ Lecture Instructor: _____

ECE 302H

Please answer ALL questions

100 points total.

Fall 2023, Midterm Exam I

Time: 600-800 PM

21 Sept. 2023

Instructions for turning in your exam:

After completing your exam, you may turn on your phones

0) Please write your EID on every page of the exam

1) Log in to Gradescope and find MT1 or Midterm I

2) For each problem: a. If your response is ≤ 1 page, you may choose the option to have Gradescope take a picture of your page

b. If your response is ≥ 1 page, you must take pictures of each page with your camera app and choose the option to upload the solution

3) DOUBLE CHECK YOUR SUBMISSION

4) Turn in your paper exam to the proctor (this will be used as a reference)

Q

- 1 a 8 points
b 8 points
c 9 points

Q

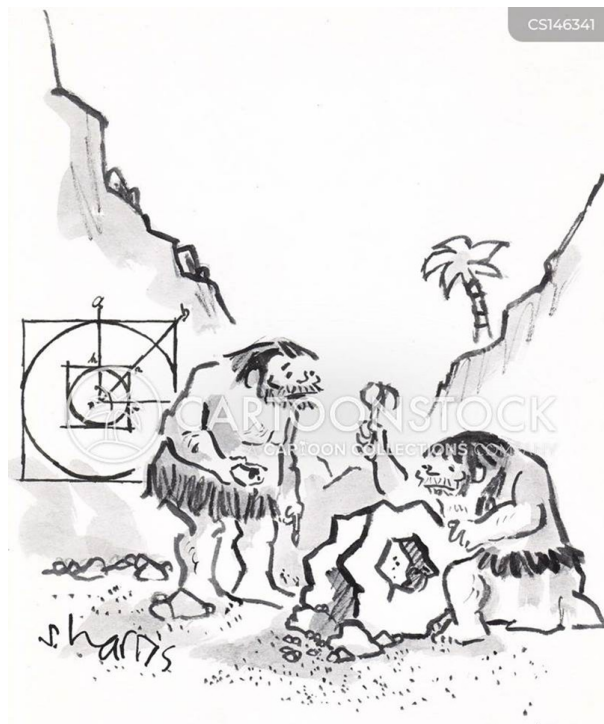
- 2 a 5 points
b 5 points
c 15 points

Q

- 3 a 6 points
b 19 points

Q

- 4 a 8 points
b 12 points
c 5 points



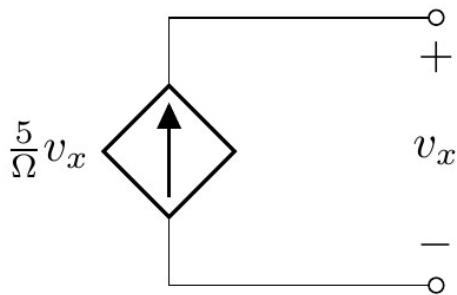
Early ECE 302 Labs

UT EID:

1. Please complete parts (a)-(c) below.

(a) Does the equation $y=mx+b$ (x input, y output, m and b constants) qualify as linear according to the definition we learned in class? Prove your answer.

(b) Consider the following circuit that consists of a single voltage-dependent current source. Draw its Thevenin equivalent circuit and label the quantities for V_{TH} and R_{TH} .



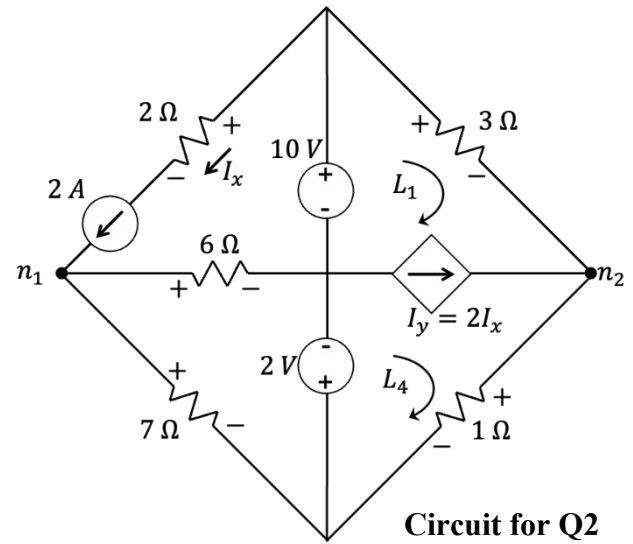
UT EID:

- (c) A series of experiments are performed on a linear system according to the table below. Predict the system output for the final experiment.

	Inputs		Output
	u	v	y
Completed Experiment 1	3	2	4
Completed Experiment 2	-1	3	-5
Experiment to be predicted	5	5	??

UT EID:

2. (a) For the circuit, write down the KVL equations for loop 1 (L_1) and loop 4 (L_4). If a quantity is unknown, give it a label and label it in the circuit.

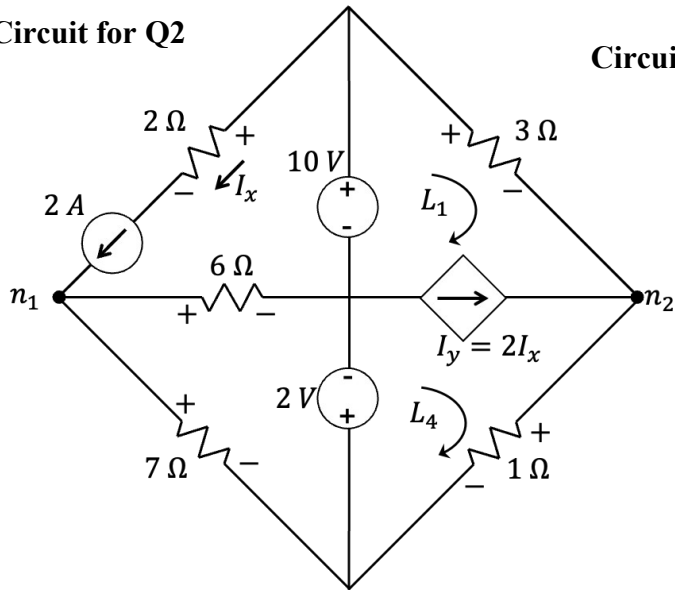


(b) For the above circuit, write down the KCL equations for nodes n_1 and n_2 , making sure that the signs of your labels are consistent with part (a).

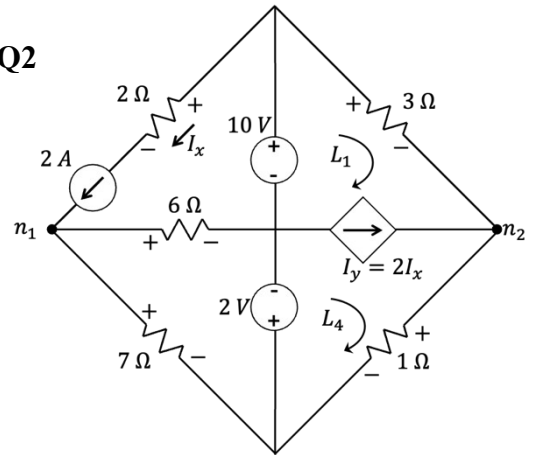
UT EID:

2.(c) What is the power of the dependent current source, and is it a supply or a dissipator?

Circuit for Q2



Circuit for Q2

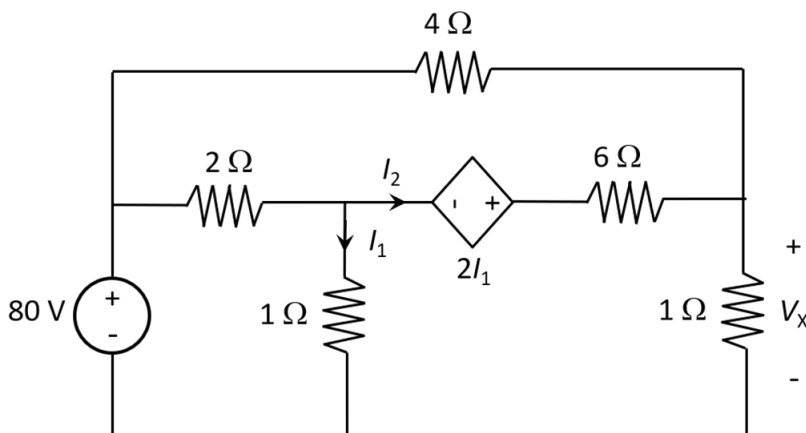


2(c) answer continued:

UT EID:

3. (a) Two students are given a circuit which has 3 nodes a , b , c with voltages V_a , V_b , V_c . The first student chooses node b as ground and, using node voltage analysis, calculates $V_a = 1$ V, $V_c = -1$ V. If the second student chooses node a as ground, what should they calculate for V_b and V_c ? Express your answer with appropriate units.

(b) Determine V_x , I_1 and I_2 in the circuit below using node voltage analysis. Express your answer in decimal form to 3 significant digits with appropriate units.



Circuit for Q3(b)

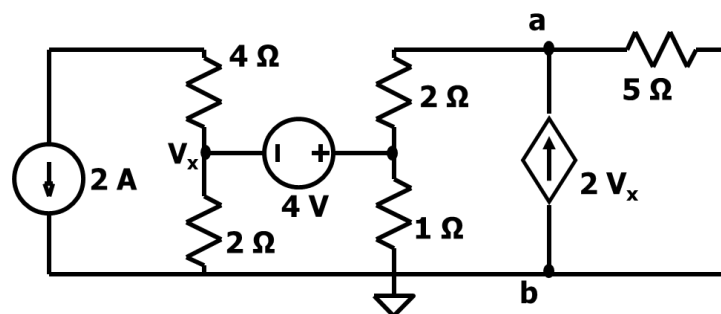
UT EID:

3(b) answer continued:

4. (a) A linear circuit has 2 independent sources (V_1 and I_1) and has a Thevenin voltage and resistance between two output nodes of V_{Th} and R_{Th} . When only source V_1 is deactivated, the Thevenin voltage and resistance of the resulting circuit between the same two output nodes are V_{Th1} and R_{Th1} respectively. When only source I_1 is deactivated, the Thevenin voltage and resistance of the resulting circuit between the output nodes are V_{Th2} and R_{Th2} respectively.
- (i) Write an equation relating V_{Th} to V_{Th1} and V_{Th2} . Briefly explain your answer.

- (ii) Write an equation relating R_{Th} to R_{Th1} and R_{Th2} . Briefly explain your answer.

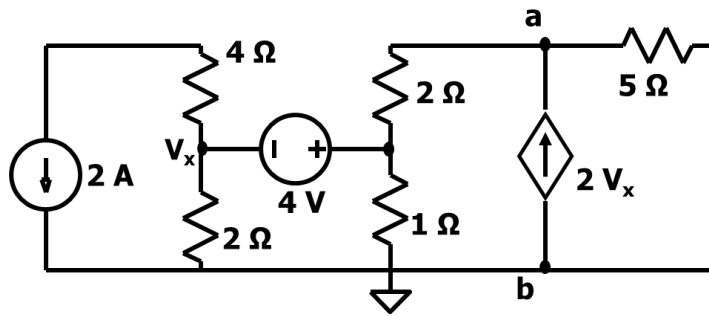
- (b) Consider the linear circuit to right, with two independent sources. Find the Thevenin voltage between **a** and **b** using the principle of superposition after first calculating the Thevenin voltage due to each of the independent sources acting alone.



Circuit for Q 4(b)

UT EID:

Circuit for Q 4(b)



UT EID:

- (c) If the independent voltage source output (initially at 4 V as shown in the figure for 4(b)) falls to 3 V due to degradation from prolonged use, recalculate the Thevenin voltage between **a** and **b**.

[Hint: Remember that the circuit is linear, and you have already calculated the response due to the 4 V source]