Intro to ECSE

Quiz 1

Spring 2023

1.	**/18**
2.	**/16**
3.	**/12**
Total	**/46**

Name _____

Notes:

SHOW ALL WORK. BEGIN WITH FORMULAS, THEN SUBSTITUTE VALUES AND UNITS. No credit will be given for numbers that appear without justification.

Use the backs of pages if there is not enough room on the front.

For partial credit on some questions, you may want to re-draw circuit diagrams as you simplify the circuits.

Many problems can be solved using more than one method. check your answers by using a second method.

At least skim through the entire quiz before you begin and then start with the problems you know best. The proctor will only answer clarification questions where wording is unclear or where there may be errors/typos. No other questions will be responded to.

Problem 1 (18 Points): Combining Resistors, Circuit Reduction, Voltage Dividers

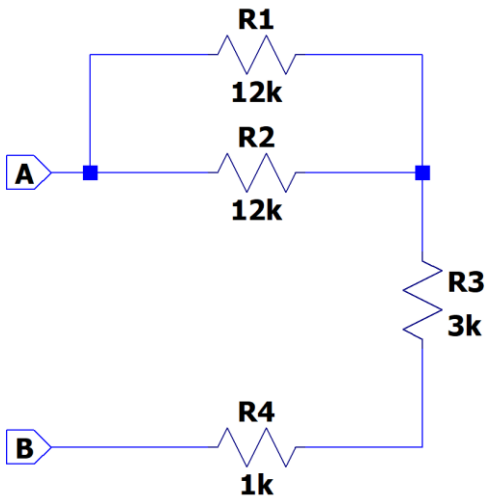
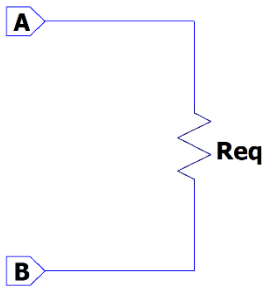


Figure 1

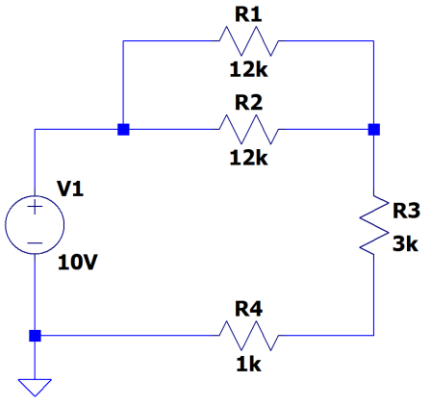
a) (2 pts) In the circuit diagram above, which of the resistors (if any) are in series?

b) (2 pts) In the circuit diagram above, which of the resistors (if any) are in parallel?

c) (6 pts) What is the equivalent resistance (R_{eq}) between terminals A and B in the circuit above, such that the circuit simplifies to the circuit diagram to the right?

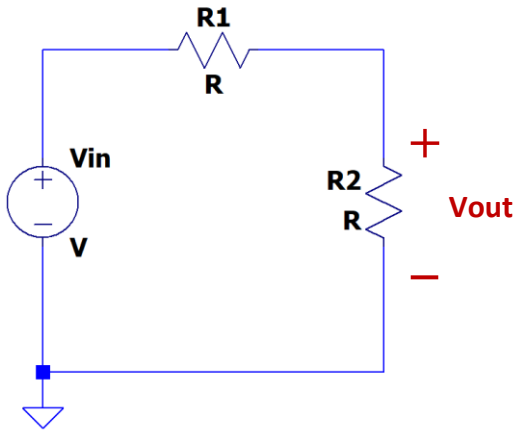


d) (2 pts) If a voltage source with a value of 10V is added between terminals A and B of the original circuit to create the circuit to the right, what is the current flowing through R3?



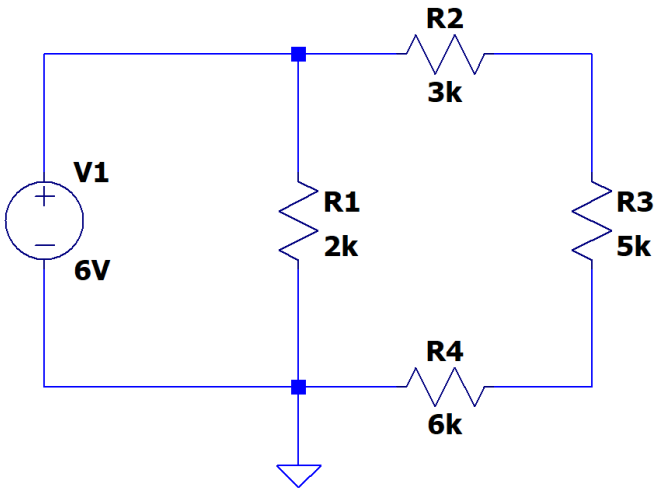
e) (2 pts) In the same circuit as above (in part *d*), what is the voltage across R2?

f) (4 pts) You are tasked with designing a circuit whose output voltage is 20% of its input voltage (i.e. Vout = 0.2Vin), using the circuit design below and the resistor values in the table below. Choose values for R1 and R2 to satisfy the design requirement of Vout = 0.2Vin. You may use each resistor value only once, but you may combine resistors to provide equivalent values for R1 or R2 if you wish (for example R1 = 1kΩ + 2kΩ).



1kΩ	2kΩ
4kΩ	8kΩ

Problem 2 (16 pts): KVL/KCL/Ohm's Law Method of Circuit Analysis



a) (4 pts) How many nodes are in the circuit above? How many loops are there? Label all nodes and loops on the circuit diagram.

b) (2 pts) How many unknowns are there in this circuit as it is drawn (i.e. do not combine resistances)?

c) (2 pts) Draw reference marks on your circuit diagram.

d) (4 pts) Write the linearly-independent equations that will solve for all unknowns in the circuit in terms of ***voltage*** (i.e. in the final form of your equations, the unknowns must be expressed in terms of voltage).

e) (4 pts) Write the equations in matrix form, giving your final answer in terms of numerical values for circuit elements. Note: You do not have to solve the matrix equation to obtain a numerical answer for the unknowns, but you may if you'd like to check your answer. If you do choose to solve the matrix equation, *that work will not be graded*.

Problem 3 (12 pts): Electrical Engineering Fundamentals, Proof of Skills, and Coming to Class

a) (2 pts) Circle one: current is defined as the flow of:

(A) voltage

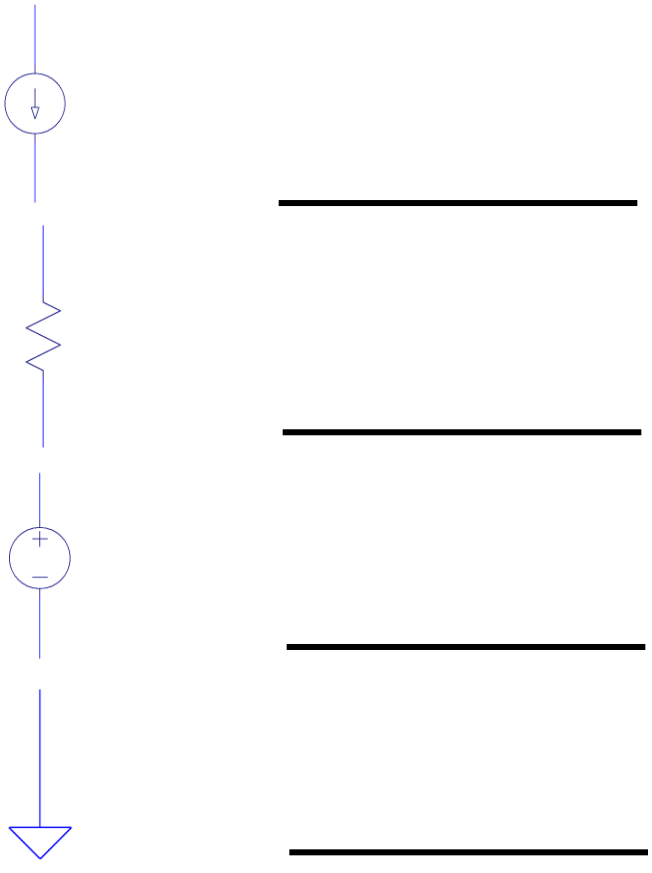
(B) power

(C) charge

(D) potential energy

b) (2 pts) What is the name of the reference point with respect to which all node voltages are measured in an electrical circuit?

c) (4 pts) Write the names of the following circuit elements on the lines next to their symbols:



i) _____

ii) _____

iii) _____

iv) _____

d) (2 pts) What does it mean to be able to “optimize” an assignment in Intro to ECSE?

e) (2 pts) What is the purpose of proof of skills?