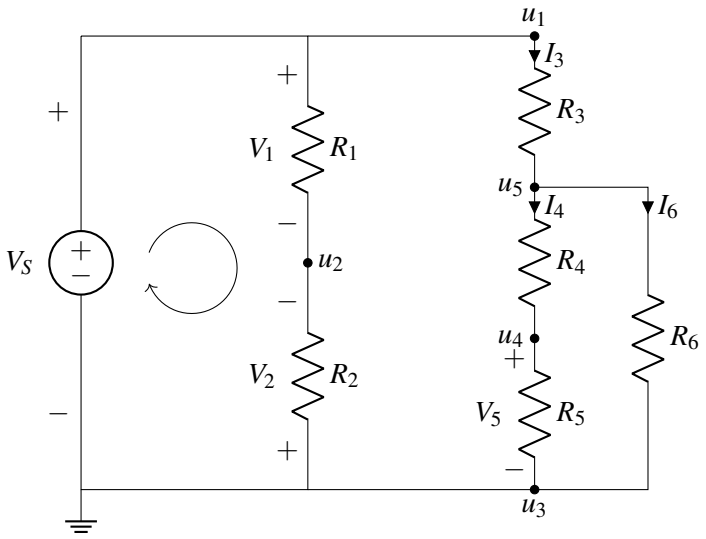
EECS 16A Designing Information Devices and Systems I
Summer 2023 Discussion 4C

1. Passive Sign Convention and NVA Basics

The following question is a modified version of Spring 2022 Midterm 2 Question 1

Suppose we have the following circuit:



(a) Following passive sign convention, **label** the missing currents and the missing voltages for each element in the circuit, including the voltage source.

(b) **Write the KCL expression** at node u_5 in terms of currents I_3, I_4, and I_6 as labeled in the circuit diagram.

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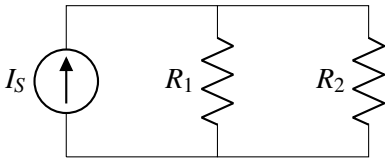
(c) Find the voltage across R_4, R_5, and R_6 in terms of the node voltages u_3, u_4, and u_5. Then use Ohm's law to express the currents across R_4, R_5, and R_6 in terms of node voltages and resistances.

(d) **Write the KVL expression** for the loop drawn in the circuit diagram in terms of voltages V_S, V_1, and V_2.

2. A Simple Current Circuit

For the circuit shown below, find the voltages across all the elements and the currents through all the elements.



(a) In the above circuit, pick a reference node. Does your choice of reference matter?

(b) With your choice of reference, label the node potentials for every node in the circuit.

(c) Label all of the branch currents. Does the direction you pick matter?

(d) Draw the $+/-$ labels on every element. What convention must you follow?

(e) Use KCL to find as many equations as you can.

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(f) Use KVL and Ohm's law to find the remaining equations to solve the circuit.

(g) Solve for the voltages across both resistors and the currents going through them if $I_S = 5\,\text{A}$, $R_1 = 5\,\Omega$, and $R_2 = 10\,\Omega$.

(h) (OPTIONAL) Rather than solve for the system using substitution, we can also use matrices! Set up a matrix equation in the form $\mathbf{A}\vec{x} = \vec{b}$ to solve for the unknown node potentials and currents, which are I_0, I_1, I_2 and u_1. Then use part (e) and (f) to fill in the entries of $\mathbf{A}$ and $\vec{b}$, and solve for the unknowns.

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