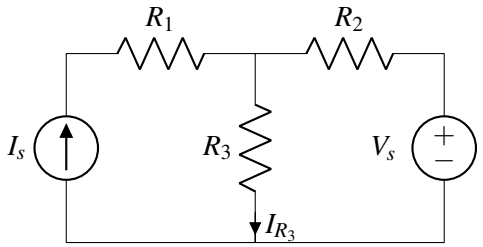
EECS 16A Designing Information Devices and Systems I
Fall 2022 Discussion 12A

1. Superposition

Consider the following circuit:



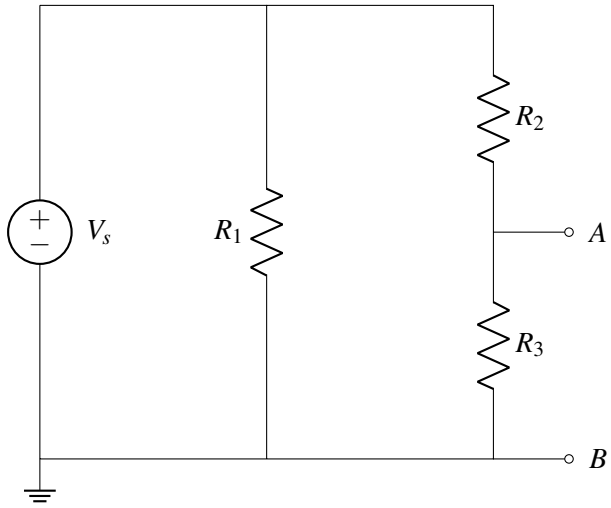
(a) With the current source turned on and the voltage source turned off, find the current I_{R_3}.

(b) With the voltage source turned on and the current source turned off, find the voltage drop V_{R_3} across R_3.

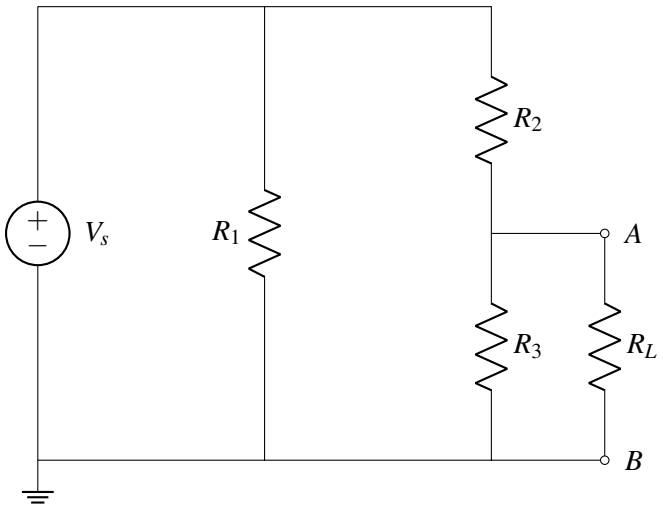
(c) Find the power dissipated by R_3.

2. Thévenin/Norton Equivalence

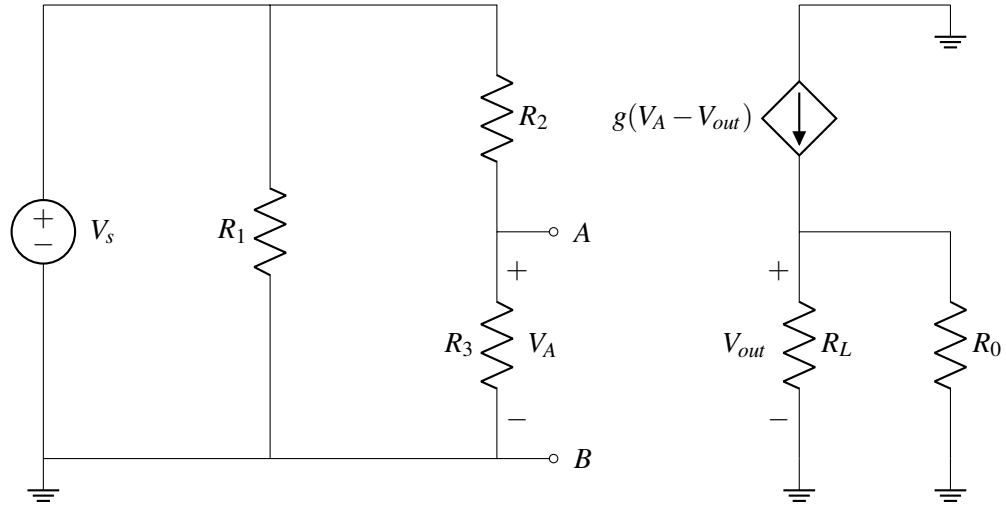
(a) Find the Thévenin resistance R_{th} of the circuit shown below, with respect to its terminals A and B.



(b) Now, a load resistor, $R_L = R$, is connected across terminals A and B, as shown in the circuit below. Find the power dissipated in the load resistor in terms of the given variables.



(c) We modify the circuit as shown below, where g is a known constant:

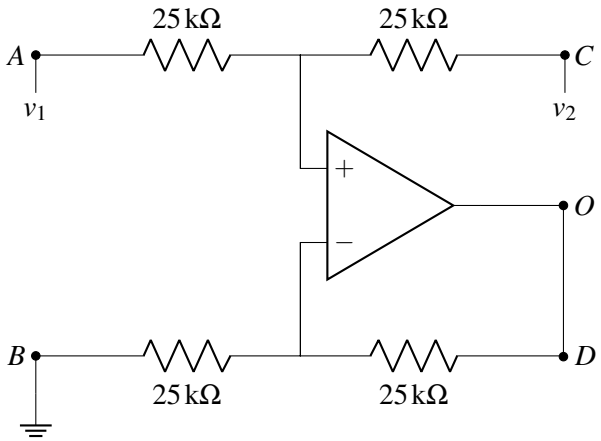


Find a symbolic expression for V_{out} as a function of V_s.
Hint: Redraw the left part of the circuit using its Thévenin equivalent.

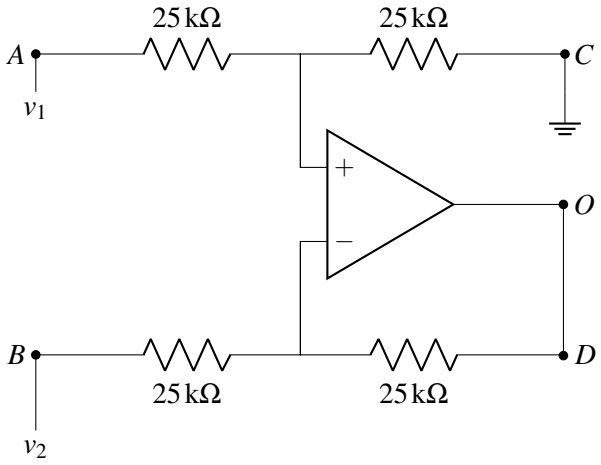
3. A Versatile Opamp Circuit

For each subpart, determine the voltage at O, given that v_1 and v_2 are voltage sources.

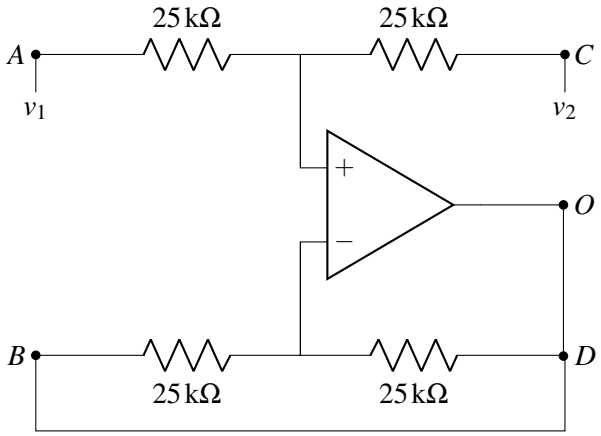
(a) Configuration 1:



(b) Configuration 2:



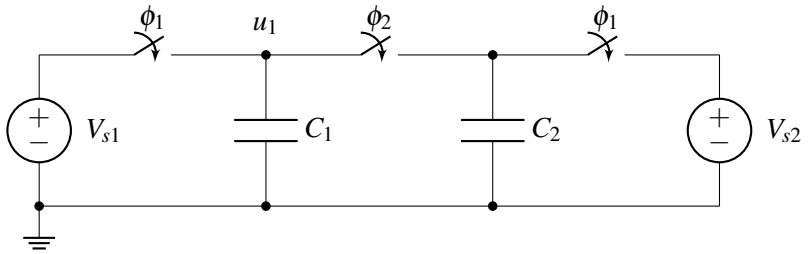
(c) Configuration 3:



4. Capacitive Charge Sharing (from Spring 2020 Midterm 2)

Consider the circuit below with $C_1 = C_2 = 1\,\mu\text{F}$ and three switches ϕ_1, ϕ_2. Suppose that initially the switches

ϕ_1 are closed and ϕ_2 is open, such that C_1 and C_2 are charged through the corresponding voltage sources $V_{s1} = 1\,\text{V}$ and $V_{s2} = 2\,\text{V}$.



(a) How much charge is on C_1 and C_2?

(b) Now suppose that some time later, switch ϕ_1 opens and switch ϕ_2 closes. What is the value of the voltage u_1 at steady state?