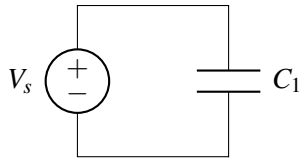
EECS 16A Designing Information Devices and Systems I
Spring 2020 Discussion 8B

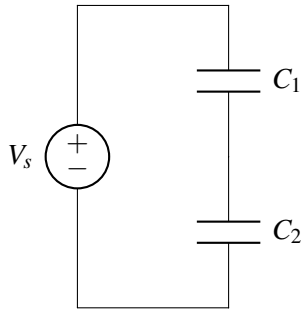
1. Voltages Across Capacitors

For the circuits given below, calculate the voltage across the capacitors. For parts (a) and (b) only, also calculate the charge and energy stored in each capacitor. Let $C_1 = 1\,\mu\text{F}$, $C_2 = 3\,\mu\text{F}$, $V_s = 1\,\text{V}$, and $I_s = 2\,\text{mA}$.

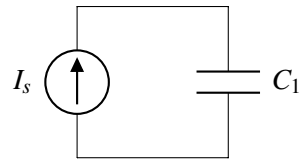
(a)



(b)

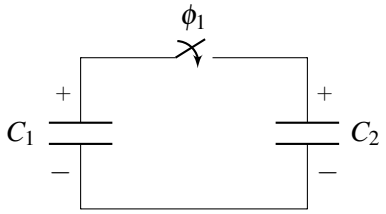


(c)



2. Capacitors and Charge Conservation (with Energy!)

(a) Consider the circuit below with $C_1 = C_2 = 1\,\mu\text{F}$ and an open switch. Suppose that C_1 is initially charged to $+1\,\text{V}$ and that C_2 is charged to $+2\,\text{V}$. How much charge is on C_1 and C_2? How much energy is stored in each of the capacitors? What is the total stored energy?



(b) Now the switch is closed (i.e. the capacitors are connected together.) Is charge conserved? What are the voltages across and the charges on C_1 and C_2? What is the total stored energy?

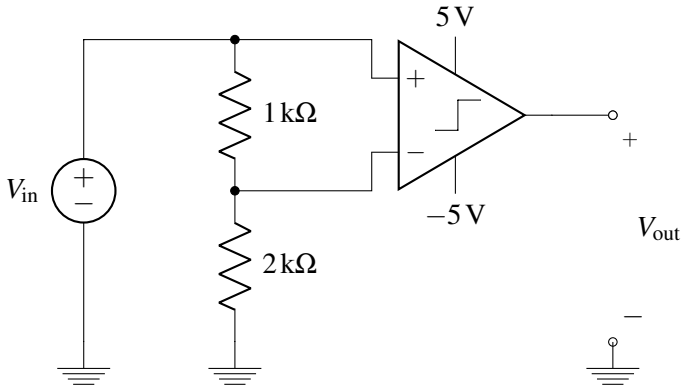
(c) Is there more or less energy than before the switch was closed? Why?

(d) Answer the above three questions but now with $C_1 = 2\,\mu\text{F}$ and $C_2 = 1\,\mu\text{F}$. Suppose that they are initially charged in the same way: C_1 is charged to $+1\,\text{V}$, and C_2 is charged to $+2\,\text{V}$.

3. Comparators

For each of the circuits shown below, plot V_{out} for V_{in} ranging from $-10\,\text{V}$ to $10\,\text{V}$ for part (a) and from $0\,\text{V}$ to $10\,\text{V}$ for part (b).

(a)



(b)