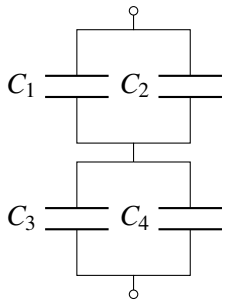
EECS 16A Designing Information Devices and Systems I
Summer 2023 Discussion 5C

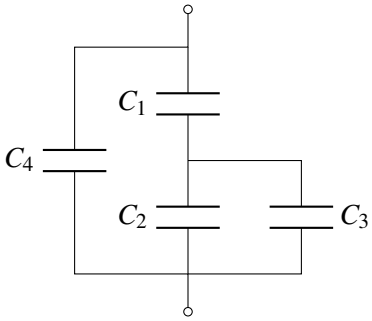
1. Series And Parallel Capacitors

Derive C_{eq} for the following circuits.

(a)

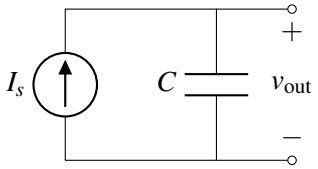


(b)



2. Current Sources And Capacitors

Given the circuit below, find an expression for $v_{\text{out}}(t)$ in terms of I_s, C, V_0, and t, where V_0 is the initial voltage across the capacitor at $t = 0$.



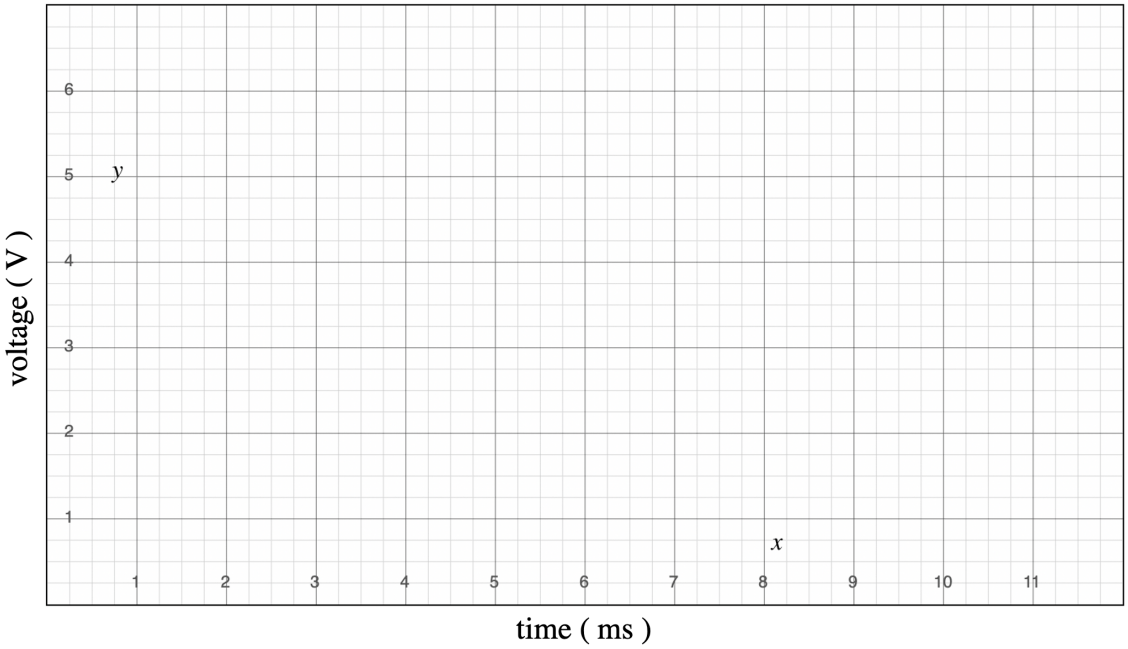
Then plot the function $v_{\text{out}}(t)$ over time on the graph below for the following conditions detailed below. Use the values $I_s = 1\text{mA}$ and $C = 2\,\mu\text{F}$.

(a) Capacitor is initially uncharged, with $V_0 = 0$ at $t = 0$.

(b) Capacitor has been charged with $V_0 = +1.5\text{V}$ at $t = 0$.

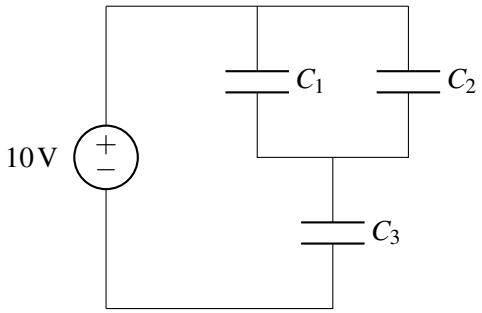
(c) **Practice:** Swap this capacitor for one with half the capacitance $C = 1\,\mu\text{F}$, which is initially uncharged, with $V_0 = 0$ at $t = 0$.

HINT: Recall the calculus identity $\int_a^b f'(x)dx = f(b) - f(a)$, where $f'(x) = \frac{df}{dx}$.



3. Series And Parallel Capacitors

(a) Consider the following circuit with $C_1 = 1\,\text{F}$, $C_2 = 3\,\text{F}$ and $C_3 = 4\,\text{F}$ Assume that both capacitors are initially uncharged before voltage is applied.



What are the voltages across each capacitor? Assume that we are in steady state.