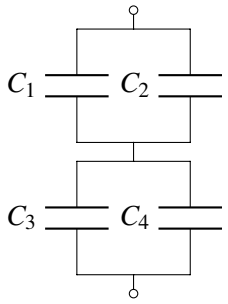
# EECS 16A Designing Information Devices and Systems I
# Spring 2022 Discussion 9A

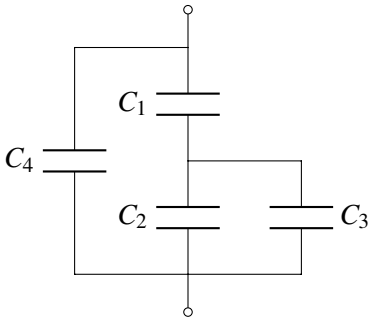
## 1. Series And Parallel Capacitors

Derive $C_{eq}$ for the following circuits.

(a)



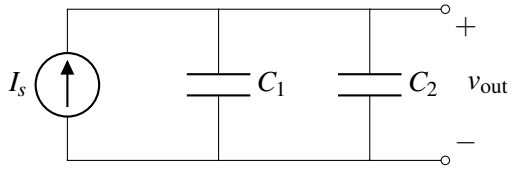

(b)



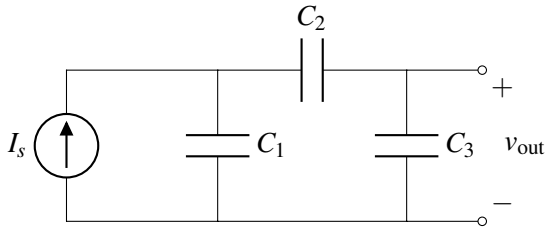

## 2. Current Sources And Capacitors

(a) For the circuits given below, give an expression for $v_{\text{out}}(t)$ in terms of $I_s$, $C_1$, $C_2$, $C_3$ and $t$. Assume that all capacitors are initially uncharged, i.e. the initial voltage across each capacitor is 0 V.

i.




ii.

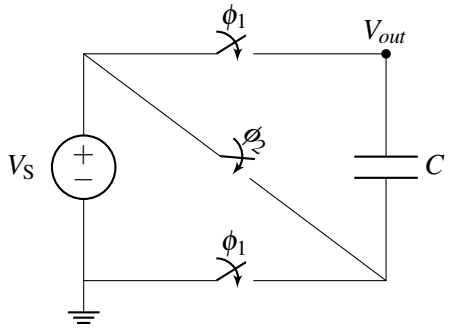


(b) For the circuit in subpart (i) of part (a), assume that the direction of the current is flipped at some time $t = T$. Give an expression for $v_{\text{out}}(t)$ for $t > T$ in terms of $I_s$, $C_1$ and $C_2$. For what value of $t$ will $v_{\text{out}}(t) = 0$?

## 3. Voltage Booster

We have made extensive use of resistive voltage dividers to reduce voltage. What about a circuit that boosts voltage to a value greater than the supply $V_S = 5V$? We can do this with capacitors!




(a) In the circuit above switches $\phi_1$ are initially closed and switch $\phi_2$ is initially open. Calculate the value of the output voltage, $V_{out}$ with respect to ground, and the amount of charge stored on capacitor, $C$, at that state (phase 1).

(b) Now, after the capacitors are charged, switches $\phi_1$ are opened and switch $\phi_2$ is closed. Calculate the new voltage output voltage, $V_{out}$, at steady state.