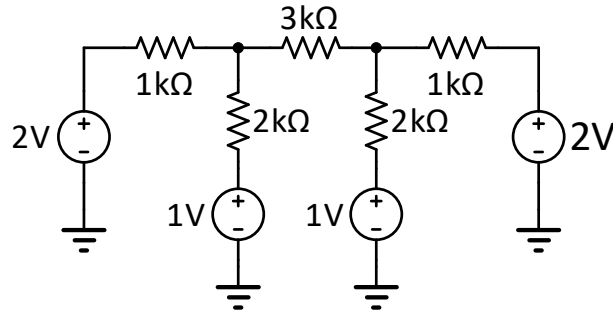


FINAL EXAMINATION

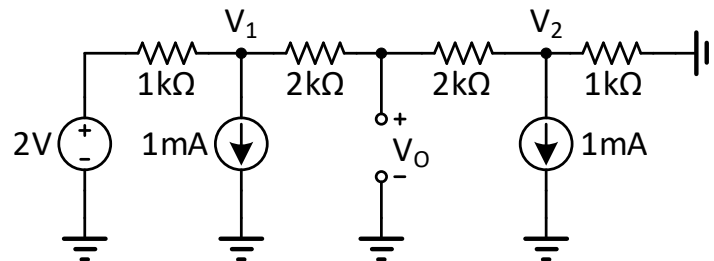
ECE 580

December 14, 2023

1. Analyze the circuit shown. **Warning:** look for a shortcut!!



2. Analyze the circuit shown using inter-reciprocity.

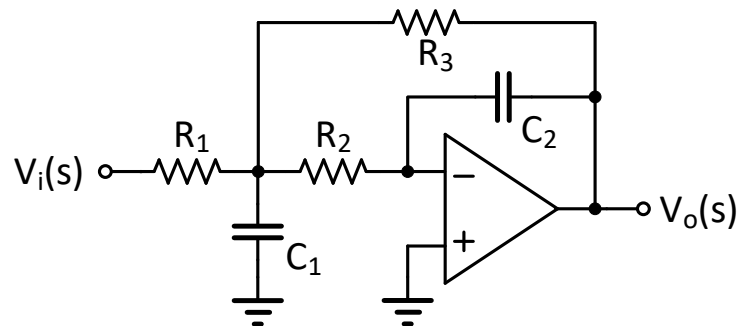


For extra credit, find V_1 and V_2 .

3. The Rauch filter shown has a transfer function (assume ideal opamp)

$$H(s) = \frac{1}{s^2 \cdot R_1 \cdot R_2 \cdot C_1 \cdot C_2 + s \cdot C_2 \cdot \left(R_1 + R_2 + \frac{R_1 \cdot R_2}{R_3} \right) + \frac{R_1}{R_3}}$$

If $R_1 = 2R_2 = 2R_3$ and pole Q is $Q = 1/\sqrt{3}$, what should be the ratio C_1/C_2 ?



For extra credit, find the requirements for the DC gain A_0 and the pole Q so that the minimum capacitance spread (C_1/C_2 or C_2/C_1) can be 1. **Hint:** consider the requirements for A_0 and Q so that there is real solution for R_2/R_3 when $C_1 = C_2$.