

CENG4480 2021F Homework 1

Due: Oct. 24, 2021

All solutions should be submitted to the blackboard in the format of **PDF/MS Word**.

- Q1** (10%) The following circuit Figure 1 is a difference amplifier circuit. $U_1 = 40V$, $U_2 = 25V$, $R_1 = 6\Omega$, $R_2 = 4\Omega$, $R_3 = 15\Omega$, $R_4 = 20\Omega$. Please calculate the output voltage of U_o .

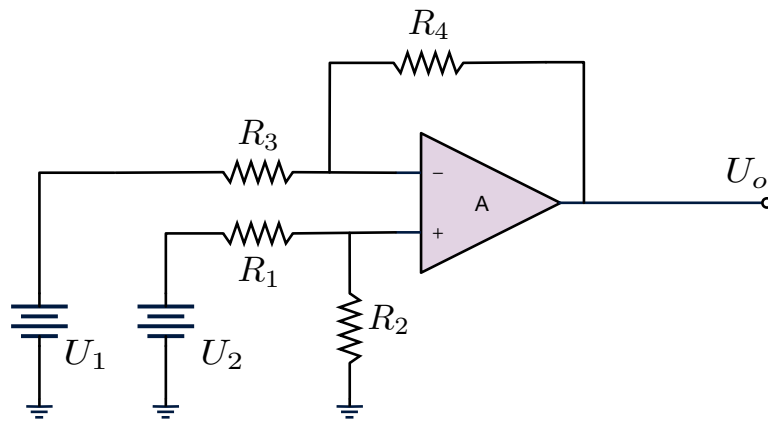


Figure 1: Q1 Circuit

- Q2** (20%) Given an ideal op-amp circuit below where $R_1 = 1k\Omega$, $R_2 = 2k\Omega$, $R_3 = 3k\Omega$, if I want to obtain a gain of 5, what's the value of the resistor R_4 as shown in the circuit?

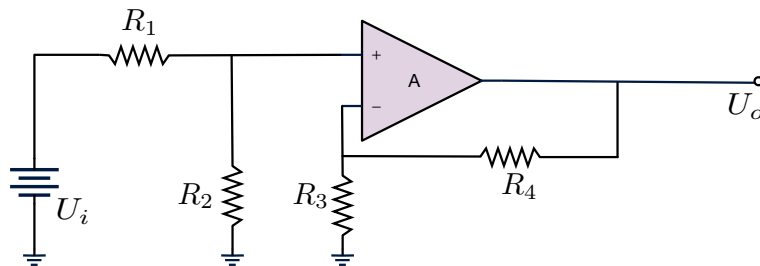


Figure 2: Q2 Circuit

- Q3** (20%) Given the following amplifier circuit as shown in Figure 3. $R_1 = 1M\Omega$, $R_2 = 500k\Omega$ and $R_3 = 100\Omega$. Also, I want to acquire a voltage gain $U_o/U_i = -120$, how to choose the value of R_4 ?

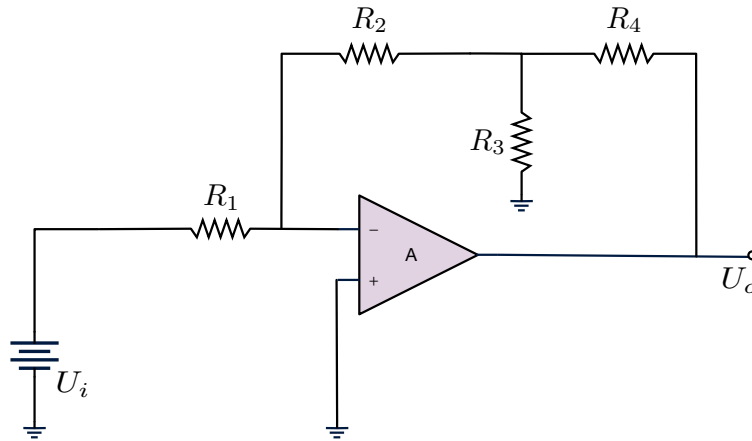


Figure 3: Q3 Circuit

Q4 (20%) The diagram of amplifier circuit is shown in fig. 4. Given $R_1 = 4\text{k}\Omega$, $R_2 = 6\text{k}\Omega$ and $R_3 = 12\text{k}\Omega$, answer the following questions.

1. Find the output voltage U_o if $U_a = 4\text{V}$ and $U_b = -12\text{V}$.
2. When $U_b = -12\text{V}$, determine the range of U_a for linear operation if the saturation voltage of op-amp is $\pm 12\text{V}$.

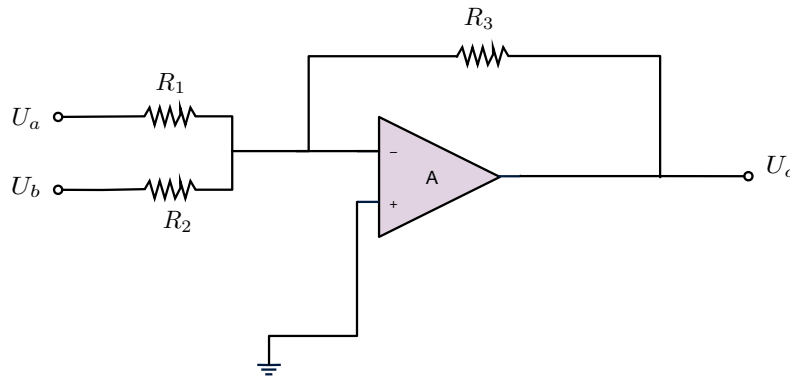


Figure 4: Q4 Circuit Diagram

Q5 (20%) In the circuit of Figure 5, $R_3 = R_4 = R_5 = R_6 = R_7 = R = 2R_1 = 2R_2 = 100\text{k}\Omega$ and $C = 1\mu\text{F}$. Assume the op-amps are ideal. What is the relationship between U_i and U_o

Q6 (10%) Draw the output voltage waveform for the circuit below. $R = 5\text{k}\Omega$ and $C = 0.2\mu\text{F}$. The input voltage is as follows:

$$U_i = \begin{cases} 2000t, & 0 < t < 2 \text{ ms} \\ 8 - 2000t, & 2 \leq t < 4 \text{ ms} \end{cases}$$

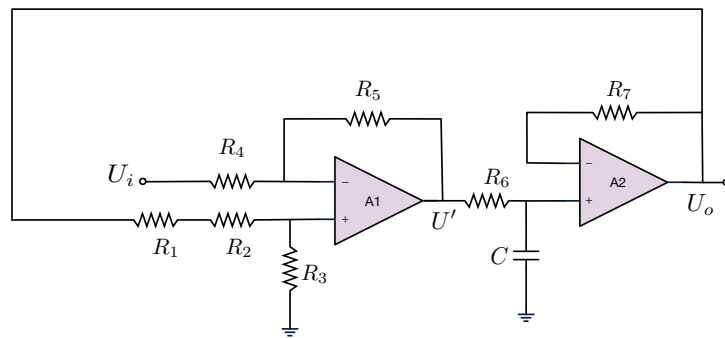


Figure 5: Q5 Circuit Diagram