BRAC UNIVERSITY

CSE 350

Quiz-3, Section 8

Fall 2024

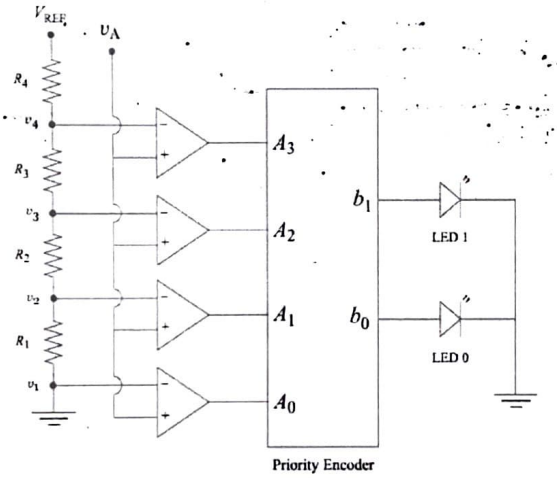
Marks: 20

Name: ID:

1. The figure shows a 2-bit Flash ADC with VREF = 12V and its input ranged from 0V to 12V.

Given: R1 = 5kΩ, R2 = 10kΩ, R3 = 10kΩ, R4 = 15kΩ. The two outputs of the ADC are connected to two LEDs.

This circuit works as Active High Logic. (High Voltage Output → '1' and Low Voltage Output → '0')



a. Determine the quantization range, corresponding digital output, and the states of the LED for the 2-bit Flash ADC. Make a table with quantization range, corresponding digital output, and the states of the LED. [6]

b. Find the truth table of the Encoder and state the priority sequence of the Encoder. [4]

a) Here, $V_1 = 0V$

$$I = \frac{12-0}{40k} = \frac{12}{40k},$$

$$\frac{V_2 - 0}{5k} = \frac{12}{40k}$$

$$\Rightarrow V_2 = 1.5\ V$$

$$V_3 = V_2 + \frac{12}{40k} \times 10k = 4.5V$$

$$V_4 = V_3 + \frac{12}{40k} \times 10k = 7.5V$$

Q. Range	b_1 b_0	LED_1	LED_0
0 – 1.5	00	off	off
1.5 – 4.5	01	off	On
4.5 – 7.5	10	On	off
7.5 – 12	11	On	On

b) Truth table,

A_3	A_2	A_1	A_0	b_1	b_0
0	0	0	1	0	0
0	0	1	1	0	1
0	1	1	1	1	0
1	1	1	1	1	1

Priority. $A_3 > A_2 > A_1 > A_0$

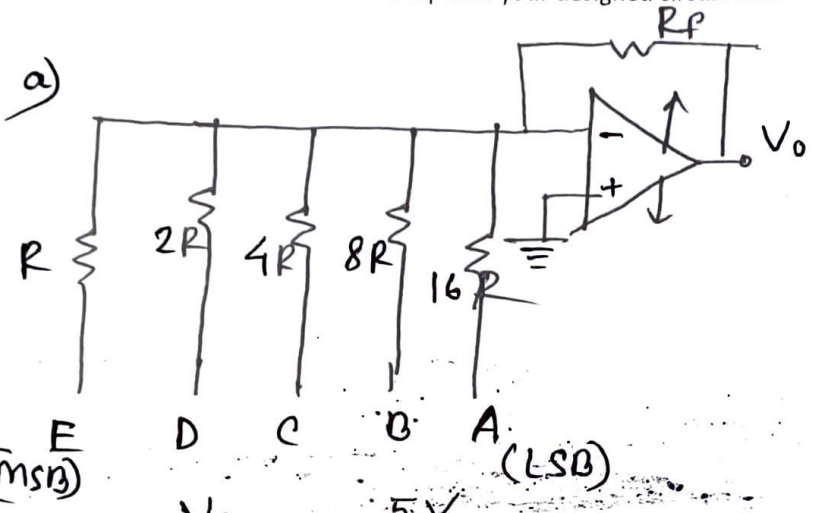
2. You want to design a 5-bit binary weighted DAC circuit. You need to use -5V as reference voltage, +15 V as positive power supply and -15 V as negative power supply.

a. Design the circuit to make the step size 0.25 V. [4]

b. Draw the output voltage vs input plot with proper labeling. [3]

c. For 4Rf what will be the output of your designed circuit when all the inputs are high. [3]

a)



$V_{REF} = -5\,V$

For, 00001, $V_o = 0.25\,V$

$$0.25 = -\frac{R_F}{R} V_{REF}\left(E + \frac{D}{2} + \frac{C}{4} + \frac{B}{8} + \frac{A}{16}\right)$$

$$\Rightarrow 0.25 = -\frac{R_F}{R} \times -5 \times \left(0 + 0 + 0 + 0 + \frac{1}{16}\right)$$

$$\Rightarrow \frac{4}{5} = \frac{R_F}{R}$$

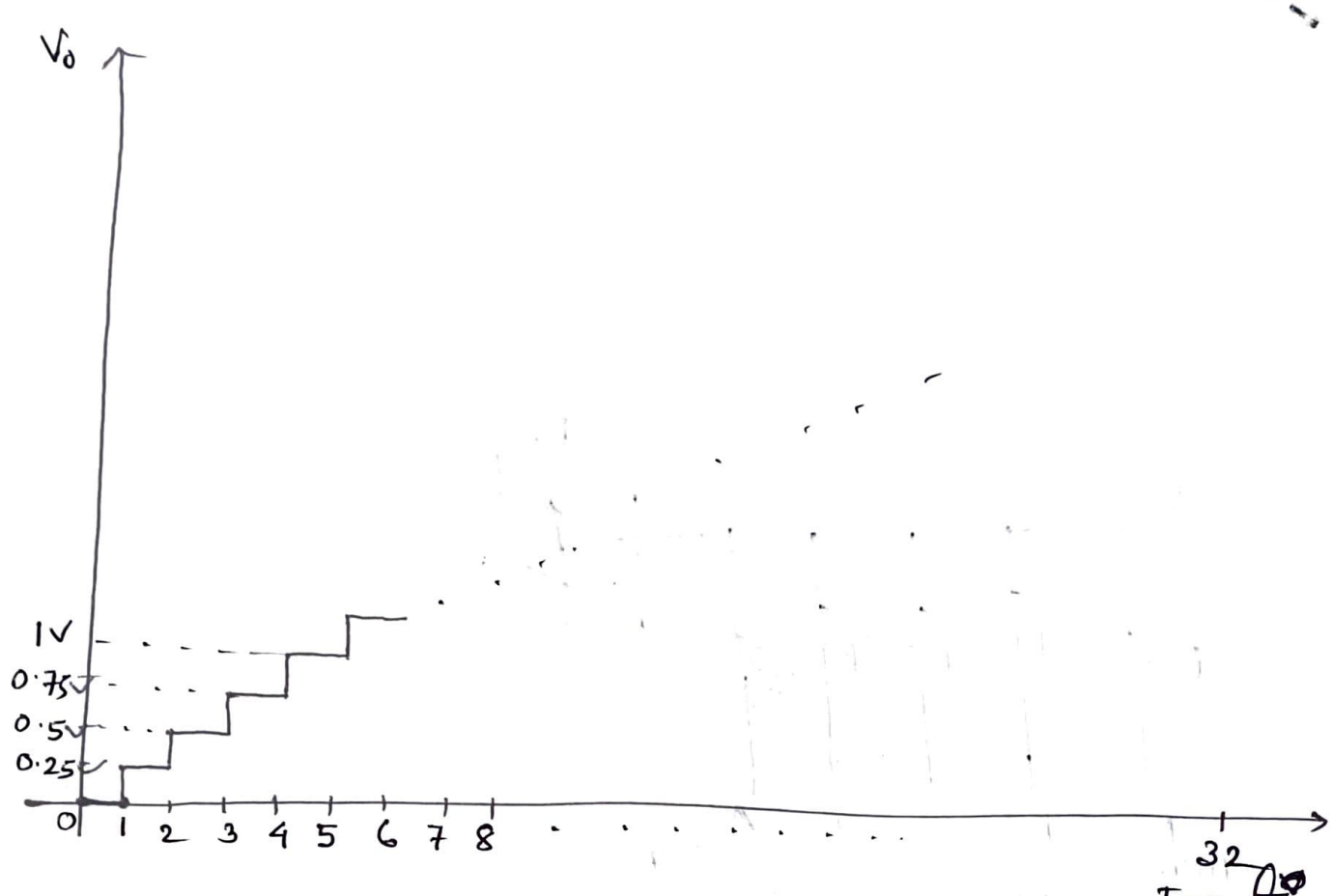
Assuming, $R = 10K$,

$$\frac{4}{5} = \frac{R_F}{10K}$$

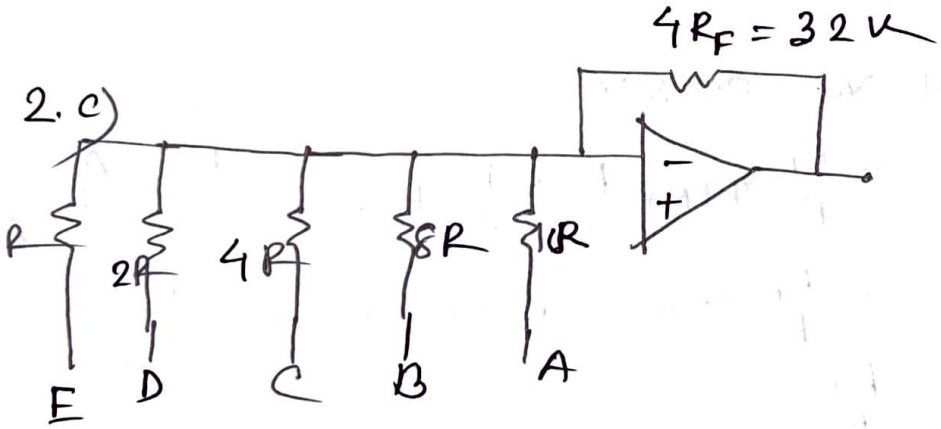
$$\therefore R_F = 8K$$

$V_H = +15V$, $V_L = -15V$

2.b)



2.c)



$$V_0 = -\frac{R_F}{R} V_{REF}\left(E + \frac{D}{2} + \frac{C}{4} + \frac{B}{8} + \frac{C}{16}\right)$$

$$V_0 = -\frac{32}{10} \times -5\left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}\right)$$

$$= \frac{1}{2} \times \left(32 + 16 + 8 + 4 + 2\right)$$

$$= (16 + 8 + 4 + 2 + 1)$$

$$= 31V$$

but this is not possible,

$$V_0 = 15V$$