Solve

BRAC UNIVERSITY

CSE 350

Quiz-3, Section 13

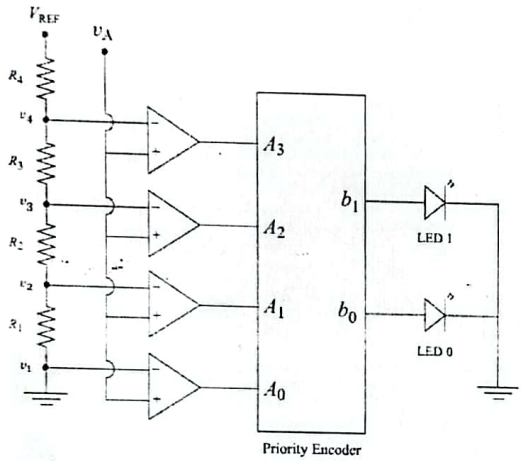
Fall 2024

Marks: 20

Name: ID:

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

Given: R1 = /2R, R2 = 3/2 R, R3 = 3/2 R, R4 = R/2. The two outputs of the ADC are connected to two LEDs. This circuit works as Active High Logic.



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]

1.a) $I = \frac{12-0}{4R}$

$V_1 = 0$

$V_2 = V_1 + I \times \frac{R}{2} = 0 + \frac{12}{4R} \times \frac{R}{2} = 1.5V$

$V_3 = V_2 + \frac{12}{4R} \times \frac{3R}{2} = 6V$

$V_4 = V_3 + \frac{12}{4R} \times \frac{3R}{2} = 10.5V$

Range	b_1 b_0	LED_1	LED_0
0–1.5	00	off	off
1.5–6	01	off	on
6–10.5	10	on	off
10.5–12	11	on	on

1. b)

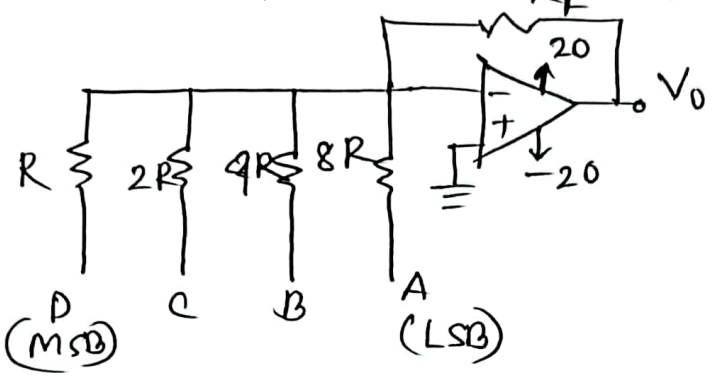
A_3	A_2	A_1	A_0	b_1	b_0
0	0	0	1	0	0
0	0	1	1	0	1
0	1	1	1	1	0
1	1	1	1	1	1

priority, $A_3 > A_2 > A_1 > A_0$

2. You want to design a 4-bit Flash ADC circuit. You need to use -5V as reference voltage, +20 V as positive power supply and -20 V as negative power supply.

a. Design the circuit to make the maximum output voltage 15 V. [6]

b. What will be the step size of the circuit and output voltage for 0101, 1010. [2+2]



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

$V_H = 20\,V$, and, $V_L = -20\,V$

For Max output, Input 1111

$$15 = -\frac{R_F}{R} \times -5 \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} \right)$$

$$\frac{R_F}{R} = \frac{8}{5}$$

Assume, $R = 20\,k\Omega$

$$R_F = \frac{8}{5} \times 20\,k\Omega$$

$$= 32\,k\Omega$$

2.b) For, 0001,

step size $= V_0 = -\frac{R_F}{R} \times V_{REF} \left(0 + 0 + 0 + \frac{1}{8} \right)$

$$= -\frac{32}{20} \times -5 \left(\frac{1}{8} \right)$$

$$= 1\,V$$

V_0 for $0101 = -\frac{32}{20} \times -5 \left(0 + \frac{1}{2} + 0 + \frac{1}{8} \right) = 5\,V$

V_0 for, $1010 = -\frac{32}{20} \times -5 \left(1 + 0 + \frac{1}{4} + 0 \right) = 10\,V$