MD Rakib Hossain

ID: 21301188

sec: 11

CSE350

Ans to the Q. No. 1

a

input voltage range = $(0 - V_{ref})$.

so, 5.12 V.

Given, step size = 0.02 V

$$\text{Setp size} = \frac{\text{voltage range}}{\text{number of steps}}$$

$$\therefore \text{number of steps} = \frac{\text{voltage rang}}{\text{steps size}}$$

$$= \frac{5.12}{0.02}$$

$$= 256$$

bit

~~$2^n = 256$~~

~~$\therefore n = 8$~~

$$\text{Number of bits users} = \log_2(256)$$

$$= 8 \quad \text{Ans!-}$$

B

Given, $V_{in} = 3V$

Let output count $= m$

$$V_{in} = \frac{m}{2^n} V_{ref}$$

$$\Rightarrow m = \frac{V_{in} 2^n}{V_{ref}}$$

$$= \frac{3 \times 256}{5.12}$$

$$= 150$$

the ADC output counts 150.

clock $= 2MHz$
$= 2 \times 10^6 \ Hz$

$$T_1 = \frac{2^n}{clock}$$

$$= \frac{256}{2 \times 10^6} s$$

$$= \cancel{2.56 \times 10^{-4} s}$$
$$= 1.28 \times 10^{-4} s$$

$$T_2 = \frac{m}{clock} = \frac{150}{2 \times 10^6} = 7.5 \times 10^{-5} s$$

so, time to get the output $= T_1 + T_2$

$= 1.28 \times 10^{-4} + 7.5 \times 10^{-5}$ $= \cancel{2.56 \times 10^{-4} + 7.5 \times 10^{-5}}$

$= 2.03 \times 10^{-4} s$ $\cancel{= 3.31 \times 10^{-4}} s$

(c)

if $V_{in} = 4$ we need to find how the grap will change. ~~for~~ from (b),

$$V_o(t) = \frac{V_{in}}{RC} t \quad [t = t_1] \qquad V_{in} = 3$$

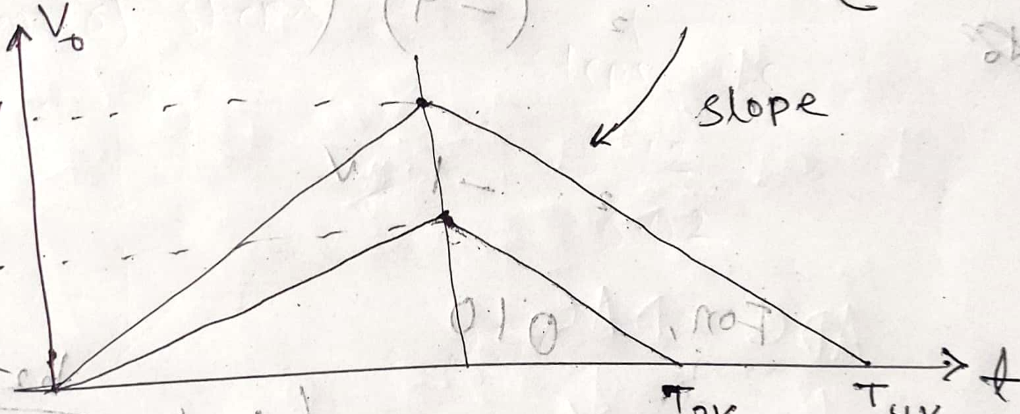
$$\therefore V_o(t_1) = \frac{V_{in}}{R_c} \times t_1$$

for, $t > t_1$

$$V_o(t) = -\frac{V_{ref}}{RC}$$

Here, V_{o3V} is the value of $V_{in} = 3V$

V_{o4V} is the value of $V_{in} = 4V$



Here, we can see since the slope before t_1 line depends on V_{in}, the slope of $V_{in} = 4v$ is more, After the t_1 line, slope is constant.

Ans to the Q. No. 2

a

Given, $R_f = 10\,k\Omega$, $V_R = -4$

for, 001,

$$V_o = -(V_R) \times \left(\frac{R_f}{R_1}\right)$$

$$= -(-4) \times \frac{10}{40}$$

$$= 1\,V$$

for, 010,

$$V_o = -(-4) \times \left(\frac{10}{20}\right)$$

$$= 2\,V$$

B

① Step size $= \frac{16-0}{2^3} = \frac{16}{8} = 2$

$$I = \frac{16}{8R} = \frac{2}{R}$$

$V_0 = 0V$

$V_1 = IR_1 = \frac{\cancel{2}}{R} \times \frac{\cancel{R}}{\cancel{2}} = 1V$

$V_2 = \frac{\cancel{2}}{R} \times \frac{3R}{\cancel{2}} = 3V$

$V_3 = \frac{\cancel{2}}{R} \times \frac{5R}{\cancel{2}} = 5V$

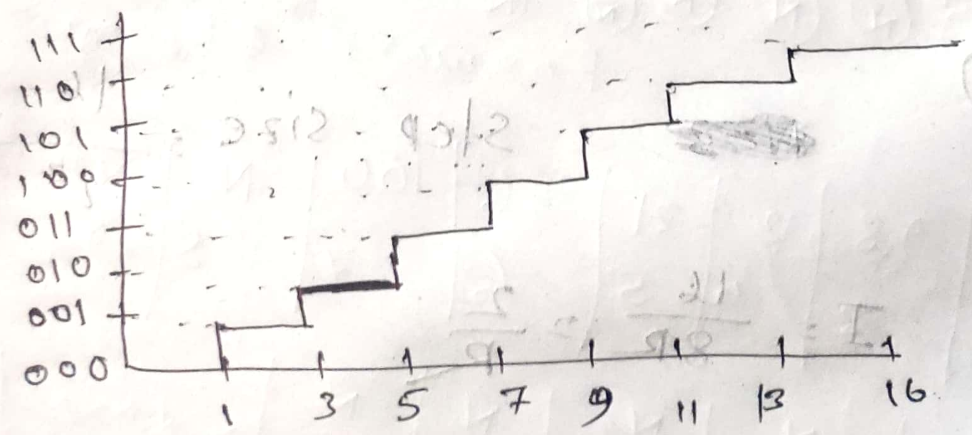
$V_4 = \frac{\cancel{2}}{R} \times \frac{7R}{\cancel{2}} = 7V$

$V_5 = \frac{\cancel{2}}{R} \times \frac{9R}{\cancel{2}} = 9V$

$V_6 = \frac{\cancel{2}}{R} \times \frac{11R}{\cancel{2}} = 11V$

$V_7 = \frac{\cancel{2}}{R} \times \frac{13R}{\cancel{2}} = 13V$

$V_8 = \frac{\cancel{2}}{R} \times \frac{16R}{\cancel{2}} = 16V$



The range = 3 to 5 V

11 Here, since the range is between 3V to 5V the DAC will only be able to produe 3V to 5V and since, the V_R is -4V it can't produce any voltage than that. The LSB value is

1V =
2V = menas the input is 010

$3V = 010 + 001 = 011$

$$\left[\left(4\times\left(\frac{10}{40} * \frac{10}{20}\right)\right) = 3V\right]$$

$4V = 011 + 001 = 100$

$$\left[4\left(\frac{10}{10}\right) = 4V\right]$$

All possible combination are

(011 and 100)

Ans.

c

For a 2-bit flash ADC,

N = 2

So, Registor need = $2^2 = 4$

comparator need = $2^2 - 1 = 4 - 1$

$= 3$

Ans:-