

CSE-350 Quiz-03

ADC & DAC

Set-A

Total – 20 marks

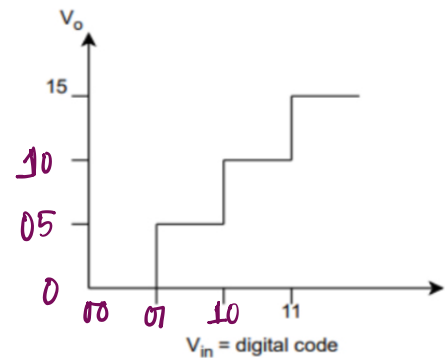
Time – 20 minutes

Name -	Id -	Section -
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Problem-1

10 marks

The figure shows the input-output characteristics of a converter. The output of the converter is denoted as V_o and the input as V_{in} . Identify the converter type and the number of bits used by the converter. Further, calculate V_{ref} when $R_F = 2R$.



Soln: \rightarrow DAC converter
2 bits

$$R_F = 2R$$

$$\begin{matrix} b_1 & b_2 \\ 1 & 1 \end{matrix} \rightarrow V_o = 1.5$$

$$V_o = V_{ref} \times \frac{R_F}{R} \left(b_1 + \frac{b_2}{2} \right)$$

$$\Rightarrow 1.5 = V_{ref} \times \frac{2R}{R} \left(1 + \frac{1}{2} \right)$$

$$\Rightarrow 1.5 = V_{ref} \times 2 \times \frac{3}{2}$$

$$\therefore \boxed{V_{ref} = 5V} \quad (\text{Ans.})$$

Problem-2

10 marks

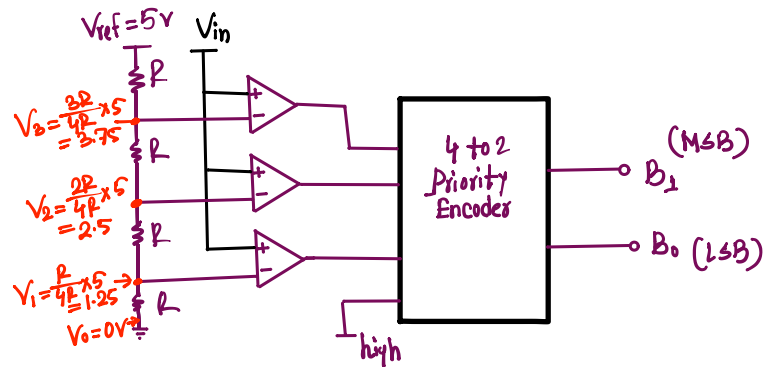
Design a 2 bit Flash ADC for an analog signal of range (0, 5). According to your circuit answer the following questions.

- What is the resolution and quantization error for this quantizer.
- Write the encoded sequences for the following input sequences { 2.3, 0.6, 4.8, 3.7 }

Soln: $n=2 \rightarrow \Delta = \frac{V_{\max} - V_{\min}}{2^n} = \frac{5-0}{2^2} = \frac{5}{4} = 1.25$

quantization error = $\frac{\Delta}{2} = 0.625$

Quantization Range	Encoded Seq.
3.75 - 5	11
2.5 - 3.75	10
1.25 - 2.5	01
0 - 1.25	00



i/p $\rightarrow \{ 2.3, 0.6, 4.8, 3.7 \}$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

encoded $\rightarrow \{ 01, 00, 11, 10 \}$

CSE-350 Quiz-03

ADC & DAC

Set-B

Total – 20 marks

Time – 20 minutes

Name -	Id -	Section -
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Problem-1

10 marks

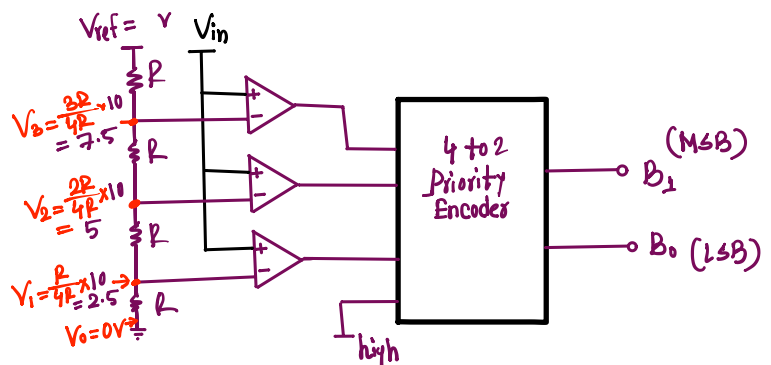
Design a 2 bit Flash ADC for an analog signal of range (0, 10). According to your circuit answer the following questions.

- What is the resolution and quantization error for this quantizer.
- Write the encoded sequences for the following input sequences { 2.3, 7.6, 5.8, 0.7 }

Soln: $n=2 \rightarrow \Delta = \frac{V_{\max} - V_{\min}}{2^n} = \frac{10 - 0}{2^2} = \frac{10}{4} = 2.5$

quantization error = $\frac{\Delta}{2} = 1.25$

Quantization Range	Encoded Seq.
7.5 - 10	11
5 - 7.5	10
2.5 - 5	01
0 - 2.5	00



i/p $\rightarrow \{ 2.3, 7.6, 5.8, 0.7 \}$

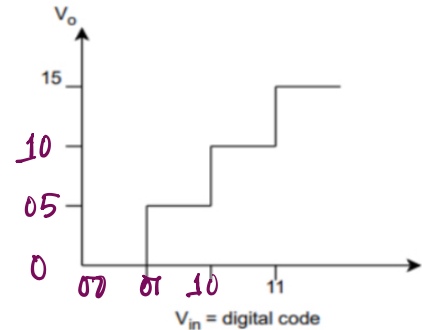
$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

encoded $\rightarrow \{ 00, 11, 10, 00 \}$

Problem-2

10 marks

The figure shows the input-output characteristics of a converter. The output of the converter is denoted as V_o and the input as V_{in} . Identify the converter type and the number of bits used by the converter. Further, calculate V_{ref} when $R_F = R$.



Soln: \rightarrow DAC Converter
2 bits

$$R_F = R$$

$$\begin{matrix} b_1 b_2 \\ 1 \ 1 \end{matrix} \rightarrow V_o = 15$$

$$V_o = V_{ref} \times \frac{R_F}{R} \left(b_1 + \frac{b_2}{2} \right)$$

$$\Rightarrow 15 = V_{ref} \times \frac{R}{R} \left(1 + \frac{1}{2} \right)$$

$$\Rightarrow 15 = V_{ref} \times \frac{3}{2}$$

$$\therefore \boxed{V_{ref} = 10 \text{ V}} \quad (\text{Ans.})$$