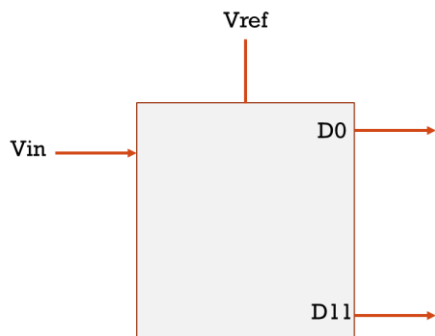


Name:

CMPE 451, Section 2

Quiz 4

1. Calculate the digital output for a microcontroller with an ADC shown below, for $V_{in} = 3V$ and $V_{ref} = 4.096V$ (30 pts)



D0 – D11 : 12 bit ADC

$$\text{Step size} = V_{ref}/2^n = 4.096/2^{12} \\ = 4.096V/4096 = 0.001V$$

$$\frac{V_{in}}{\text{Step size}} = \frac{3V}{0.001V} = 3000 \text{ (decimal)}$$

$$D_{out} = 101110111000 \text{ (binary)}$$

2. For an ADC with $V_{ref} = 2.56V$ and given incomplete table of successive approximation, calculate $V_{DAC}(s)$ and estimate the range for V_{in} (40 pts.)

Successive Approximation Method (4 bit example)	ADC
<ul style="list-style-type: none"> Step 1: set index =n-1 (i.e. 3) Step 2: set SAR = 1000 Step 3: read an input-voltage i.e. V_{in} Step 4: if (Index > 0) set SAR[Index -1] =1 Step 5: <ul style="list-style-type: none"> if $V_{in} > V_{DAC}$ $\text{SAR[Index]}=1$ else $\text{SAR[Index]}=0$ Step 6: Index-- Step 7: Go to Step 4 	

$$\text{Step size} = V_{ref}/2^n = 2.56/2^4 = 0.16$$

$$V_{DAC} = (\text{SAR}) \times \text{Step size}$$

Vin	SAR	V_{DAC}	Comment	Index	Index-1
1.6 – 1.76V	1000	1.28	$V_{in} > V_{DAC}$	3	2
	1100	2.24	$V_{in} < V_{DAC}$	2	1
	1010	1.6	$V_{in} > V_{DAC}$	1	0
	1011	1.76	$V_{in} < V_{DAC}$	0	-1
	1010	1.6			

