Homework 8: Answers

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Please note that the particular homework assignment that you answered will have the same options as listed here, but the order of these options may have been randomized for each quiz. So your option (b) may instead be written here as option (c), etc. Please read the questions and options in full.
The answers to these questions are all found in the course notes, textbook, and video lessons.

1. Problem: Consider a 4-bit successive-approximation register (SAR) ADC with $V_{ref} = 3.3\,\text{V}$.
The analog input is $V_{in} = 2\,\text{V}$. Complete the following table to show how the binary search is implemented.

Answer: The final bit pattern and digitized voltage is `0b1001` and $1.856\,25\,\text{V}$. The binary search is:

Step	Bit Pattern	Digitized Voltage (V)
1	0b1000	1.65
2	0b1100	2.475
3	0b1010	2.0625
4	0b1001	1.856 25

2. Problem: Which option below best describes the ADC on the DE1-SoC board?

(a). The ADC is 12-bit, SAR-type with 8 channels. Each channel has its own data register. All channels can convert simultaneously.

(b). The ADC is 12-bit, SAR-type with 8 channels. All channels share a common data register. Only one channel can convert at a time.

(c). The ADC is 8-bit, sigma-delta-type ADC with 4 channels. All channels share a common data register. Only one channel can convert at a time.

(d). The ADC is a 8-bit, flash-type ADC with 12 channels. Each channel has its own data register. All channels can convert simultaneously.

Answer: Option (a).

3. Problem: You somehow have a 6-bit ADC that uses $V_{ref} = 8\,\text{V}$. What is the voltage resolution of this device?

Answer: A 6-bit ADC has $2^6 = 64$ intervals.

$$\Delta V = \frac{V_{ref}}{2^6} = 0.125 \text{ V}$$