NCERT Math 11.9.2 Q8

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Question: An 8 bit ADC converts analog voltage in the range of 0 to +5 V to the corresponding digital code as per the conversion characteristics shown in figure. For $V_{in} = 1.9922\,V$, which of the following digital output, given in hex, is true?

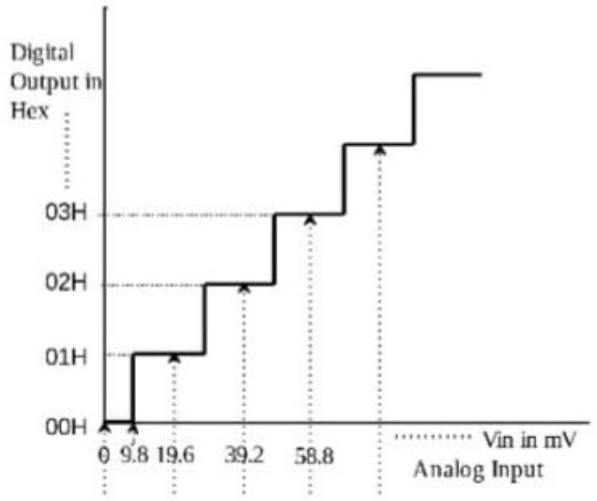

Fig. 1: Caption

(a) $64H$
(b) $65H$
(c) $66H$
(d) $67H$

Solution:

Symbol	Value	Description
n	8	Number of bits of ADC
V_{min}	$0V$	Minimum Analog Voltage
V_{max}	$5V$	Maximum Analog Voltage
V_{in}	$1.9922V$	Input Voltage
V_{out}		Output Voltage

TABLE I: Given Parameters

Calculating the step-size:

$$\Delta V_{in} = \frac{V_{max} - V_{min}}{2^n - 1} \tag{1}$$

$$= \frac{5 - 0}{2^8 - 1} \tag{2}$$

$$= \frac{5}{255} \tag{3}$$

$\therefore$ digital output (V_{out}) corresponding to $V_{in} = 1.9922V$

$$V_{out} = \frac{V_{in}}{\Delta V_{in}} \tag{4}$$

$$= \frac{1.9922 \times 255}{5} \tag{5}$$

$$= 101.59 \tag{6}$$

$$\approx 102 \tag{7}$$

Converting decimal number into hexadecimal number:

$$(102)_{10} = (66)_H \tag{8}$$

$\therefore$ correct answer is option (c).