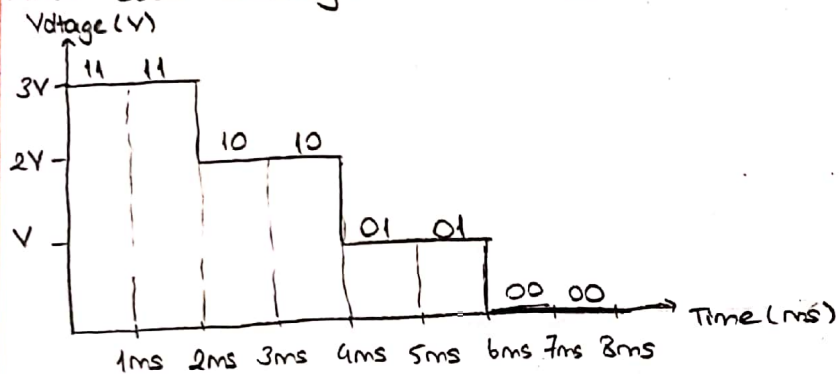


HOMEWORK - 1

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1- Assume that 0V is encoded as 00, 1V as 01, 2V as 10, 3V as 11. You are given a digital encoding of an audio signal as follows: 111101001010000. Plot the re-created signal with time on the x-axis and voltage on the y-axis. Assume that each encoding's corresponding voltage should be output for 1 millisecond.



2- Convert following binary numbers to decimal numbers

a. 000011

$$1 \times 2^0 + 1 \times 2^1 = 3$$

b. 1111

$$1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2 + 1 \times 2^3 = 15$$

c. 11110

$$0 \cdot 2^0 + 1 \cdot 2^1 + 1 \cdot 2^2 + 1 \cdot 2^3 + 1 \cdot 2^4 = 30$$

d. 111100

$$0 \cdot 2^0 + 0 \cdot 2^1 + 1 \cdot 2^2 + 1 \cdot 2^3 + 1 \cdot 2^4 + 1 \cdot 2^5 = 60$$

e. 0011010

$$0 \cdot 2^0 + 1 \cdot 2^1 + 0 \cdot 2^2 + 1 \cdot 2^3 + 1 \cdot 2^4 = 25$$

3- Convert the following binary numbers to hexadecimal

a. 1100 1101

$$\begin{aligned} 1 \cdot 2^3 + 1 \cdot 2^2 &= 12 \rightarrow C \\ 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^0 &= 13 \rightarrow D \end{aligned} \quad \left. \vphantom{\begin{aligned} 1 \cdot 2^3 + 1 \cdot 2^2 &= 12 \rightarrow C \\ 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^0 &= 13 \rightarrow D \end{aligned}} \right\} CD$$

c. 1111 0001

$$\begin{aligned} 1111 &\rightarrow 2^3 + 2^2 + 2^1 + 2^0 = 15 \rightarrow F \\ 0001 &\rightarrow 1 \rightarrow 1 \end{aligned} \quad \left. \vphantom{\begin{aligned} 1111 &\rightarrow 2^3 + 2^2 + 2^1 + 2^0 = 15 \rightarrow F \\ 0001 &\rightarrow 1 \rightarrow 1 \end{aligned}} \right\} F1$$

b. 10100101

$$\begin{aligned} 1010 &\rightarrow 2^3 + 2 = 10 \rightarrow A \\ 0101 &\rightarrow 2^2 + 1 = 5 \rightarrow 5 \end{aligned} \quad \left. \vphantom{\begin{aligned} 1010 &\rightarrow 2^3 + 2 = 10 \rightarrow A \\ 0101 &\rightarrow 2^2 + 1 = 5 \rightarrow 5 \end{aligned}} \right\} A5$$

d. 110110111100

$$\begin{aligned} 1 &\rightarrow 1 \rightarrow 1 \\ 1011 &\rightarrow 2^3 + 2 + 1 = 11 \rightarrow B \\ 0111 &\rightarrow 2^2 + 2 + 1 = 7 \rightarrow 7 \\ 1100 &\rightarrow 2^3 + 2^2 = 12 \rightarrow C \end{aligned} \quad \left. \vphantom{\begin{aligned} 1 &\rightarrow 1 \rightarrow 1 \\ 1011 &\rightarrow 2^3 + 2 + 1 = 11 \rightarrow B \\ 0111 &\rightarrow 2^2 + 2 + 1 = 7 \rightarrow 7 \\ 1100 &\rightarrow 2^3 + 2^2 = 12 \rightarrow C \end{aligned}} \right\} 1B7C$$

4- Convert the following hexadecimal numbers to decimal

a. 10

$$0.16^0 + 1.16 = 16$$

b. 4E3

$$3.16^0 + 14.16 + 4.16^2 = 1251$$

c. FFO

$$0.16^0 + 15.16^1 + 15.16^2 = 4080$$

d. 200

$$0.16^0 + 0.16 + 2.16^2 = 512$$

5. Encode following words into bits using the ASCII encoding table in Figure 1.9

a.

LET

100 1100 100 0101 101 0100

b.

RESET!

101 0100 1000 101 101 0011 1000 101 101 0100 010 0001

c.

HELLO \$!

100 1000 1000 101 100 1100 100 1100 100 1111 010 0000 0100 100 011 0001