POSTAL Study Package 2019

Electrical Engineering

Conventional Practice Sets

Digital Electronics

Contents

MADE EASY Publications

1 CHAPTER
Number Systems and Codes

Q.1 Convert the following Octal numbers into its equivalent Hexadecimal numbers

(a) 134 **(b) 67**

(c) 1527.5 **(d) 4753**

Solution:

The most convenient method for converting the Octal numbers into its equivalent Hexadecimal is that firstly we have to change octal to the binary (in 3-bits) and then we arrange a group of 4-bits from right to its equivalent Hexadecimal numbers.

(a) $(134)_8 \xrightarrow{\text{Binary}} (001011100)_2$

Now $\underbrace{0000}_{0}\ \underbrace{0101}_{5}\ \underbrace{1100}_{C} = (5C)_{16}$

(b) $(67)_8 \xrightarrow{\text{Binary}} (110111)_2$

Now, $\underbrace{0011}_{3}\ \underbrace{0111}_{7} = (37)_{16}$

(c) $(1527.5)_8 \xrightarrow{\text{Binary}} (001101010111.101)_2$

Now, $\underbrace{0011}_{3}\ \underbrace{0101}_{5}\ \underbrace{0111}_{7}.\ \underbrace{1010}_{10}$

In Hexform, $(357.A)_{16}$

(d) $(4753)_8 \xrightarrow{\text{Binary}} (100111101011)_2$

Now, $\underbrace{1001}_{9}\ \underbrace{1110}_{E}\ \underbrace{1011}_{B} \xrightarrow{\text{Hexa}} (9EB)_{16}$

Q.2 List out the rules for the BCD (Binary Coded Decimal) addition with corresponding examples?

Solution:

BCD numbers are class of binary encodings of decimal numbers where each decimal digit is represented by four bits (4 bit code). This is also called 8421 weighted code. Valid BCD numbers are from decimal digit 0-9. BCD is a numerical code. In arithmetic operation, addition is the most important operation. The rule for addition of two BCD numbers are as following :

(i) Add the two numbers using the rules for binary addition.

(ii) In BCD addition if any invalid number (i.e. a 4-bit stream greater than 9) is present then $(0110)_2$ is added to the corresponding group to make it valid.

Example:

Add 56 and 57

$$\begin{array}{rll} 56 \rightarrow & 0101 & 0110 \\ 67 \rightarrow & 0110 & 0111 \\ \hline \text{BCD sum} = & \underbrace{1011}_{\text{not a valid BCD no.}} & \underbrace{1101}_{\text{not a valid BCD no.}} \end{array}$$

So, add 6 $\rightarrow$ 0110 0110

$\Downarrow$ $\Downarrow$

Now,

Carry

sum = 1 0010 0011

1 2 3

$\therefore$ $56 + 67 \xrightarrow{\text{BCD SUM}} 123$

(iii) If any carry is generated from only particular group then we add $(0110)_2$ to the corresponding group.

Example:

Add 74 and 94

74 → 0111 0100

94 → 1001 0100

Carry

BCD sum = 1 0000 1000

Due to carry add $(0110)_2$ | Valid BCD

1 0000 1000

0110

Now, BCD sum = 1 0110 1000

1 6 8

$\therefore$ $74 + 94 \xrightarrow{\text{BCD SUM}} 168$

Q.3 Convert the following:

(a) Octal 756 to Decimal

(b) Hexadecimal 3B2 to Decimal

(c) Long Binary number 1001001101010001 to Octal and to Hexadecimal

(d) Decimal 675.625 to Hexadecimal

Solution:

(a) Octal to decimal conversion:

$$(756)_8 = 7 \times 8^2 + 5 \times 8^1 + 6 \times 8^0$$
$$= 7 \times 64 + 5 \times 8^1 + 6 \times 1$$
$$= (494)_{10}$$

(b) Hexa to decimal:

$$(3\,B\,2)_{16} = 3 \times 16^2 + B \times 16^1 + 2 \times 16^0$$
$$= 3 \times 256 + 11 \times 16 + 2$$
$$= (946)_{10}$$

(c) Binary number can be converted into equivalent octal by making groups of 3-bits starting from LSB and moving towards MSB for integer part and then replace each group of 3-bit by its octal representation. So,

MSB side 1 001 001 101 010 001 LSB side

1 1 1 5 2 1

$= (111521)_8$

Now for Hexadecimal conversion we have to group 4-bit from LSB to MSB as shown.