No.: 1
Date: . .

Assignment – 2

Q-1 i) 1101 . 10110011

D . B 3

∴ Hexadecimal equivalent ⇒ D.B3

ii) 0010 1001 1010 0101 . 1000 1100

2 9 A 5 . 8 C

∴ Hexadecimal equivalent ⇒ 29A5.8C

Q-2 i) 2 B D

101011 1101.

∴ Binary equivalent ⇒ 1010111101

ii) 5A3.CE2

10110100011.110011100010

∴ Binary equivalent ⇒ 10110100011.110011100010

Q-3 $(475.25)_8 =$

$4\times8^2 + 7\times8^1 + 5\times8^0 + 2\times\frac{1}{8^1} + 5\times\frac{1}{8^2}$

$256 + 56 + 5 + 0.25 + 0.078125$

$= 317.328125$

Q-4

$(1\ 2\ 3\ 4)_8$

Converting it to decimal $\Rightarrow$

$1 \times 8^3 + 2 \times 8^2 + 3 \times 8^1 + 4 \times 8^0$

$\Rightarrow 512 + 128 + 24 + 4$

$\Rightarrow 640 + 28$

$\Rightarrow (668)_2$

Converting decimal to hexadecimal $\Rightarrow$

16	668	
16	41	C
	2	9

$\therefore$ Hexadecimal equivalent $\Rightarrow$ 2 9 C

Q-5

$(CAB6.13)_{16}$

Converting it to binary $\Rightarrow$

$(101010110110.00010011)_2$

Converting binary to octal $\Rightarrow$

$\underbrace{101}\,\underbrace{010}\,\underbrace{110}\,\underbrace{110}.\,\underbrace{000}\,\underbrace{100}\,\underbrace{110}$

$(5266.046)_8$

$\therefore$ Octal equivalent $\Rightarrow$ 5266.046

Q-6

$(4570.F8)_{16}$

Converting it to binary $\Rightarrow$

$(1000101011111101.11111000)_2$

Converting binary to octal $\Rightarrow$

$\underbrace{100}_{4}\ \underbrace{010}_{2}\ \underbrace{101}_{5}\ \underbrace{111}_{7}\ \underbrace{101}_{5}\ .\ \underbrace{111}_{7}\ \underbrace{110}_{6}\ \underbrace{000}_{0}$

$\therefore$ Octal equivalent $\Rightarrow$ 42575.760

Q-7

a)

$(16)_{10} = (10000)_2$

$(10)_{10} = (1010)_2$

Now, $(16)_{10} - (10)_{10} = (10000)_2 - (01010)_2$

Taking 2's complement of $(01010)_2$ = 10110

$\therefore$ Difference $\Rightarrow (10000)_2 + (10110)_2$

$$\begin{array}{r} {}^{1} \\ 10000 \\ +\ 10110 \\ \hline 100110 \end{array}$$

↓ carry

Drop the carry (or) Drop MSB ⇒ 110 is the required solution.

∴ Required difference ⇒ $(110)_2 = (6)_{10}$ and result is positive.

b)

$(22)_{10} = (10110)_2$

$(10)_{10} = (1010)_2$

Now, $(22)_{10} - (10)_{10} = (10110)_2 - (01010)_2$

Taking 2's complement of $(01010)_2 = 10110$

∴ Difference = $(10110) + (10110)$

$$\begin{array}{r} {}^{1} \\ 10110 \\ +\ 10110 \\ \hline 101100 \end{array}$$

↓ Carry

Drop the carry (or) Drop MSB ⇒ 1100 is the required solution.

∴ Required difference ⇒ $(1100)_2 = (12)_{10}$ and result is positive.

Q-8

a) 43 - 57

$(43)_{10} = (101011)_2$

$(57)_{10} = (111001)_2$

1's complement of $(111001)_2$ = 000110

Now, $(101011)_2 + (000110)_2$

$$\begin{array}{r} 101011 \\ 000110 \\ \hline 110001 \\ \hline \end{array}$$

Since, there is no carry generated ⇒ Result is negative

Taking 1's complement of $(110001)_2$ = $(001110)_2$ is the required solution = 14

∴ Required result ⇒ 14 in negative.

b) 8 - 10

$(8)_{10} = (1000)_2$
$(10)_{10} = (1010)_2$

1's complement of $(1010)_2$ = 0101

Now, $(1000)_2 + (0101)_2$

$$\begin{array}{r} 1000 \\ +\ 0101 \\ \hline 1101 \end{array}$$

Since, no carry is generated ⇒ Result is negative.

Taking 1's complement of $(1101)_2 = (0010)_2$, which is the required result = 2.

∴ Required result = 2 in negative.

c) 8.75 − 10.624

$(8.75)_{10} = (1000.11)_2$

$(10.624)_{10} = (1010.100111)_2$

$(1010.100111)_2$ one's complement ⇒ $(0101.011000)_2$

Now, $(1000.11)_2 + (0101.011000)_2$

$$\begin{array}{r} 1000.110000 \\ +\ 0101.011000 \\ \hline 1110.001000 \end{array}$$

Since, there is no carry ⇒ Result is negative.

Taking 1's complement of $(1110.001000)_2 = (0001.110111)_2$ which is the required result = 1.874

∴ Required result = 1.874 in negative.

d) $11.125 - 16.875$

$(11.125)_{10} = (1011.001)_2$

$(16.875)_{10} = (10000.111)_2$

One's complement of $(10000.111)_2 = (01111.000)_2$

Now, $(1011.001)_2 + (01111,000)_2$

$$
\begin{array}{r}
01011.001 \\
+\ 01111.000 \\
\hline
11010.001 \\
\hline
\end{array}
$$

Since, there is no carry ⇒ result is negative

Taking 1's complement of $(11010.001)_2 = (00101.110)_2$

∴ Required solution ⇒ $(00101.110)_2 = 5.75$ in negative.

Q-9

a) 1010, 2's complement ⇒

$$
\begin{array}{r}
0101 \\
+\ \ \ \ 1 \\
\hline
0110 \\
\hline
\end{array}
$$

∴ 2's complement ⇒ 0110.

b) 1111, 2's complement ⇒

$$
\begin{array}{r}
0000 \\
+\ \ \ \ 1 \\
\hline
0001 \\
\hline
\end{array}
$$

∴ 2's complement ⇒ 0001.

c) 11.01, 2's complement $= 00.10$

$$\begin{array}{r} 00.10 \\ +\quad\ \ 1 \\ \hline 00.11 \end{array}$$

$\therefore$ 2's complement $= 00.11$

Q-11

a) $7-22$

$(7)_{10} = (111)_2$

$(22)_{10} = (10110)_2$

2's complement of $(10110)_2 = 01001$

$$\begin{array}{r} 01001 \\ +\quad\ \ 1 \\ \hline 01010 \end{array}$$

Now $(111)_2 + (01010)_2 \Rightarrow$

$$\begin{array}{r} 00111 \\ +\,01010 \\ \hline 10001 \end{array}$$

Since, there is no carry, hence the result is negative.

2's complement of $(10001)_2 = (01110)$

$$\begin{array}{r} 01110 \\ 1 \\ \hline 01111 \end{array}$$

$\therefore$ Required result $= (01111)_2 = 15$ in negative.

6) 13 − 27

$(13)_{10} = (1101)_2$

$(27)_{10} = (11011)_2$

2's complement of $(11011)_2 \Rightarrow (00100)_2$

$$\begin{array}{r} 00100 \\ +\quad\;\; 1 \\ \hline 00101 \end{array}$$

Now, $(1101)_2 + (00101)_2$

$$\begin{array}{r} 0\,1\,1\,0\,1 \\ 0\,0\,1\,0\,1 \\ \hline 1\,0\,0\,1\,0 \end{array}$$

Since, there is no carry ⇒ result is negative.

2's complement of $(10010)_2 = (01101)$

$$\begin{array}{r} 01101 \\ +\quad\;\; 1 \\ \hline 1110 \end{array}$$

∴ Required result ⇒ $(1110)_2$ = 14 in negative.

c) 10 − 28

$(10)_{10} = (1010)_2$

$(28)_{10} = (11100)_2$

2's complement of $(11100)_2$ =

$$\begin{array}{r} 00011 \\ +\quad 1 \\ \hline 00100 \end{array}$$

Now, $(1010)_2 + (00100)_2$

$$\begin{array}{r} 01010 \\ +\ 00100 \\ \hline 01110 \end{array}$$

Since, there is no carry, ⇒ result is negative.

2's complement of $(01110)_2$ ⇒

$$\begin{array}{r} 10001 \\ +\quad 1 \\ \hline 10010 \end{array}$$

∴ Required result = $(10010)_2$ = 18 in negative.

d) $16.5 - 24.75$

$(16.5)_{10} = (10000.1)_2$

$(24.75)_{10} = (11000.11)_2$

2's complement of $(11000.11)_2 = 00111.00$
$+ \qquad 1$
00111.01

Now, $(10000.1)_2 + (00111.01)_2 \Rightarrow$

$$\begin{array}{r} 10000.10 \\ 00111.01 \\ \hline 10111.11 \end{array}$$

Since, there is no carry, $\Rightarrow$ result is negative.

2's complement of $(10111.11)_2 = 01000.00$
$+ \qquad 1$
01000.01

$\therefore$ Required result $\Rightarrow (01000.01)_2 = 8.25$ in negative.

Q-12

a) $(1011)_2$

Ex-3 $\Rightarrow$

$$\begin{array}{r} 1011 \\ 0011 \\ \hline 1110 \end{array}$$

$\therefore$ Required Ex-3 code = $(1110)_{Ex-3}$

b) $(436)_8$

$(436)_8 = (280)_{10}$

$$\begin{array}{ccc} 2 & 8 & 0 \\ +3 & +3 & +3 \\ \hline 5 & 11 & 3 \\ \hline 0101 & 1011 & 0011 \end{array}$$

$\therefore$ EX-3 code $\Rightarrow$ $(0101\ 1011\ 0011)_{Ex-3}$

c) $(3A)_{16}$

$(3A)_{16} = (58)_{10}$

$$\begin{array}{cc} 5 & 8 \\ +3 & +3 \\ \hline 8 & 11 \\ \hline 1000 & 1011 \end{array}$$

$\therefore$ Ex-3 code $\Rightarrow$ $(1000\ 1011)_{Ex-3}$

d) $(1100.011)_2$

$(1100.011)_2 = 12.375$

1	2	.	3	7	5
+3	+3		+3	+3	+3
4	5		6	10	8
0100	0101		0110	1010	1000

$\therefore$ Ex-3 code $\Rightarrow (0100\,0101\,0110\,1010\,1000)_{EX-3}$

Q-13

a) 46 + 33

$(46)_{10} \Rightarrow$

4	6
+3	+3
7	9
0111	1001

$(46)_{10} = (0111\,1001)_{Ex-3}$

$(33)_{10} \Rightarrow$

3	3
+3	+3
6	6
0110	0110

$(33)_{10} = (01100110)_{EX-3}$

Adding ⇒

$$\begin{array}{r} 0111 \\ 0110 \\ \hline 1101 \end{array} \qquad \begin{array}{r} 1001 \\ 0110 \\ \hline 1111 \end{array}$$

Now subtracting Ex-3 ⇒

$$\begin{array}{r} 1101 \\ 0011 \\ \hline 1010 \end{array} \qquad \begin{array}{r} 1111 \\ 0011 \\ \hline 1100 \end{array}$$

∴ Required EX-3 code ⇒ $(10101100)_{EX-3}$

b) 72.6 + 15.2

$(72.6)_{10}$ ⇒

$$\begin{array}{ccc} 7 & 2 & .\ 6 \\ +3 & +3 & +3 \\ \hline 10 & 5 & 9 \\ 1010 & 0101 & 1001 \end{array}$$

$(72.6)_{10} = (10100101.1001)_{EX-3}$

$(15.2)_{10}$ ⇒

$$\begin{array}{ccc} 1 & 5 & .\ 2 \\ +3 & +3 & +3 \\ \hline 4 & 8 & 5 \\ 0100 & 1000 & 0101 \end{array}$$

$(15.2)_{10} = (01001000.0101)_{EX-3}$

Adding ⇒

$$\begin{array}{ccc} 1010 & 0101 & 1001 \\ 0100 & 1000 & 0101 \\ \hline 1110 & 1101 & 1101 \end{array}$$

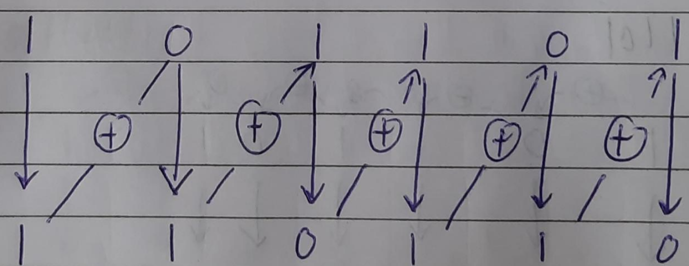
Now, subtracting EX-3 ⇒

$$\begin{array}{ccc} 1110 & 1101 & 1101 \\ 0011 & 0011 & 0011 \\ \hline 1011 & 1010 & 1010 \end{array}$$

∴ Required EX-3 code ⇒ $(1011\,1010.1010)_{EX-3}$

Q-14

a) 101101



∴ Required binary equivalent ⇒ $(110110)_2$

b) 10101111

1 0 1 0 1 1 1 1

1 1 0 0 1 0 1 0

∴ Required binary equivalent ⇒ $(11001010)_2$

c) 101011

1 0 1 0 1 1

1 1 0 0 1 0

∴ Required binary equivalent ⇒ $(110010)_2$

Q-15

a) 101101

1 0 1 1 0 1

1 1 1 0 1 1

∴ Required gray code = $(111011)_{gray}$

b) 10101111

⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕

1 0 1 0 1 1 1 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 1 1 1 1 0 0 0

∴ Required gray code = $(11111000)_{gray}$

c) 101011

⊕ ⊕ ⊕ ⊕ ⊕

1 0 1 0 1 1

↓ ↓ ↓ ↓ ↓ ↓

1 1 1 1 1 0

∴ Required gray code = $(111110)_{gray}$

Q-16

a) 11011001

⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕

1 1 0 1 1 0 0 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 0 1 1 0 1 0 1

∴ Required gray code = $(10110101)_{gray}$

b) 111 010 1111

1 1 1 0 1 0 1 1 1 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 0 0 1 1 1 1 0 0 0

∴ Required gray code ⇒ $(1001111000)_{gray}$

c) 10 11 0111111

1 0 1 1 0 1 1 1 1 1 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 1 1 0 1 1 0 0 0 0 0

∴ Required gray code ⇒ $(11101100000)_{gray}$

Q-18 The weighted code are those that obey the position weighting principle, which states that the position of each number represent a specific weight. In weighted codes, each digit is assigned a specific weight according to its position.

The non-weighted code are not positionally weighted. In other words, codes that are not assigned with any weight to each digit position.

Q-19 Complements are used in the digital computers in order to simplify the subtraction operation and for the logical manipulations. For each radix-r system (radix r represents base of number system) there are two types of complements.

1) Radix Complement → The radix complement is referred to as the r's complement.

2) Diminished Radix Complement → The diminished radix complement is referred to as the (r-1)'s complement.

Q-20 Alphanumeric codes, also called character codes, are binary codes used to represent alphanumeric data. The codes write alphanumeric data, including letters of the alphabet, numbers, mathematical symbols and punctuation marks, in a form that is understandable and processable by a computer. Using these codes, we can interface input-output devices such as keyboards, monitors, printers etc. with computer.