Question # 01:-

Convert the following numbers

a) 1 0 0 1 0 1 0 1 1 1 0 1 to decimal.

$= (1\times2^{11}) + (0\times2^{10}) + (0\times2^{9}) + (1\times2^{8}) + (0\times2^{7}) + (1\times2^{6})$
$+ (0\times2^{5}) + (1\times2^{4}) + (1\times2^{3}) + (1\times2^{2}) + (0\times2^{1}) + (1\times2^{0})$

$= 2048 + 256 + 64 + 16 + 8 + 4 + 1$

$=$ **2397D** Ans

b) FAE2Ch to decimal.

$= (15\times16^{4}) + (10\times16^{3}) + (14\times16^{2})$
$+ (2\times16^{1}) + (12\times16^{0})$.

∴ F = 15
A = 10
E = 14
C = 12

$= 983040 + 40960 + 3584 + 32 + 12$

$=$ **1027628D** Ans

c) 6120 to hex

16	6120	
16	382	8 ↑
16	23	E
16	1	7
	0	1.

$=$ **17E8h** Ans

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d) 1001011 to hex.

0100, 1011

4 11 (B)

= 4Bh. Ans

0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A 10	1	0	1	0
B 11	1	0	1	1
C 12	1	1	0	0
D 13	1	1	0	1
E 14	1	1	1	0
F 15	1	1	1	1

e) B34Dh to binary

B 3 4 D

1011 0011 0100 1101

= 1011001101001101

Question # 02:-

Perform the following additions / subtractions.

a) 100101b + 10111b

```
    1 1 1
  1 0 0 1 0 1 b
+   1 0 1 1 1 b
-------------
  1 1 1 1 0 0 b
```

= 111100b. Ans

b) B23Dh + 17912h

$$\begin{array}{r} B\ 2\ 3\ C\ Dh \\ +\ 1\ 7\ 9\ 1\ 2h \\ \hline C\ 9\ C\ D\ F \end{array}$$

= C9CDFh Ans

c) 11011b − 10110b.

$$\begin{array}{r} {}^{0}\ {}^{b} \\ 1\ \not{1}\ 0\ 1\ 1\ b \\ -\ 1\ 0\ 1\ 1\ 0b \\ \hline 0\ 0\ 1\ 0\ 1\ b \end{array}$$

= 00101b Ans

d) F001Eh − 1FF3Fh.

$$\begin{array}{r} {}^{15}\ {}^{15}\ {}^{16}\ \ {}^{16} \\ F\ 0\ 0\ 1\ E\ h \\ -\ 1\ F\ F\ 3\ F\ h \\ \hline D\ 0\ 0\ D\ Fh \end{array}$$

16
+14
30
−15
15

= D00DFh Ans

Question # 03:-

Do the following binary and hex subtractions by two's complement addition.

a) ~~100~~ 10110100 - 10010111.

First we will take the one's complement of the second number (10010111).

1 0 0 1 0 1 1 1

0 1 1 0 1 0 0 0 → one's complement

In order to get the two's complement simply add 1 in one's complement.

```
  0 1 1 0 1 0 0 0 b
+               1 b
-----------------------
  0 1 1 0 1 0 0 1 → two's complemer
```

Now add first number (10110100) and two's complement of second number (01101001).

```
    1 1
  1 1 0 1 1 0 1 0 0 b
+   0 1 1 0 1 0 0 1 b
-----------------------
  1 0 0 0 1 1 0 1 b.
```

As the answer is in 9 bit we will simply neglect the most significant Bit.

00011101b Ans

b) 10001011 - 11110111

one's complement of 11110111

= 00001000 -> one's complement

Add 1

= 00001000b

+ 1b

00001001b -> two's compleme

Add First number and two's complement of second number.

$$\begin{array}{r} {\scriptstyle 1\ \ \ 1\ 1} \\ 10001011b \\ +\ 00001001b \\ \hline 10010100b \end{array}$$

As there is no carry over the most significant bit we will take the two's complemer of the answer. and put negative sig

= ~~10010100b~~

First take one's complement of 10010100b.

= 01100100

now add 1 to get two's complement.

$$\begin{array}{r} 01100100 \\ +\ \ \ \ \ 1 \\ \hline 01100101 \end{array}$$

= -01100101 Ans

c) FEOFh - 12ABh.

convert these numbers into binary.

F E O F → 1111

F → 1111, E → 1110, O → 0000

1 2 A B → 0001 0010 1010 1011

Take one's complement of 12AB.

0001001010101011 b

1110110101010100 b.

↓

one's complement.

For two's complement add 1.

```
  1 1 1 0 1 1 0 1 0 1 0 1 0 1 0 0 b.
+                               1 b
-------------------------------------
  1 1 1 0 1 1 0 1 0 1 0 1 0 1 0 1 b
```

↓

two's complement.

Now add FEOFh and two's complement of 12ABh

```
    1 1 1 1   1 1 1 0   0 0 0 0   1 1 1 1 b
+   1 1 1 0   1 1 0 1   0 1 0 1   0 1 0 1 b
-----------------------------------------
  1 1 1 1 0   1 0 1 1   0 1 1 0   0 1 0 0
```

Most significant Bit will be neglected.

= 1110 1011 0110 0100

convert into hex.

E B 6 4 h.

= **EB64h**

d) 1ABCh − B3EAh.

1	A	B	C
0001	1010	1011	1100

B	3	E	A
011	0011	1110	1010.

Take one's complement of B3EAh.

1011 0011 1110 1010

0100 1100 0001 0101.

↗ one's complement.

Adding 1

0100 1100 0001 0101 b

\+ 1 b.

0100 1100 0001 0110

↗ two's complement

Adding 1ABCh and two's complement of B3E4h

0001	1010	1011	1100 b
+ 0100	1100	0001	0110 b
0110	0110	1101	0010 b.

Convert into hex. As there is no carry over the most significant bit, we will take the answer and take it's two complement

66D2h

0110 0110 1101 0010

Take one's complement first.

1001 1001 0010 1101.

Now add 1. to take two's complement.

1001	1001	0010	1101
+			1
1001	1001	0010	1110

Convert into hex and put negative sign.

-992E Ans