=> DLD Assignment 01 :-

Name :- Yash Raj
Roll-no :- 24K-0737

Question #1 :-

Convert $(1073)_{10}$ into binary number.

1073 ÷ 2 = 536.5 R = 1
536 ÷ 2 = 268 R = 0
268 ÷ 2 = 134 R = 0
134 ÷ 2 = 67 R = 0
67 ÷ 2 = 33.5 R = 1
33 ÷ 2 = 16.5 R = 1
16 ÷ 2 = 8 R = 0
8 ÷ 2 = 4 R = 0
4 ÷ 2 = 2 R = 0
2 ÷ 2 = 1 R = 0
1 ÷ 2 = 0.5 R = 1

$(1073)_{10} \rightarrow (10000110001)_2$ Ans

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Question #2:-

Convert $(81)_{10}$ to Binary:

Sol:-

$81 \div 2 = 40.5 \quad R = 1$
$40 \div 2 = 20 \quad R = 0$
$20 \div 2 = 10 \quad R = 0$
$10 \div 2 = 5 \quad R = 0$
$5 \div 2 = 2.5 \quad R = 1$
$2 \div 2 = 1 \quad R = 0$
$1 \div 2 = 0.5 \quad R = 1$

$(81)_{10} \rightarrow (1010001)_2$ Ans.

Question #3:-

Convert decimal 27.315 to Binary

$27 \div 2 = 13.5 \quad R = 1$
$13 \div 2 = 6.5 \quad R = 1$
$6 \div 2 = 3 \quad R = 0$
$3 \div 2 = 1.5 \quad R = 1$
$1 \div 2 = 0.5 \quad R = 1$

$0.315 \times 2 = 0.63 \quad R = 0$
$0.63 \times 2 = 1.26 \quad R = 1$
$0.26 \times 2 = 0.52 \quad R = 0$

$27.315 \rightarrow (11011.010)_2$ Ans.

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Question #4:-

(a) Add $11010_2 + 11100_2$

Sol:-

$$\begin{array}{r} 11010 \\ +\ 11100 \\ \hline 110110 \end{array}$$

(b) Add $101011_2 + 110101_2$

Sol:-

$$\begin{array}{r} 101011 \\ +\ 110101 \\ \hline 1100000 \end{array}$$

Question #5:-

perform → Subtraction:-

(a) $101110_2 - 100100_2$

Sol:-

$$\begin{array}{r} 101110 \\ -\ 100100 \\ \hline 001010 \end{array}$$

(b) $1001100_2 - 110_2$

$$\begin{array}{r} 1001100 \\ -\ 110 \\ \hline 1000110 \end{array}$$

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Question #6 :-

Hexadecimal (Base 16) to Octal (Base 8)

(i) $(FA25)_{16}$

$\frac{8}{7}$ OD:-

F = 1111

A = 1010

2 = 0010

5 = 0101

$(FA25)_{16}$ = 1111 1010 0010 0101

Group into 3 bit:

001 111 101 000 100 101

1 7 5 0 4 5

$(FA25)_{16} = (175045)_8$ Ans:-

(ii) $(F920)_{16}$

$\frac{8}{2}$ OD:-

F = 1111

9 = 1001

2 = 0010

0 = 0000

$(F920)_{16}$ = 1111 1001 0010 0000

Group into 3 bit:-

001 111 100 100 100 000

1 7 4 4 4 0

=> 174440 Ans

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(iii) $(1100)_{16}$

Sol.

1 : 0001
1 : 0001
0 : 0000
a : 0000

$(1100)_{16}$: 0001 0001 0000 0000

Group into 3-bit

~~000 001 000 100 000 000~~

000 100 010 000 000 000

$(1100)_{16}$: 042000

$(1100)_{16}$: $(42000)_{8}$

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Question #7:-

Convert Octal to Hexadecimal.

(a) $(777)_8$.

Sol:

7 = 111

7 = 111

7 = 111

$(777)_8 \rightarrow (111\ 111\ 111)_2$.

0001 1111 1111

0001 = 1

1111 = F

1111 = F

$(777)_8 \rightarrow (1FF)_{16}$ Ans.

(b) $(23)_8$

Sol:

1 = 001

2 = 010

3 = 011.

001 010 011

0000 0101 0011

0000 = 0

0101 = A

0011 = 7

$(23)_8 \rightarrow (0A7)_{16}$ Ans.

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(iii) $(635)_8$

Sol:

6 : 110

3 : 011

5 : 101

$(635)_8 \rightarrow (110\ 011\ 101)_2$

110 011 101

1 : 0001

9 : 1001

D : 1101

$(635)_8 \rightarrow (19D)_{16}$

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Question #8:

Express each decimal number as an 8-bit sign magnitude number.

(a) -83

Sol:

83 ÷ 2 = 41.5 R=1
41 ÷ 2 = 20.5 R=1
20 ÷ 2 = 10 R=0
10 ÷ 2 = 5 R=0
5 ÷ 2 = 2.5 R=1
2 ÷ 2 = 1 R=0
1 ÷ 2 = 0.5 R=1

-83 => 11010011 Ans

(b) 101

Sol:

101 ÷ 2 = 50.5 R=1
50 ÷ 2 = 25 R=0
25 ÷ 2 = 12.5 R=1
12 ÷ 6 = 6 R=0
6 ÷ 2 = 3 R=0
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

+101 = 01100101 Ans

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(c) -114

Sol:-

114 ÷ 2 = 57 R=0
57 ÷ 2 = 28.5 R=1
28 ÷ 2 = 14 R=0
14 ÷ 2 = 7 R=0
7 ÷ 2 = 3.5 R=1
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

114 = 01110010
-114 = 11110010 Ans.

Question #9:- Convert decimal to 8-bit number in 1's Complement

(a) -66

Sol:-

66 ÷ 2 = 33 R=0
33 ÷ 2 = 16.5 R=1
16 ÷ 2 = 8 R=0
8 ÷ 2 = 4 R=0
4 ÷ 2 = 2 R=0
2 ÷ 2 = 1 R=0
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

66 = 01000010 ⇒ 10111101 Ans.
-66 = 11000010
1's Complement ⇒ 00111101 Ans

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(b) +116

Sol:

116 ÷ 2 = 58 R=0
58 ÷ 2 = 29 R=0
29 ÷ 2 = 14.5 R=1
14 ÷ 2 = 7 R=0
7 ÷ 2 = 3.5 R=1
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

+116 = 01110100
1's Complement = 10001011 Ans

(c) -99

Sol:

-99
99 ÷ 2 = 49.5 R=1
49 ÷ 2 = 24.5 R=1
24 ÷ 2 = 12 R=0
12 ÷ 2 = 6 R=0
6 ÷ 2 = 3 R=0
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

99 = 01100011 ⇒ 10011100 Ans
-99 = 11100011
1's = 00011100 Ans

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Question #10: Convert given number in 8-bit number as in the 2's complement form

(a) -59

Sol:-

59 ÷ 2 = 29.5 R=1
29 ÷ 2 = 14.5 R=1
14 ÷ 2 = 7 R=0
7 ÷ 2 = 3.5 R=1
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

59: 00111011
~~-59: 1000~~
~~-59: 11100100~~
~~2's: 11000101 Ans~~
1's: 11000100
2's 11000101 Ans.

1's: 10000100
+1
11000101 Ans

(b) +102

Sol:-

102 ÷ 2 = 51 R=0
51 ÷ 2 = 25.5 R=1
25 ÷ 2 = 12.5 R=1
12 ÷ 2 = 6 R=0
6 ÷ 2 = 3 R=0
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0
+102: 01100110
2's complement => 10011010 Ans

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(c) -126

Sol:-

126 ÷ 2 = 63 R=0
63 ÷ 2 = 31.5 R=1
31 ÷ 2 = 15.5 R=1
15 ÷ 2 = 7.5 R=1
7 ÷ 2 = 3.5 R=1
3 ÷ 2 = 1.5 R=1
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

126 = 01111110
~~126 = 11111110~~
~~2's = 00000010~~

1's = 10000001
2's = 10000010

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Question #11: Determine decimal value.

(a) 10011101

SOL:-

1 0 0 1 1 1 0 1

-ve: 64 32 16 8 4 2 1

$(10011101)_2 = (-29)_{10}$ Ans.

(b) 01110100

SOL:

0 1 1 1 0 1 0 0

64 + 32 + 16 8 4 2 1

= 64+32+16+4

$(01110100)_2 = (+116)_{10}$ Ans.

(c) 10111011

SOL:

1 0 1 1 1 0 1 1

64 32 16 8 4 2 1

= 32+16+8+2+1

$(10111011)_2 = (-58)_{10}$ Ans.

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Question #2: Determine the decimal value from 1's complement:

(a) 10111001

1's = 10111001

Original = 01000110

64+

(b) 01100100

1's = 01100100

Original = 10011011

-ve 128 64 32 16 8 4 2 1

16+8+2+1 => -27 Ans.

(c) 10111101

1's = 10111101

Original = 01000010

64 32 16 8 4 2 1

= 64+2

= +66 Ans

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Question #13:-

8 bit two's complement is given. Extract original number.

(i) $(10101100)_2$

SOL:-

2's comp of 10101100

Invert bits.

01010011

Add 1

01010011
+ 1

01010100

01010100
64 32 16 8 4 2 1

64+16+4 => 84 Ans

(ii) $(01111001)_2$

SOL.

2's => 01111001
64 32 16 8 4 2 1

=> 64+32+16+8+1.

=> 121 Ans

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(c) 11110000

8 bit

2's Compliment : 11110000

Invert all values:

00001111

+1

00010000

16 8 4 2 1

=) 16 Dec.

16

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Question #14:

Addel ~~after~~ carry 2's Complement form

(a) -38 and -27

Sol:-

38 → 00100110

27 → 00011011

38 → two's Complement :) 11011010

27 → two's Complement :) 11100101

```
  11011010
+ 11100101
 1:10111111
```

```
  11111
  01111111
+ 00000001
  10000000
```

10111111 → 01000000

+1

01000001

:) 01000001 = -65 Ans.

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(b) 59 & -39.

Sol:-

59 : 00111011

39 00100111

39 → two's Complement => 11011001

00111011
+11011001
1;00010100

=) 00010100 is 20 in decimal. Ans

(c) -58 & 65

Sol:-

58 : 00111010

65 : 01000001

58 two's complement : 11000110

11000110
+01000001
100000111

00000111 (7 in decimal) Ans

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(d) -102 & -85

Sol:-

102: 01100110
85: 01010101

Sol:-

-102 two's Complement =) 10011010
-85 two's Complement =) 10101011

∴ (i)

$$\begin{array}{r} 10011010 \\ +\ 10101011 \\ \hline 101000101 \end{array}$$

01000101 → 10111010
+1
10111011

=) -187 Ans.

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Question #15:

What is Binary Coded Decimal (BCD) & how does it differ from regular binary representation.

Ans: Binary Coded Decimal (BCD) is a way of encoding decimal number in binary form.

- In BCD, each digit of a decimal number is represented by its 4-bit binary equivalent.

Ex:

5 is represented as 0101 in BCD

=) Difference:

Definition:

BCD encodes each decimal digit separately in binary whereas regular binary representation represents the entire number as single binary value.

Format:

In BCD each decimal digit (0-9) is represented by a 4-bit binary equivalent.

Whereas

In Regular Binary each position is a power of 2

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Storage efficiency:-
Less-Efficient → BCD
More-Efficient → Regular Binary Representation.

Common uses:-
BCD is used in digital clocks, calculators & financial applications.
Whereas
Regular Binary representation is used in general computing.

Question #16:-
Applications of BCD:-

(i) Digital Displays
(ii) Financial System
(iii) Calculators
(iv) Electronic Measurement Instruments
(v) Automotive System
(vi) Industrial Control System
(vii) Communication protocols

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Question #17:

Convert decimal to BCD.

(i) 57

Sol:-

5 ÷ 2 = 2 R=1
2 ÷ 2 = 1 R=0
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

7 ÷ 2 = 3.5 R=1
3 ÷ 2 = 1.5 R=0
1 ÷ 2 = 0.5 R=1
0 ÷ 2 = 0 R=0

57 = 1010 0100 Ans

(ii) 109

Sol:

1 = 0001
0 = 0000
9 ÷ 2 = 4.5 = R=1
4 ÷ 2 = 2 = R=0
2 ÷ 2 = 1 = R=0
1 ÷ 2 = 0.5 R=1

109 = 0001 0000 1001 Ans

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Question #18:- Add numbers after conversion into BCD

(a) 7+9

8421

7: 0111

9: 1001

0111
+1001
10000 : Ans.

(b) 25 + 58

2: 0010

5: 0101

5: 0101

8: 1000

25 : 0010 0101
+ 0101 1000
0111 1101

0111 1101
+0000 0000
0000 0001

=> 1000 0011 (83 in decimal) Ans

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(c) 76+84

Sol:-

76 → 0111 0110

84 → 1000 0100

```
  0111 0110
+ 1000 0100
  1111 1010
```

```
  1111 1010
+ 0000 0110
  0000 0000  (carry 1)
```

0001 0110 0000 (160) Ans.

(d) 89+68

89 → 1000 1001

68 → 0110 1000

```
  1000 1001
+ 0110 1000
  1111 0001
```

```
  1111 0001
+ 0000 0110
  0001 0101 0111
```

157 = 0001 0101 0111 Ans

add 1 to make it odd parity.

= 1000111001011 Ans.

Question #19:-

Identify which of the following even parity are in error.

(a) 110011001

Sol:-

= 110011001

1+1+0+0+1+1+0+0+1 = 5.

→ The number of 1 is 5 (odd)

→ The code is in error.

(b) 1011111101000101

Sol:-

= 1011111101000101 = 10

= 1+0+1+1+1+1+1+1+0+1+0+0+0+1+0+1

= The number of 1 is 10 (even).

= The code is not in error.

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(c) 01010110

Sol:-

01010110

0+1+0+1+0+1+1+0 = 5

- The number of 1 is 5 (odd)
- The code is in error.

(d) 01110001001011 01

Sol:-

01110001001011 01

0+1+1+1+0+0+0+1+0+0+1+0+1+1+0+1 = 8

- The number of 1 is 8 (even)
- The code is not in error.

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Question No:-

Assign proper parity (odd parity) to the following each groups:-

(a) 0110

Sol:-

0110

number of 1's is 2 (even)

add 1 to make it odd parity.

01101 Ans.

(b) 101101

Sol:-

101101

number of 1's is 4 (even)

add 1 to make it odd parity.

1011011 Ans.

(c) 101101011111

Sol:-

101101011111

number of 1 is 9

add 0 because its already odd parity.

1011010111110 Ans.

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(d) 10001110010 1

$\frac{8}{2}$

10001110010 1

number of 1 s 6 (even)

add 1 to make it odd parity.

= 100011100101 1 Ans.