DLD ASSIGNMENT 1

Q1) Convert $(1073)_{10}$ into a binary number

2	1073
2	536 - 1
2	268 - 0
2	134 - 0
2	67 - 0
2	33 - 1
2	16 - 1
2	8 - 0
2	4 - 0
2	2 - 0
	1 - 0

$(1073)_{10} \Rightarrow (10000110001)_2$

Q2) Convert $(81)_{10}$ to Binary:-

2	81
2	40 → 1
2	20 → 0
2	10 → 0
2	5 → 0
2	2 → 1
	1 - 0

$(81)_{10} \Rightarrow (1010001)_2$

Q3) Convert Decimal 27.315 to a Binary.

~~27 → 11011~~

2 | 27
2 | 13 - 1
2 | 6 - 1
2 | 3 - 0
1 - 1

27.315 → $(11011.0101)_2$

0.315 × 2 → 0.63 × 2 → 1.26

0.26 × 2 → 0.52 × 2 → 1.04

Q4) a) $(11010)_2 + (11100)_2$

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

b) $(101011)_2 + (110101)_2$

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

Q5) a) $(101110)_2 - (100100)_2$

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

b) $(1001100)_2 - (110)_2$

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

Q6) Convert Hexadecimal to octal

a) $(FA25)_{16}$

F A 2 5

1111101000100101

1 8 7 5 0 4 5

$(FA25)_{16} \Rightarrow (175045)_8$

b) $(F920)_{16}$

F 9 2 0

1111 1001 0010 0000

1 7 4 4 4 0

$(F920)_{16} \Rightarrow (174440)_8$

c) $(1100)_{16}$

1 1 0 0

0001 0001 0000 0000

0 1 0 4 0 0

$(1100)_{16} \Rightarrow (10400)_8$

Q7) Convert octal to Hexadecimal:-

a) $(777)_8$

7 7 7

111 111 111

1 F F

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

b) $(123)_8$

1 2 3

001 010 011

0101

0 ~~0010~~ 0011

0 5 ~~23~~ 3

053

$(123)_8 \Rightarrow (\cancel{23})_{16}$

c) $(635)_8$

6 3 5

110 011 101

1 1001 1101

1 9 D

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

08) Express each decimal number in Binary as 8-bit sign-magnitude number:-

a) -83

2	83
2	41 - 1
2	20 - 1
2	10 - 0
2	5 - 0
2	2 - 1
	1 - 0

$(1010011) \Rightarrow 83$

$(11010011) \Rightarrow -83$

b) +101

2	101
2	50 - 1
2	25 - 0
2	12 - 1
2	6 - 0
2	3 - 0
	1 - 1

$(1100101) \Rightarrow 101$

$(01100101) \Rightarrow +101$

c) -114

2	114
2	57 -> 0
2	28 -> 1
2	14 -> 0
2	7 -> 0
2	3 -> 1
	1 -> 1

(1110010) => 114

(1 1110010) => -114

Q9) Express each decimal as an 8bit number in the 1's complement form.

a) -66

2	66
2	33 -> 0
2	16 - 1
2	8 - 0
2	4 - 0
2	2 - 0
	1 - 0

(01000010) => 66

1st complement

(10111101) => -66

b) +102

2	102
2	51 - 0
2	25 - 1
2	12 - 1
2	6 - 0
2	3 - 0
	1 - 1

(1100110) => 102

(01100110) => +102

c) -99

2	99
2	49 - 1
2	24 - 1
2	12 - 0
2	6 - 0
2	3 - 0
	1 - ~~0~~ 1

(01100011) => 99

(10011100) => -99

Q10) Express each decimal as an 8-bit number in 2's complement form.

a) -59

2	59	
2	29	- 1
2	14	- 1
2	7	- 0
2	3	- 1
	1	- 1

(0111011) => 59

1000100

+1

(1000101) => -59

ans

b) +102

2	102	
2	51	- 0
2	25	- 1
2	12	- 1
2	6	- 0
2	3	- 0
	1	- 1

$(01100110)_2$ => +102

ans.

c) -126

2	126
2	63 - 0
2	31 - 1
2	15 - 1
2	7 - 1
2	3 - 1
	1 - 1

(01111110) => 126

10000001

+1

(10000010) => -126

ans.

Q1) Determine Decimal value of each signed binary number in the sign-magnitude form.

a) 10011101

16 8 4 2 1

1 0011101

- 16+8+4+1 => $\boxed{-29}$ ans

b) 01110100

64 32 16 8 4 2 1

0 1110100

+ 64+32+16+4 => $\boxed{+116}$ ans.

c) 10111011

32 16 8 4 2 1

1 0111011

- 32+16+8+2+1 => -59

Q 12) Determine the decimal value of each signed binary number in the 1's complement form.

a) 10111001

-128 32 16 8 4 2 1
1 0 1 1 1 0 0 1

$-128 + 32 + 16 + 8 + \cancel{1} \Rightarrow -71 + 1$

$\Rightarrow \boxed{-70}$ ans.

b) 01100100

64 32 16 8 4 2 1
0 1 1 0 0 1 0 0

$64 + 32 + 4 \Rightarrow \boxed{100}$ ans.

c) 10111101

32 16 8 4 2 1
~~128~~ 1 0 1 1 1 1 0 1

$-128 + 32 + 16 + 8 + 4 + 1 \Rightarrow -6\cancel{8}7 + 1$

$\Rightarrow \cancel{-67}$

$\boxed{-66}$ ans

Q 13) A system uses 8 bit two's complement representation for signed numbers. What is the decimal equivalent of the following binary number?

a) 10101100

32 16 8 4 2 1
1 0 1 0 1 1 0 0

$-128 + 32 + 8 + 4 \Rightarrow \boxed{-84}$ ans

b) 0 1 1 1 1 0 0 1

64 32 16 8 1

0 1 1 1 1 0 0 1

$64+32+16+8+1 \Rightarrow \boxed{121}$ ans.

c) 1 1 1 1 0 0 0 0

-128 64 32 16

1 1 1 1 0 0 0 0

$-128+64+32+16 \Rightarrow \boxed{-16}$ → ans.

Q15) What is Binary Coded Decimal, and how does it differ from Regular Binary representation?

Ans) In BCD each decimal digit (0-9) is represented by its own group of binary bits, typically using 4 bits per digit this mean that the decimal number is broken up into its individual digits, and each digit is then converted to its 4 bit binary equivalent.

For example number 45 in BCD would be written as 0100 0101 whereas in regular binary the number 45 would be written as 101101. BCD makes reading of binary number easier for humans.

Q16) Analyze your Surroundings and think of applications of BCD where it is being used?

-> Digital clocks
-> watches
-> Calculators
-> Embedded Systems.

Q17) Convert decimal to BCD

a) 57

=> 01010111

b) 109

=> 000100001001

Q18) Add the numbers after conversion to BCD.

a) 7 + 9

```
   0111
 + 1001
 ------
  10000
 + 0110
 ------
0001 0110
  1    6
```

$\boxed{0001\ 0110}$ => ans.

b) 25 + 58.

```
   0010   0101
 + 0101   1000
 --------------
   0111   1101
        + 0110
 --------------
  1000   0011
    8      3
```

(1000 0011) ans.

c) 76 + 84

```
   0111   0110
 + 1000   0100
 --------------
   1111   1010
        + 0110
 --------------
  10000  0000
 + 0110
 --------------
  1 0110 0000
  1   6    0
```

(1 0110 0000) ans.

D) 89 + 68.

```
   1000   1001
   0110   1000
 --------------
   1111   0001
 + 0110   0110
 --------------
  1 0101  0111
  1   5    7
```

(1 0101 0111) ans

Q19) a) 110011001
∴ 5 ones, the even parity code is in error.

b) 1011111101000l010
10 ones; the even parity code is not in error.

c) 010101110
5 ones; the even parity code is in error.

d) 01110001001010l101
8 ones; the even parity code is not in error.

Q20) a) 0110
2 ones; need 1 more for odd
= 10110

b) 101101
4 ones; need 1 more for odd
= 1101101.

c) 010101110
5 ones; the even parity code is in error

d) 0111000100101101
8 ones; the even parity code not in error

Q14) a) -38 and -27

2	38
2	19 - 0
2	9 - 1
2	4 - 1
2	2 - 0
	1 - 0

2	27
2	13 - 1
2	6 - 1
2	3 - 0
	1 - 1

$00100110 \xrightarrow{1's} 11011001$

$\quad +1$

11011010

$00011011 \xrightarrow{1's} 11100100$

$\quad +1$

11100101

$\quad 11011010$

$+ \; 11100101$

$\cancel{1}\,10111111 \Rightarrow -65 \Rightarrow$ ans.

7) -102 and -85

2	102
2	51 - 0
2	25 - 1
2	12 - 1
2	6 - 0
2	3 - 0
	1 - 1

2	85
2	42 - 1
2	21 - 0
2	10 - 1
2	5 - 0
2	2 - 1
	1 - 0

01100110 -> 10011001
+1
10011010

01010101 -> 10101010
+1
10101011

 10011010
+10101011
~~1~~ 01000101 => overflow

c) -58 and 65

2	58
2	29 - 0
2	14 - 1
2	7 - 0
2	3 - 1
	1 - 1

2	65
2	32 1
2	16 0
2	8 0
2	4 0
2	2 0
	1 - 0

00111010 -> 11000101 01000001

+1

11000110

11000110
+01000001

X00000111 => 7 => ans

b) 59 and -39

2	59	
2	29	1
2	14	1
2	7	0
2	3	1
	1 – 1	

00111011

2	39	
2	19	1
2	9	1
2	4	1
2	2	0
	1 – 0	

00100111 → 11011000

+1

11011001

$$
\begin{array}{r}
00111011 \\
+\ 11011001 \\
\hline
\cancel{1}\,00010100
\end{array}
$$

= 20 ⇒ ans.