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Section:
BS(CS) - 2D

Subject:
Digital logics and Designs (DLD).

Question # 1

Decimal	Signed Magnitude Form	1's Complement	2's Complement
7	0111	0111	0111
6	0110	0110	0110
5	0101	0101	0101
4	0100	0100	0100
3	0011	0011	0011
2	0010	0010	0010
1	0001	0001	0001
0	0000	0000	0000
-0	1000	1111	-
-1	1001	1110	1111
-2	1010	1101	1110
-3	1011	1100	1101

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-4	1100	1011	1100
-5	1101	1010	1011
-6	1110	1001	1010
-7	1111	1000	1001
-8	–	–	1000

Question # 3.

$(86235.876)_{10} = (?)_{2}$

By Sum of weight:

86235.876

86235

$= 65536 + 20699$

$= 65536 + 16384 + 4315$

$= 65536 + 16384 + 4096 + 219$

$= 65536 + 16384 + 4096 + 128 + 91$

$= 65536 + 16384 + 4096 + 128 + 64 + 27$

$= 65536 + 16384 + 4096 + 128 + 64 + 16 + 11$

$= 65536 + 16384 + 4096 + 128 + 64 + 16 + 8 + 3$

$= 65536 + 16384 + 4096 + 128 + 64 + 16 + 8 + 2 + 1$

$2^{16} \quad 2^{14} \quad 2^{12} \quad 2^{7} \quad 2^{6}$

$= 65536 + 16384 + 4096 + 128 + 64 +$

$2^{4} \quad 2^{3} \quad 2^{1} \quad 2^{0}$

$16 + 8 + 2 + 1$

1010100001101101

$2^{0} = 1$ ✓

$2^{1} = 2$ ✓

$2^{2} = 4$

$2^{3} = 8$ ✓

$2^{4} = 16$ ✓

$2^{5} = 32$

$2^{6} = 64$ ✓

$2^{7} = 128$ ✓

$2^{8} = 256$

$2^{9} = 512$

$2^{10} = 1024$

$2^{11} = 2048$

$2^{12} = 4096$ ✓

$2^{13} = 8192$

$2^{14} = 16384$ ✓

$2^{15} = 32768$

$2^{16} = 65536$ ✓

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0.876

$= 0.5 + 0.376$

$= 0.5 + 0.25 + 0.126$

$= 0.5 + 0.25 + 0.125 + 0.001$

2^{-1} 2^{-2} 2^{-3} 0

$= 0.5 + 0.25 + 0.125 + 0.001$

$2^{-1} = 0.5$ ✓

$2^{-2} = 0.25$ ✓

$2^{-3} = 0.125$ ✓

$2^{-4} = 0.0625$

$2^{-5} = 0.03125$

0.11100

So,

$(1010|0000|1011|0111.11100)_2 = (86235.876)_{10}$.

By Reapeated division and multiplication method:

86235.876.

2	86235
2	43117 – 1
2	21558 – 1
2	10779 – 0
2	5389 – 1
2	2694 – 1
2	1347 – 0
2	673 – 1
	336 – 1

43117
2 | 86235
86234
1

21558
2 | 43117
43116
1

10779
2 | 21558
21558
0

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2	336
2	168 – 0
2	84 – 0
2	42 – 0
2	21 – 0
2	10 – 1
2	5 – 0
2	2 – 1
	1 – 0

$0.876 = 0.876 \times 2 = 1.752 - 1$

$0.752 \times 2 = 1.504 - 1$

$0.504 \times 2 = 1.008 - 1$

$0.008 \times 2 = 0.036 - 0$

$0.036 \times 2 = 0.072 - 0$

So,

$(101010000110111011.11100)_2$

Question # 4

-412.390625 to single-precision floating-point.

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412

2	412
2	206 – 0
2	103 – 0
2	51 – 1
2	25 – 1
2	12 – 1
2	6 – 0
2	3 – 0
	1 – 1

0.390625

$0.390625 \times 2 = 0.781250 - 0$
$0.78125 \times 2 = 1.56250 - 1$
$0.5625 \times 2 = 1.1250 - 1$
$0.125 \times 2 = 0.250 - 0$
$0.25 \times 2 = 0.5 - 0$
$0.5 \times 2 = 1.00 - 1$

$(412)_{10} = (11.00111100)_2$

$(0.390625)_{10} = (011001)_2$

11001100 . 011001

As it is a negative number so sign bit (S) is 1

Now we will write (11001100.011001) in scientific form, so

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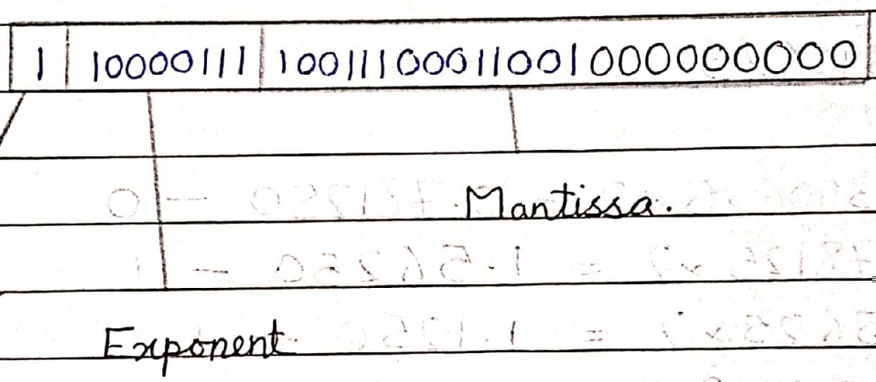
$$11001110 0.011001 = 1.\underbrace{10011100011001}_{\text{Mantissa}} \times 2^{8}$$

As the power is +8 so we will add 8 with 127, so.

$$127+8 = 135 = (\underbrace{10000111}_{\text{Exponent.}})_2.$$

Now.



Question # 2

$$(11011101 \cdot 1011)_2 = (?)$$

By sum of weights:

$$1\times 2^{8}+1\times 2^{7}+0\times 2^{6}+1\times 2^{5}+1\times 2^{4}+1\times 2^{3}+1\times 2^{2}+0\times 2^{1}+1\times 2^{0}+1\times 2^{-1}+0\times 2^{-2}+1\times 2^{-3}+1\times 2^{-4}$$

$$1\times 256+1\times 128+0+1\times 32+1\times 16+1\times 8+1\times 4+0+1+1\times 0.5+0+1\times 0.125+0.0625\times 1$$

$$256+128+32+16+8+4+1+0.5+0.125+0.0625$$

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445 + 0.6875

445.6875

We can not convert the binary number to decimal by reapeated division/ multiplication method as it is not possible.

Question # 5.

1101101101100010110011101010110111

S	E	M.
1	10110110	11000101100111010110111

As we know that

$(-1)^S (1.\text{Mantissa})(2^{\text{Exp. in decimal} - 127})$.

$(-1)^1 (1.11000101100111010110111)(2^{55})$

As the value of mantissa is very small so we will take some numbers i.e taking first six bits, so

7 6 5 4 3 2 1 0
2 2 2 2 2 2 2 2
1 0 1 1 0 1 1 0

128 + 32 + 16 + 4 + 2

182

182 - 127 = 55.

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$(-1)(1.110001)(2^{55})$

Now. calculating mantissa i.e.

mantissa = 110001

$= 1\times2^{-1} + 1\times2^{-2} + 0\times2^{-3} + 0\times2^{-4} + 0\times2^{-5} + 1\times2^{-6}$

$= 0.5 + 0.25 + 0 + 0 + 0 + 0.015625.$

$= 0.765625$

So now, put it in general formula i.e eq ①

$(-1)^1(1.765625)(2^{55})$ — ②

By solving the eq 2 we get.

$-6.36133474 \times 10^{16}$