COMP 273 Assignment

9/22

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1.1) $1101001_2 =$

$1(2^0) + 1(2^3) + 1(2^5) + 1(2^6) = 1 + 8 + 32 + 64 =$ $\boxed{105_{10}}$

105/16 = 6 R9
6/16 = 0 R6

$\boxed{69_{16}}$

1.2) $0.101101_2 =$

$1(2^{-1}) + 1(2^{-3}) + 1(2^{-4}) + 1(2^{-6}) = \frac{1}{2} + \frac{1}{8} + \frac{1}{16} + \frac{1}{64} = \boxed{\left(\frac{45}{64}\right)_{10}}$

$\frac{45}{64} \times 16 =$ B R $\frac{1}{4}$
$\frac{1}{4} \times 16 =$ 4 R 0

$\boxed{0.B4_{16}}$

1.3) $5.25_{10} =$

5 + 0.25
5/2 = 2 R1
2/2 = 1 R0
1/2 = 0 R1

$0.25 \times 2 = 0$ R 0.5
$0.5 \times 2 = 1$ R 0

$101 + .01 = \boxed{101.01_2}$

5/16 = 0 R5

$0.25 \times 16 = 4$ R 0

$\boxed{(5.4_{16})}$

1.4) $0xBEEF_{16} =$

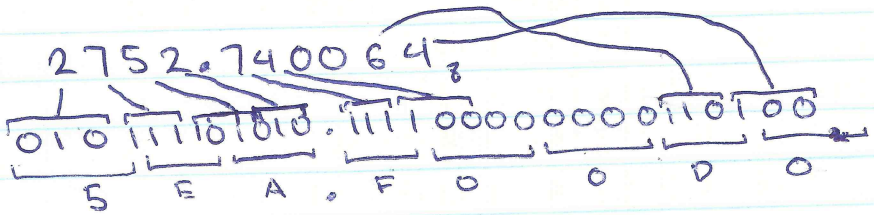
$15(16)^0 + 14(16) + 14(16^2) + 11(16^3) = \boxed{48879_{10}}$

48879 ÷2 = 24439 R1
÷2 = 12219 R1
÷2 = 6109 R1
3054 R1
1527 R0
763 R1
381 R1
190 R1

95 R0
47 R1
23 R1
11 R1
5 R1
2 R1
1 R0
0 R1

$\boxed{1011111011011111_2}$

1.5) 2752.740064_8



$010111101010.111100000000011010_2$ $SEA.FOOD_{16}$

1.6) convert 49278785_{10} to binary dividing by 2 and getting remainder

00111111000000000001000 1

negate by inverting digits and adding 1

$11000000111111111110111 1_2$

$C\ O\ F\ F\ E\ F_{16}$ (so close)

2.1) Convert to binary:

0.71828 × 2 = 1 R 0.43656
0.43656 × 2 = 0 R 0.87312
0.87312 × 2 = 1 R 0.74624
0.74624 × 2 = 1 R 0.49248
0.49248 × 2 = 0 R 0.98496
0.98496 × 2 = 1 R 0.96992
0.96992 × 2 = 1 R 0.93984
0.93984 × 2 = 1 R 0.87968
0.87968 × 2 = 1 R 0.75936
0.75936 × 2 = 1 R 0.51872
0.51872 × 2 = 1 R 0.03744

$(\times 2^4)$ 0 0 0 0 R 0.59904

0.59904 × 2 = 1 R 0.19808
0.19808 × 2 = 0 R 0.39616
0.39616 × 2 = 0 R 0.79232
0.79232 × 2 = 1 R 0.58464
0.58464 × 2 = 1 R 0.16928

0 0 1 :

THIS REPRESENTATION IS NOT EXACT

10.10110111111000010011001

= 1.0101101111110000100110 × 2^1 (one bit lost)

NORMALIZED

S bit = 0

E bit = 127 + 1 = 128 = 10000000

FINAL ANSWER:

01000000010110111111000010011010

in single precision floating point.

hexadecimal:

402DF84D

2.2) $10^{-12} = (2^x)^{-12}$

$x = \frac{\log 10}{\log 2} \approx 3.321928$

$\approx 2^{39.86313714}$

$1.0 \times 10^{-12} \approx 1.0 \times 2^{-39} \times 2^{-0.86313714}$

$\approx 0.5419755813388 \times 2^{-39}$ ← wrote a simple program to get this

Via same process in 2.1:

$0.10001100101111001100110 \times 2^{-39}$

$\rightarrow 1.00011001011110011001100 \times 2^{-40}$

S bit: 0

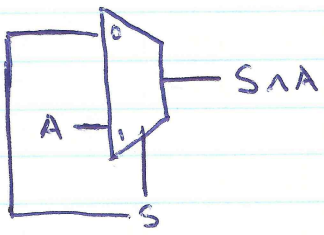
E bit: $-40 + 127 = 87 = 01010111_2$

Final answer: 00101011100011001011110011001100

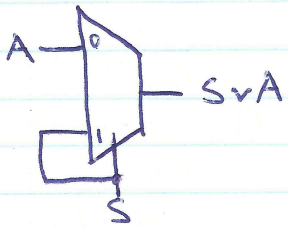
2B8CBCCC (hexadecimal)

3.1)

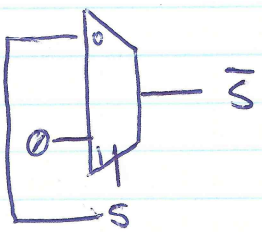
AND GATE:



OR GATE:



NOT GATE:



3.2)

a	b	c	d	$a \oplus b \oplus c \oplus d$
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

can be written only using [and] and [or] as:

$$(a\bar{b}\bar{c}\bar{d}) \vee (\bar{a}b\bar{c}\bar{d}) \vee (\bar{a}\bar{b}cd) \vee (\bar{a}\bar{b}\bar{c}d) \vee (abc\bar{d}) \vee (ab\bar{c}d) \vee (a\bar{b}cd) \vee (\bar{a}bcd)$$