Exercise Chapter 3
Arithmetic for Computer

EX 3-1

For 8 bits number, do 111 + 123

0110 1111 +

0111 1011

1110 1010 = 234

Ans : 11101010

For 8 bits number, do 111 - 123

0110 1111 -

0111 1011

1111 0100 = -12

Ans : 11110100

For 8 bits number, do 123 - 111

0111 1011-

0110 1111

0000 1100 = 12

Ans : 00001100

Multiply -5 x 25

STEP	Multipiler(A)	Multiplicant(B)	Product(C)
Initialize	0101	0001 1001	0000 0000
1: C=C+B			0001 1001
:Shift L(B)		0011 0010	
:Shift R(A)	0010		
2: No add			0001 1001
:Shift L(B)		0110 0100	
:Shift R(A)	0001		
3: C=C+B			0111 1101
:Shift L(B)		1100 1000	
:Shift R(A)	0000		
4: No add			0111 1101
:Shift L(B)		1001 0000	
:Shift R(A)	0000		
5:check sign			1000 0011
Final:			1000 0011

Ans : $-5_{10} \times 25_{10} = -125_{10}$

$0101_2 \times 00011001_2 = 01111101_2$

change sign = 10000011_2

Divide of 125 and -25

STEP	Divisor(A)	Remainder(B)	Quotient(C)
initialize	0110 0100	0111 1101	0000 0000
1:B = B – A		0001 1001	
:Shift L C			0000 0001
:shift R A	0011 0010		
2:B = B – A		0001 1001	
:Shift L C			0000 0010
:shift R A	0001 1001		
3:B = B – A		0000 0000	
:Shift L C			0000 0101
:shift R A	0000 1100		
4:check sign			1111 1011
final			1111 1011

Ans : 125_{10} / -25_{10} = -5_{10}

01100100_2 / 01111101_2 = 00000101_2

change sign = 11111011_2

Represent the encoding of IEEE 754 of 1.25_{10} in both float and double

From: $X = (-1)^s \times (1 + \text{Fraction}) \times 2^{\text{exponent} - \text{bias}}$

$1.25 = 125/100$

$= 5/4$

$= 5*2^{-2}$

$= 101_2 * 2^{-2}$

$= 101_2 * 2^{-2} * 2^{-2} * 2^2$

$= 1.01_2 * 2^0$

float:

$1.25 = (-1)^0 \times (1 + 0.01) * 2^{127 - 127}$

S	exponent	fraction
0	011 1111 1	010 0000 0000 0000 0000 0000

Ans : 00111111101000000000000000000000

double:

$1.25 = (-1)^0 \times (1 + 0.01) * 2^{1023 - 1023}$

S	exponent	Fraction
0	011 1111 1111	0100 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

Ans : 0011111111110100000000000000000000000000000000000000000000000000

Ex 3-2

Represent the encoding of IEEE 754 of -2.00_{10} in both float and double

From: $X = (-1)^s \times (1 + \text{Fraction}) \times 2^{\text{exponent} - \text{bias}}$

$-2.00 = -200/100$

$= -2/1$

$= -2*2^0$

$= -10_2 * 2^0$

$= -10_2 * 2^0 * 2^{-1} * 2^1$

$= -1.0_2 * 2^1$

float:

$-2.00 = (-1)^1 \times (1 + 0.0) * 2^{128 - 127}$

S	exponent	fraction
1	100 0000 0	000 0000 0000 0000 0000 0000

Ans : 11000000000000000000000000000000

double:

$-2.22 = (-1)^1 \times (1 + 0.0) * 2^{1024 - 1023}$

S	exponent	Fraction
1	100 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

Ans : 1100000000000000000000000000000000000000000000000000000000000000

Add 1.25 and -2.00

Float :

00111111101000000000000000000000 +
11000000000000000000000000000000

10111111101000000000000000000000 = -0.75

Ans : 10111111101000000000000000000000

Double :

0011111111110100000000000000000000000000000000000000000000000000 +
1100000000000000000000000000000000000000000000000000000000000000

1011111111110100000000000000000000000000000000000000000000000000 = -0.75

Ans : 1011111111110100000000000000000000000000000000000000000000000000

Ex 3-3

What is the ten base float of the number kept in IEEE standard below?

1	10000111	1011 0000 0000 0000 0000 0000

$X = (-1)^1 \times (1 + 0.1011) \times 2^{135 - 127}$

$X = -1 \times (1.1011) \times 2^8$

$X = -1 \times 1.1011 \times 2^8$

$X = -1 \times 1.1011 \times 2^8 \times 2^4 \times 2^{-4}$

$X = -1 \times 1011 \times 2^4$

$X = -1 \times 27 \times 16$

$X = -432$

Ans : -432

What is the ten base float of the number kept in IEEE standard below?

0	110 0000 1111	1011 1000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

$X = (-1)^0 \times (1 + 0.10111) \times 2^{1551 - 1023}$

$X = 1 \times (1.10111) \times 2^{528}$

$X = 1 \times 1.10111 \times 2^{528}$

$X = 1 \times 1.10111 \times 2^{528} \times 2^5 \times 2^{-5}$

$X = 1 \times 110111 \times 2^{523}$

$X = 1 \times 55 \times 2^{523}$

$X = 55 \times 2^{523}$

Ans : $1.51025549 \times 10^{159}$

What is the ten based number corresponding to

10011.101×2^{-2}

To ten based

$10011.101 \times 2^{-2} \times 2^3 \times 2^{-3} = 10011101 \times 2^{-5}$

$= 157 / 2^5$

$= 157 / 32$

$= 4.90625$

Ans : $10011.101 \times 2^{-2} = 4.90625$

What is the ten based number corresponding to

0.0010011×2^{-2}

To ten based

$$0.0010011 \times 2^{-2} \times 2^{7} \times 2^{-7} = 10011 \times 2^{-9}$$
$$= 19 / 2^{9}$$
$$= 19 / 512$$
$$= 0.037109375$$

Ans : $0.0010011 \times 2^{-2} = 0.037109375$

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