

Lab 1 ①

1) IEEE 745 SP

	0x40c80000	0xbcc4cccc	0x41233333	0xbdc00000
Sign Bit (0 or 1)	0	1	0	1
Sign (+/-)	+	-	+	-
Exponent bits (8-bit binary)	1000001	01111000	10000010	01111011
Real Exponent factor	2^2	2^{-7}	2^3	2^{-4}
Expressed in decimal unbiased				
Significant bits (23-bit binary, no hidden 1)	1001 0000 0000	1001 1000 1000	0100 0110 0110	0000 0000 0000
	<u>0000</u>	<u>1000</u>	<u>0110</u>	<u>0000</u>
Significant (Expressed as a decimal with a radix point, should be in [1,2])	1.5625	1.59999	1.27503	1.0

① 0x40c80000

binary: 01000000110010000000000000000000

$$10000001 = 129 - 127 = 2 \quad \therefore 2^2$$

$$2^{-1} 10010... = 2^{-1} + 2^{-4} = .5625$$

28
16
32
64
128

② 0xbcc4cccc

binary: 10111000100110011001100110011001

$$\text{Sign bit} = 1 \quad 0111000 = 120 - 127 = -7$$

$$100110011001100110011001 = 2^{-1} + 2^{-4} + 2^{-5} + 2^{-8} + 2^{-9} + 2^{-12} + 2^{-13} + 2^{-16} + 2^{-17} + 2^{-20} + 2^{-21} = .59999$$

③ binary: 0100000010 0100 0110 0110 0110 0110

$$10000010 = 130 - 127 = 3$$

$$2^{-2} + 2^{-6} + 2^{-7} + 2^{-10} + 2^{-11} + 2^{-14} + 2^{-15} + 2^{-16} + 2^{-19} + 2^{-22} + 2^{-23} = .27503$$

hex: 41233333

$$④ 2^{-4} = x - 127 = -4 \quad x = 123$$

$$01111011 = 123 - 127 = -4$$

1011101100000000 00000000 0000 0000

B d 8 0 0 1 0 1 0 0 0 0 0 0 0 0

$$-1^s \times (1+m) \times 2^e$$

Binary: 01000000100001100110011001100110
sign bit: 0 + 8 bit = 10000001

sign bit: 0 + 8 bit: 10000001 = $129 - 127 = 2$

$$000011001100110011001100 = 2^{-5} + 2^{-6} + 2^{-9} + 2^{-10} + 2^{-13} + 2^{-14} + 2^{-17} + 2^{-18} + 2^{-21} + 2^{-22}$$
$$(-1)^0 (1.2949) \times 2^{129-127}$$
$$= 0.04999$$
$$(-1)^{\circ}(1.2999) \times 2^2 = 4.1996 \times 10^0$$

Binary: 01100110111111000000000000000000

Sign bit = 0 8 bit : 11001101 = 205 - 127 = 78

$$1111110000000000000000 = 2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6} + 2^{-7} = .99218$$
$$(-1)^8 \times (1.99218) \times 2^{78} = 6.0210 \times 10^{23}$$

2) A) -1600, 6666

$$2 \times 11000 = 11000000000$$
$$2 \overline{) 800} \quad 00 \quad .6666$$
$$0.6666 \times 2 \mid 1.3332 \mid 1$$

2 1400 0

3332x2	6664	0
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 $2 \overline{) 200} \quad 0$

6664 x 2	1.3328	1
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$$2 \overline{) 1000}$$

1.3328 x 2	.6656	0
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 $2 \mid 50 \quad 0$ $6656 \times 2 = 1.3312$ $2 \overline{) 25} 6 \text{ G}$

3312 x 2 | .6624 | 0

2 | 12 |

2160

• repeat

2130

$$.6666 = 1010101010$$

211 ①

(6)

So $1600.6666 = 11001000000.10101010$

$$1.00000010101010 \dots \times 2^{10}$$

X XXXXXXXX XXXX X

sign bit exponent (8) Fraction (23)

sign bit exponent (8) fraction (23)

$x - 127 = 10, x = 137$
 $10001001 \quad 100100000010101010 \dots$

32bit: 1100 0100 1100 1000, 0001 0101 0101 0101

Hex: 000E A4 0C 8 1 5 5 5

Hex: 0xC4C81555

Lab 7 ⑤

2) 13) -1.6×10^{-19}

C-1) Sign bit

$$S0 \frac{1.6 \times 10^{-19}}{2^x} = (1 + \text{fraction}) * 2^{\text{power}}$$

$$\frac{1.6 \times 10^{-19}}{2^{-63}} = 1.4757$$

So your bias = -63

$$1.6 \times 10^{-19} = 1.4757 \times 2^{-63}$$

$$X - 127 = -63$$

$$X = 64 = 01000000$$

.4757 x 2 = .9514	0	.6592 x 2 = 1.3184	1	.7552 x 2 = 1.5104	1
.9514 x 2 = 1.9028	1	.3184 x 2 = .6368	0	.5104 x 2 = 1.0208	1
.9028 x 2 = 1.8056	1	.6368 x 2 = 1.2736	1	.0208 x 2 = .0416	0
.8056 x 2 = 1.6112	1	.2736 x 2 = .5472	0	.0632 x 2 = .1264	0
.6112 x 2 = 1.2224	1	.5472 x 2 = 1.0944	1	.3664 x 2 = .7328	0
.3224 x 2 = .6448	0	.0944 x 2 = .1888	0	.3328 x 2 = .6656	0
.6448 x 2 = 1.2896	1	.1888 x 2 = .3776	0	.6656 x 2 = 1.3312	1
.3296 x 2 = .6592	0	.3776 x 2 = .7552	0		

$$1010000011111010101010001100001 = 0xA03D5461$$

3) A) $0x44800000 + 0x3f000000$

$$x: 0x44800000 : 01000100100000000000000000000000$$

$$y: 0x3f000000 : 00111111000000000000000000000000$$

$$\begin{matrix} x & y \\ \text{exponent} & 10001001 = 137 & \text{exponent} & 01111110 \end{matrix}$$

$$137 - 127 = 10 \quad 126 - 127 = -1$$

$$S0: 1.00000 \times 2^{10} \quad S0: 1.00000 \times 2^{-1}$$

$$\begin{matrix} x: 1.00000 \times 2^{10} & y: 1.00000 \times 2^{-1} \\ y: 1.00000 \times 2^{-1} & y: .000000000001000 \times 2^{10} \\ & 1.000000000001 \times 2^{10} \end{matrix}$$

$$x - 127 = 10$$

$$x = 137$$

$$\text{exponent: } 10001001 \quad \text{significant: } 0000$$

$$01000100100000000001000000000000$$

$$0x44801000$$

3b) $0x3C066666 + 0x3C111111$

x: $0x3C066666$: 0011 1100 0000 1011 1011 1011 1011

y: $0x3C111111$: 0011 1100 0001 0001 0001 0001 0001

x

y

exponent: $01111000 = 120$

exponent: 01111000

$120 - 127 = -7$

$120 - 127 = -7$

1.0001011×2^{-7}

$1.0010001 \dots \times 2^{-7}$

x: $1.0001011011101110111011 \times 2^{-7}$

y: $1.0010001000100010001000 \times 2^{-7}$

$10.00111001100110011001100 \times 2^{-7}$

$= 1.000111001100110011001100 \times 2^{-6}$

$x - 127 = -6 \rightarrow$ exponent = 01111001 significand: 00011100

$x = 121$

$00111001000111001100110011001100110011001100$

$0x3C8e6666$

3c) $0x42C80000 + 0xC1F80000$

x: $0x42C80000$: 0100 0010 1100 1000 0000 0000 0000

y: $0xC1F80000$: 1100 0001 1111 1000 0000 0000 0000

x

y

exponent: 10000101 exponent: 10000001

$133 - 127 = 6$

$131 - 127 = 4$

1.100100×2^6

1.111100×2^4

x: 1.100100×2^6

1.000100×2^6

y: 1.111100×2^4

$- .011111 \times 2^0$

1.000101×2^6

$= 1.000101 \times 2^6$

$x - 127 = 6$ exponent: 10000101 significand: 000101000000

$x = 133$

$0100001010001010000000000000000000000000000$

$0x42820000$

4) (A) $0x36666666 \times 0xc2f00000$

$0x36666666$:

$0xc2f00000$:

Fraction: 1.1101011

exponent: 01110110

$$\begin{array}{r} 1.1101011 \\ + 0.1111111 \\ \hline 1.0111011 \\ + 0.1110101 \\ \hline 1.0110101 \\ + 0.1110101 \\ \hline 1.1101011 \end{array}$$

$$\begin{array}{r} 10000101 \\ + 1 \\ \hline 11111100 \\ + 10000001 \\ \hline 11011101 \end{array}$$

$1.1101011 + 1.0001011 = 10.001011$

So, $1011110110111000101111111111$ Flip bits
 B E D C B F F F

$0xBEDC5FFF$

(B) $0x44000000 \times 0x3b000000$

$0x44000000$: $0100\ 0100\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000$

$0x3b000000$: $0011\ 1011\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000$

Fraction: 0
 $\times 0$
 $\hline 0$

exponent: 10001000

$$\begin{array}{r} 01110110 \\ + 11111110 \\ \hline 10000001 \\ + 10111111 \\ \hline 10111111 \end{array}$$

So, $001111111000\ 0000\ 0000\ 0000\ 0000$

$0x3f800000$