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CSC 137
H.W #1

## Problem 1.1

a) $12 = (1100)_2$

b) $12 = (01100)_2$

c) $+1 = (0001)_{2s}$

d) $-1 = -(0001)_{2s} = (1110)$ (Inverting)

Add 1 $\Rightarrow$ $-1 = (1111)_{2s}$

e) $-1 = -(00001)_{2s} = (11110)$ (Inverting)

Add 1 $\Rightarrow$ $-1 = (11111)_{2s}$

f) $+1 = (0001)_{sm}$ (MSB=0 : positive)

g) $-1 = (1001)_{sm}$ (MSB=1 : negative)

## Problem 1.3

$5.375 = 5 + 0.25 + 0.125 = 5 + \frac{1}{4} + \frac{1}{8}$

$= (101)_2 + (0.01)_2 + (0.001)_2$

$= \cancel{(101)}\ (101.011)_2 \times 2^0$

$= (1.01011) \times 2^2$ (exponent = 2)

$= (1.01011) \times 2^9$ (biased-exponent = 9, bias = 7)

Because of negative side $\Rightarrow (1, 1001, 0101100000 00)$ (16 bit)

$\Rightarrow$ **0x CAC0** (-5.375)

# Problem 1.4

0x3400 = 0011 0100 0000 0000

= (0, 0110, 100 0000 0000)

⇒ bias exponent = 6

⇒ fraction = 100 0000 0000 (1)

exponent = bias exponent − bias = 6 − 7 = −1 (2)

From (1) and (2) ⇒ $(1.1)_2 \times 2^{-1}$

⇔ $(0.11)_2 \times 2^0$

⇔ $(0.1)_2 + (0.01)_2$

= $\frac{1}{2} + \frac{1}{4} = 0.5 + 0.25 =$ **0.75**

# Problem 1.5

0x3400 = 0011 0100 0000 0000

= (0, 0110, 100 0000 0000)

⇒ bias exponent = 6

⇒ fraction = 100 0000 0000 (1)

exponent = 6 − 8 = −2 (2)

From (1) and (2) ⇒ $(1.1)_2 \times 2^{-2}$

⇒ $(0.011)_2 \times 2^0$

⇒ $(0.01)_2 + (0.001)_2$

= $\frac{1}{4} + \frac{1}{8} = 0.25 + 0.125 =$ **0.375**

## Problem 1.6

Biggest Positive FP Number

(0, 1110, 111 1111 1111) (16 bit FP representation)

Exponent = (Biased exponent − bias)

= 14 − 7 = 7

Fraction = 111 1111 1111 = $1 + (1 - 2^{-11}) = 2 - 2^{-11}$

Biggest Positive Number = $(2 - 2^{-11}) \times 2^{7}$ = 255.9375

## Problem 1.7

Biggest Positive FP Number

(0, 1110, 111 1111 1111) (16 bit FP representation)

Exponent = (biased exponent − bias)

= 14 − 8 = 6

Fraction = 111111111111 = $1 + (1 - 2^{-11}) = 2 - 2^{-11}$

Biggest Positive FP Number = $(2 - 2^{-11}) \times 2^{6}$ = 127.96875