CMPUT 229 - Quiz #4 — Winter 2014

Name: __Solution__

The following is a format for the binary representation of a floating-point number:

10	9		5	4		0
S	exponent			fraction		

The exponent is expressed using a bias of 15. Given the binary representation above, the decimal value of the number represented can be computed by the following expression:

$$N = \begin{cases} 0.0 & \text{if } exponent = 0 \text{ and } fraction = 0 \\ (-1)^S \times 0.fraction \times 2^{-15} & \text{if } exponent = 0 \text{ and } fraction \neq 0 \\ (-1)^S \times 1.fraction \times 2^{-15} & \text{if } 0 < exponent < 31 \\ (-1)^S \times \infty & \text{if } exponent = 31 \text{ and } fraction = 0 \\ NaN & \text{if } exponent = 31 \text{ and } fraction \neq 0 \end{cases}$$

Question 1 (3 points):

Let $X = 40_{10}$. Give the normalized binary representation for X and the bit pattern representation of X in this notation.

$40_{10} = 101000_2 \Rightarrow \boxed{1.01 \times 2^5}$

Exponent = 5 + bias = 20 ⇒ 10100

Sign = 0

Fraction = 01000

$\boxed{0 \quad 10100 \quad 01000}$

Question 2 (3 points):

Let $Y = 4.25_{10}$. Give the normalized binary representation for Y and the bit pattern representation of Y in this notation.

$4.25_{10} = 100.01_2 \Rightarrow \boxed{1.0001 \times 2^2}$

Exponent = 2 + bias = 17 ⇒ 10001

Sign = 0

Fraction = 00010

$\boxed{0 \quad 10001 \quad 00010}$

Question 3 (4 points): If this machine has an adder with a round bit, a guard bit and a sticky bit, what is the value of $X + Y$ computed by this machine? Give both the normalized binary notation and the decimal value.

```
  1.01
+ 0.0010001
─────────────
  1.01100  x2⁵
```

guard = 0
round = 1   don't round
sticky = 0

$\boxed{1.011 \times 2^5}$

$1.011 00_2 = 32_{10} + 8_{10} + 4_{10} = \boxed{44_{10}}$