

## Answers to Assignment-1

1. a)  $11010-10000 \Rightarrow 11010+10000(2'S \text{ comp.})=1(\text{end carry}) \ 01010$

**So answer = + (01010)**

b)  $000100-110000 \Rightarrow 000100+010000 (2'S \text{ comp.})=010100 \ (\text{no carry})$

**So answer = (-) 2's of (010100) = - (101100)**

c)  $11010-01101 \Rightarrow 11010+10011(2'S \text{ comp.})=1(\text{end carry}) \ 01101$

**So answer = + (01101)**

2.

a)  $-32.75 = -(100000.11)_2 = -(1.0000011)_2 * 2^5$

Sign bit = 1 for negative numbers. The exponent w/o bias is 5.

With 8 bit , bias value is 127 and exponent =  $127+5 = 132=(10000100)_2$  .

**Sign ,exponent , mantissa : 1 - 10000100 – 000001100000000..**

b)  $0.0625 = (0.0001)_2 = (1.0)_2 * 2^{-4}$

Sign bit = 0 for positive numbers. The exponent w/o bias is -4.

With 8 bit , bias value is 127 and exponent =  $127-4 = 123=(0111 \ 1011)_2$  .

**Sign exponent mantissa : 0 – 0111 1011 – 0000000000000000..**

3. **Sign – exponent – mantissa**

a) **1011 1101 0100 0000 0000 0000 0000 0000**

Sign = 1 means negative number.

Exponent =  $(0111 \ 1010)_2 = 122$  means exponent w/o biased is  $122 - 127 = -5$  .

Mantissa = 1000 000....

**Number = - (1.1) \*  $2^{-5} = - 0.046875$ .**

b) **0101 0101 0110 0000 0000 0000 0000 0000**

Sign = 0 means positive number.

Exponent =  $(1010 \ 1010)_2 = 170$  means exponent w/o biased is  $170 - 127 = 43$  .

Mantissa = 1100 000....

**Number = (1.11) \*  $2^{43}$ .**

4. i) The number of different values can be expressed for both formats are same and equal to  $2^{32}$  for 32 bit representation.  
 Number =  $1.m 16^e$ .  
 A larger exponent base gives a greater range at the expense of less precision.  
 For  $r=16$  range :  $-(2-2^{-23}) * 16^{128}$  ----  $+(2-2^{-23}) * 16^{128}$   
 precision : for  $e = 1$  number =  $1.m * 16 > 1.m * 2$  for all  $m$ .
- ii) The number of different values can be expressed for both formats are same and equal to  $2^{32}$  for 32 bit representation.  
 Number =  $1.m 2^{e1}$ .  
 The range of expressible numbers are expanded but because only a fixed number of different values can be expressed , we have reduced the density of those numbers and therefore the precision. (For larger  $e1$  the number increases so the range.)
- iii) The only way to increase both range and precision is to use more bits both exponent and mantissa. Prove : exponent " $e$ " increases so the range increases , mantissa " $m$ " increases so the precision.