

**Quiz 1 Solutions**  
**CSE 112 Computer Organization**

---

**Question 1:**

**n = 9 bits**

$C_9 \oplus C_8 = 1$   
**Overflow!**

$\begin{array}{ccccccccccc} \text{1} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} \\ \text{C}_9 & \text{C}_8 & & & & & & & & & \end{array}$

-255 = 1 0 0 0 0 0 0 0 1 +

-230 = 1 0 0 0 1 1 0 1 0

0 0 0 0 1 1 0 1 1

-255-230 = -485  $\notin [-2^8, 2^8-1] \rightarrow$  overflow!

**To avoid overflow:**

**n = 10 bits (sign-extension)**

$C_{10} \oplus C_9 = 0$   
**No Overflow**

$\begin{array}{ccccccccccc} \text{1} & \text{1} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} & \text{0} \\ \text{C}_{10} & \text{C}_9 & & & & & & & & & \end{array}$

-255 = 1 1 0 0 0 0 0 0 0 1 +

-230 = 1 1 0 0 0 1 1 0 1 0

-485 = 1 0 0 0 0 1 1 0 1 1

-255-230 = -485  $\in [-2^9, 2^9-1] \rightarrow$  no overflow

1. [1 mark for 2's complement notation of -255]
2. [1 mark for 2's complement notation of -230]
3. [1 mark for computation of 9 LSBs of the result]
4. [1 mark for computation of MSB of the result]
5. [1 mark to mention the number of bits to represent the result is 10]

**Question 2**

0100\_0000\_1011\_0100\_0000\_0000\_0000\_0000

- a. +ve [1 marks]
- b. 1000\_0001 = 129 = 127 + 2. Therefore 2. [2 marks]
- c. 011\_0100\_0000\_0000\_0000\_0000 [2 marks]
- d.  $1.01101_2 \times 2^2 = 101.101_2 = 5.625_{10}$  [3 marks. Students must show the steps.]

**Question 3**

Binary fixed point representation for 17.6875 = 10001.1011 = 1.00011011  $\times 2^4$  [2 marks]

Sign = 1 (Negative number) [1 marks]

Exponent = 127 + 4 = 1000\_0011<sub>2</sub> [2 marks]

Mantissa = 000\_1101\_1000\_0000\_0000\_0000 [2 marks]

Therefore: 1100\_0001\_1000\_1101\_1000\_0000\_0000\_0000 [1 marks]

#### **Question 4**

- a. 21 [2 marks]
- b. 21 [2 marks]
- c. 6 [2 marks]
- d. 16 [2 marks]
- e.  $2^5 = 32$  [2 marks]
- f.  $2^6 = 64$  [2 marks]

#### **Question 5**

- a) 1100\_1100\_1100\_1100\_1100\_0000\_0000.  
Students should mention that the multiplication is just a left shift operation. **[1 marks.**  
**“Left shift” must be mentioned]**  
Students should mention the shift is by 8 bits. **[1 mark to shift by 8 bits]**  
**[1 mark to copy the rest of the number correctly]**
  
  - b) In case of IEEE754 floating point number when multiplying with 2, we add 1 to the exponent part of the IEEE format  
Given number = 0100\_1010\_1011\_1100\_1011\_0000\_0000\_0000  
Sign = 0  
Exponent = 1001\_0101  
New Exponent =  $1001_0101 + 1 = 1001_0110$   
Mantissa = 011\_1100\_1011\_0000\_0000\_0000  
New Number after multiplying by 2 = {Sign, New Exponent, Mantissa}  
= 0100\_1011\_0011\_1100\_1011\_0000\_0000\_0000  
**[1 marks for sign bit]**  
**[2 for exponent part]**  
**[1 mark for mantissa part]**
-