**GATE** 

### **CS&IT**

# **Computer Organization and Architecture**

DPP: 1

## Floating Point Representation

- Q1 Which of the following is the representation of  $(-1)_{10}$  in IEEE-754 single precision floating point number?
- Q2 Which of the following is the representation of + (0.0000101)<sub>2</sub> in IEEE-754 single precision floating point number?
  - (A) S = 0, E = 01111010, M 10100000000000000000000

  - (C) S = 0, E = 01111010, M 01000000000000000000000
- Q3 The value of a float type variable is represented using the single- precision 32-bit floating point format IEEE-754 standard that uses 1bit for sign, 8 bits for biased exponent and 23 bits for mantissa. A float type variable X is assigned the decimal value of -22.25. The representation of X in hexadecimal notation is

- (A) C1B40000H
- (B) 41B20000H
- (C) C1B20000H
- (D) 41B40000H
- **Q4** Consider the following representation of a number in IEEE 754 single-precision floating point format?
- **Q5** Minimum possible positive normalized value represented in IEEE-754 single precision format is?
- **Q6** Maximum possible positive denormalized value represented in IEEE-754 single precision format is?
  - (A)  $(2^{23}-1)*2^{-150}$
  - (B)  $(2^{24}-1)*2^{-149}$
  - (C)  $(2^{23}-1)*2^{-149}$
  - (D)  $(2^{24}-1)*2^{-150}$

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## **Answer Key**

Q1 (B) Q4 28 Q2 (C) Q5 (B)

Q3 (C) Q6 (C)



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### **Hints & Solutions**

#### Q1 Text Solution:

For  $(-1)_{10}$ , sign = 1 for negative value

 $(1)_{10} = 1.0 \times 2^{0}$ 

Mantissa = 000 . . . . 0

Original exponent = 0

Bais exponent =  $0 + 127 = (127)_{10} = (01111111)_2$ 

#### Q2 Text Solution:

For positive value sign S = 0

 $(0.0000101)_2 = 1.01 \times 2^{-5}$ 

Mantissa = 0100 . . . . 0

Original exponent = -5

Baissed exponent =  $-5 + 127 = (122)_{10} = 0111010$ 

#### Q3 Text Solution:

For negative value sign S = 1

 $(22.25)_{10} = (10110.01)_2$ 

After implicit normalization = 1.011001 × 24

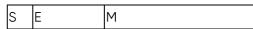
Mantissa = 011001000 . . . 0

Original exponent = 4

Biased exponent =  $4 + 127 = (131)_2 = (10000011)_2$ 

The number will look like as:

1	10000011	0110010000000000000
	10000011	0000



In hexadecimal the number will be: C1B20000

#### Q4 Text Solution:

Sign is 0, hence it's a positive value.

Given biased exponent =  $(10000011)_2$  = 131

Value =  $+1.11 \times 2^{131 - 127}$ 

 $= 1.11 \times 2^4$ 

 $= (11100)_2$ 

= +28

#### Q5 Text Solution:

If normalized value then it will be having biased exponent (1)<sub>10</sub>. And mantissa can have all zeros because number will be implicitly normalized.

#### **Q6** Text Solution:

For positive number sign S = 0

For denormalized number E = 00000000

Mantissa should be all (23 times) 1s.

Value =  $+ 0.1111....1 * 2^{-126}$ 

= 1111111111111111111111.0 \*2<sup>-149</sup>

 $=(2^{23}-1)*2^{-149}$ 

