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# 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?

(A) S = 1, E = 00000000, M = 00000000000000000000000

(B) S = 1, E = 01111111, M = 00000000000000000000000

(C) S = 1, E = 10000000, M = 00000000000000000000000

(D) S = 1, E = 01111111, M = 10000000000000000000000

**Q2** Which of the following is the representation of + $(0.0000101)_2$ in IEEE-754 single precision floating point number?

(A) S = 0, E = 01111010, M = 10100000000000000000000

(B) S = 1, E = 01111010, M = 10100000000000000000000

(C) S = 0, E = 01111010, M = 01000000000000000000000

(D) S = 0, E = 01111011, M = 10100000000000000000000

**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?

0 10000011 11000000000000000000000

The decimal value corresponding to the above representation is ____ ?

**Q5** Minimum possible positive normalized value represented in IEEE-754 single precision format is?

(A) S = 0, E = 00000000, M = 00000000000000000000000

(B) S = 0, E = 00000001, M = 00000000000000000000000

(C) S = 0, E = 00000000, M = 10000000000000000000000

(D) S = 1, E = 00000001, M = 10000000000000000000000

**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) |
| Q2 | (C) |
| Q3 | (C) |
| Q4 | 28 |
| Q5 | (B) |
| 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 = $1.011001 \times 2^4$

Mantissa = 011001000 . . . 0

Original exponent = 4

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

The number will look like as:

| | | |
|---|---|---|
| 1 | 10000011 | 01100100000000000000<br>0000 |
| S | E | M |

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 $(1)_{10}$. 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 * $2^{-126}$

= 11111111111111111111111.0* $2^{-23}$ * $2^{-126}$

= 11111111111111111111111.0 *$2^{-149}$

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

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