Computer Organization & Architecture

Floating Point Representation

DPP: 01

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 1 bit 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) $(2^{24}-1)*2^{-150}$

Answer Key

Q1	(B)
Q2	(C)
Q3	(C)
Q4	28~28
Q5	(B)
Q6	(C)

Hints & Solutions

Q1 Text Solution:

for (–1)10, sing = 1 for negative value

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

Mantissa = 000 0

Original exponent = 0

Bias 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 = 01000 0

Original exponent = –5

Biased exponent = –5 + 127 = $(122)_{10}$ = 01111010

Q3 Text Solution:

For negative value sign S =1

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

After implicit normalization = 1.011001×2^4

Mantissa = 011 00 1000 ... 0

Original exponent = 4

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

The number will look like as:

1	10000011	01100100000000000000 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 = $+1.11 \times 2^{131-127}$

= 1.11×2^4

= $(11100)_2$

= +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}

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