GATE QUESTIONS COMPUTER SCIENCE

1) GATE 2019 CS

Topic: Number Representation

In 16-bit 2's complement representation, the decimal number -28 is:

(A) 1111 1111 0001 1100
(B) 0000 0000 1110 0100
(C) 1111 1111 1110 0100
(D) 1000 0000 1110 0100

Correct answer...
Option C: 1111 1111 1110 0100

Explanation:

28 = 0000 0000 0001 1100
-28 is the 2's complement of 28
Hence -28 must be
1111 1111 1110 0100

Important Tip:
A negative number has infinite leading 1s, remember!
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2) GATE 2020 CS

Topic: Floating Point Numbers

Consider three registers R1, R2, R3 that store numbers IEEE 754 single precision floating point format. Assume that R1 and R2 contain the values (in hexadecimal notation) 0x42200000 and 0xC1200000 respectively.

If R3 = R1÷R2, what is the value stored in R3. (2 marks)

(A) 0x40800000
(B) 0xC0800000
(C) 0x83400000
(D) 0xC8500000

Important Tip:
Convert into binary and identify Sign, Exponent and Mantissa
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Correct answer…
Option B: 0xC0800000

Explanation:

R1 = 0x42200000
In binary = 0100 0010 0010 0000 0000 0000 0000 0000
S = 0, E = 1000 0100 = 132. TE = 132-127 = 5. Mantissa = 0010 0000…

R2 = 0xC1200000
In binary = 1100 0001 0010 0000 0000 0000 0000 0000
S = 1, E = 1000 0100 = 130. TE = 130-127 = 3. Mantissa = 0010 0000…

R1÷R2 ➔ S will be 1 (+ve ÷ -ve = -ve).
We simply subtract the exponents and, actually divide the mantissas.
TE = 5 – 3 = 2. Hence BE = 129.
Both mantissas are same hence result of division in mantissa is 1.0
Hence, mantissa of result = 0.
Final result: 1100 0000 1000 0000 0000 0000 0000 0000
Final result in hex: 0xC8000000

3) GATE 2021 CS

Topic: Floating Point Numbers

Consider the following representation of a number in IEEE 754 single precision floating point format with a bias of 127.

S:1 E:10000001 F:11110000000000000000000

Here S, E and F denote Sign, Exponent and Fraction components of the floating-point representation.

The decimal value corresponding to the above representation (rounded to 2 decimal places) is __________

Important Tip:
Identify Sign, Exponent and Mantissa
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Correct answer…
-7.75

Explanation:

S:1 hence number is -ve
E:10000001 = 129. This is the biased exponent.
True Exponent =129-127=2.
Normalized form is: $(-1)^S$ x 1.F x 2^E
Hence the actual number is: $(-1)^1$ x 1.1111000… x 2^2
= -1.1111000000… x 2^2 = -111.11000000...
Converting to decimal…
111 = 7 | .110000 = .75
#Refer the video for this discussion on **www.BharatAcharyaEducation.com**

Hence final number is -7.75

Special Note:

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4) GATE 2021 CS

Topic: Floating Point Extreme Cases

The format of single precision floating point IEEE 754 standard is:

Sign	Exponent	Mantissa

Which of the following choices if correct with respect to the smallest normalized positive number represented using the standard?

A) Exponent = 00000000, Mantissa = 00000000000000000000000

B) Exponent = 00000000, Mantissa = 00000000000000000000001

C) Exponent = 00000001, Mantissa = 00000000000000000000000

D) Exponent = 00000001, Mantissa = 00000000000000000000001

Correct answer... Option C:
Exponent = 00000001, Mantissa = 00000000000000000000000

Explanation:
The smallest number will be
0.0000 … 1 {almost 0, but not 0}
In normalized form it is:
$(-1)^0 \times 1.0 \times 2^{-126}$

M = 0000…0000
True Exponent = -126
Biased Exponent = -126 + 127 = 1
Hence Exponent in binary = 00000001

Important Tip:
Remember the lecture of Extreme cases in FP Numbers?
Underflow begins at TE = -127
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5) GATE 2021 CS

Topic: Number representation

If the numerical value of a 2-byte unsigned integer on a little-endian computer is 255 more than that on a big-endian computer, which of the following choices represent(s) the unsigned integer on a little endian computer?

A) 0x6665

B) 0x0001

C) 0x4243

D) 0x0100

Correct answer… Options A and D
A: 0x6665 | D: 0x0100

Explanation:
Little Endian rule stores
lower byte at lower address
Big Endian rule stores
lower byte at higher address

Important Tip:
Most computers use little endian but not necessary all use this rule.
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This means if we reverse the bytes and subtract the numbers, the result must be FF.

Consider 6665: 6665 - 6566 = FF … Hence true
Consider 0100: 0100 - 0001 = FF … Hence true