Computer Architecture and Organization - Quiz 02

Quiz 02 - 10/7/2024 - 15:30 - 16:00

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1. What are the three main components of the IEEE 754 single precision floating-point format? *

- A) Sign, Exponent, Base
- B) Sign, Exponent, Mantissa
- C) Sign, Base, Mantissa
- D) Exponent, Mantissa, Coefficient

2. For IEEE 754 single precision, what is the bias used in the exponent? *

- A) 128
- B) 127
- C) 1023
- D) 255

3. In IEEE 754 floating-point format, how is a positive infinity represented in single precision? *

- A) Sign bit 0, all exponent bits 1, all mantissa bits 0
- B) Sign bit 1, all exponent bits 1, all mantissa bits 0
- C) Sign bit 0, all exponent bits 0, all mantissa bits 1
- D) Sign bit 0, all exponent bits 1, all mantissa bits 1

4. Which of the following statements is true when performing arithmetic operations using IEEE 754 standard? *

- A) Subnormal numbers are used to increase precision around zero.
- B) Overflow in addition always results in a NaN.
- C) Multiplying two denormalized numbers results in zero.
- D) Underflow is treated the same as overflow, resulting in NaN.

5. Which IEEE 754 rounding mode rounds towards the nearest value, and if the number lies midway, it is rounded towards the nearest even number? *

- A) Round toward zero
- B) Round to nearest, ties to even
- C) Round toward positive infinity
- D) Round toward negative infinity

6. Convert the decimal number −198.1 into its IEEE 754 single precision (32-bit) floating-point binary format. Detail each step in your conversion process *

1. Determine the sign bit
It is negative so sign bit is 1

2. Convert the absolute number to binary
198 in base 10 = 1100 0110 in base 2

3. Convert the fraction part 0.1 in base 10 to base 2
0.1 * 2 = 0.2
0.2 * 2 = 0.4
0.4 * 2 = 0.8
0.8 * 2 = 1.6
0.6 * 2 = 1.2
0.2 * 2 = 0.4
….

Repeating pattern is found. Therefore, 0.1 in base 10 is 0.000110 …. In base 2.

Therefore, 198.1 in base 10 is 1100 0110 . 000110 in base 2.

4. Normalization
Convert it to scientific form
1 . 100 0110 000110 * 2^7
Determine the exponent 7
7 + 127 = 134 in base 10 is 1000 0110

5. Mantissa is the fraction part
Therefore, 100 0110 000110

6. Put all together

Sign | Exponent | Mantissa
1 10000110 1000110000110