CSCI 516 - Fundamental Concepts in Computing and Machine Organization
Homework Assignment 4

Due on 11/08/2022 (Tuesday), 11:55PM

Requirement

- You need to do your assignment independently.
- You need to submit ".pdf" file which contains your solutions to D2L

Questions

Perform each of the following computation using IEEE-754 single precision and IEEE-754 double precision representation. Clearly show all the steps.

[Method: Convert each of the decimal values to IEEE-754 single precision representation. Perform IEEE-754 computation (addition or multiplication) and convert the IEEE-754 single precision result back to decimal value. Repeat the above method for each computation using IEEE-754 double precision representation].

1. -2.25 + 15 =

2. -7.5 * 3.25 =

1. $-2.25 + 15 = 12.75$

Convert 2.25 to binary.

$(2)_{10} = (10)_2$

$(.25)_{10} = .25 \times 2 = 0.5 \rightarrow 0$

$\rightarrow 0.5 \times 2 = 1$

$2.25 = (10.01)_2$

$(15)_{10} = (1111)_2$

IEEE - 754 format:

Sign	Exponent	Mantissa
1 bit	8 bits	23 bits

-2.25

number is negative | Sign = 1 |

$(10.01)_2$ is 1.001×2^1 → exponent

Mantissa

IEEE exponent = Exponent + Bias

IEEE exponent = $1 + 127 = 128 = (10000000)_2$

IEEE - 754 format:

1	1000 0000	001 0000 0000 0000 0000 0000

15

number is positive | Sign = 0 |

(1111.0) is 1.111×2^3 → Exponent

Mantissa

IEEE exponent = $3 + 127 = 130 = (10000010)_2$

IEEE - 754 format:

0	1000 0010	111 0000 0000 0000 0000 0000

$15 - 2.25$

$2^3 > 2^1$

15: 1. 111 0000 0000 0000 0000 0000 $\times 2^3$

-2.25: - 0. 010 0100 0000 0000 0000 0000 $\times 2^3$

1. 111 0000 0000 0000 0000 0000 $\times 2^3$

1. 101 1100 0000 0000 0000 0000 $\times 2^3$

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1. 100 1100 0000 0000 0000 0000 $\times 2^3$

IEEE-754 format

0	1000 0010	10001100 0000 0000 0000 0000

2. $-7.5 \times 3.25 = -24.375$

IEEE-754 Singk precision:

$-1.1110000\ 0000\ 0000\ 0000 \times 2^{2} = -7.5$

$+1.1010000\ 0000\ 0000\ 0000 \times 2^{1} = 3.25$

$-11.0000110000000000000000 \times 2^{3}$

$-1.1000011000000000000000 \times 2^{4}$

$= -24.375$

IEEE-754 double precision:

$-1.1110000000000000\ 0000000 \times 2^{2} = -7.5$

$+1.1010000000000000\ 0000000 \times 2^{1} = 3.25$

$-11.0001100000000000000000000 \times 2^{3}$

$-1.1000011000000000000000 \times 2^{4}$

$= -24.375$