

BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Quiz - 3
 Duration: 30 minutes

Semester: Fall 2024
 Full Marks: 15

CSE 340: Computer Architecture

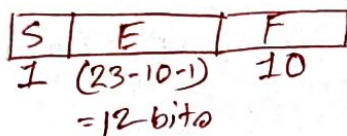
Name: <u>Solution</u>	ID:	Section: 07
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1. Given the number $A = 1.1011 \times 2^{232500}$; can this number be represented using a 23-bit IEEE-754 floating-point format, where the fraction field is 10 bits?

You must provide a justification for your answer.

[2+1]

Answer:



$$\text{Bias} = 2^{12-1} - 1$$

$$= 2047$$

Biased Exp

$$= 232500 + 2047$$

$$= 234547$$

$$\text{Biased Exp. Range} = 0 \text{ to } 2^{12} - 1$$

$$= 0 \text{ to } 4095$$

$$= 1 \text{ to } 4094 \text{ [usable]}$$

$$234547 > 4094$$

So, not possible to represent.

2. Suppose you have two floating point numbers 2.15 and 3.15 stored respectively in f2 and f3 registers. Now you run the following code:

freq.d X3, f2, f3

After running the code, what would be the value inside the X3 register?

Note: both values stored in f2 and f3 are in IEEE-754 double precision format. [1]

Answer: $f_2 \neq f_3$; So, $X_3 = 0$

3. Given two numbers 1190_{10} and 1370_{10} . We want to multiply these two numbers using the **Optimized Multiplication** method. Answer the following questions: [4]

$$(1190)_{10} = (100 \ 1010 \ 0110)_{11 \text{ bits}} ; (1370)_{10} = (101 \ 0101 \ 1010)_{11 \text{ bits}}$$

- How many iterations are necessary to complete this multiplication?
- What would be the size of the product register?
- What would be the size of the multiplicand register?
- What would be the size of the inputs of ALU?

Answer:

- 11 bits
- 22 bits
- 11 bits
- 11 bits

4. Given a number, $W = 0x100A05002$ in 36-bit IEEE-754 representation, where the size of the fraction field is 18 bits. Find the equivalent decimal number of the given number W . [7]

100A05002

= 0001 0000 0000 1010 0000 0101 0000 0000 0010
 $\underbrace{\hspace{1.5cm}}_{\text{exponent}} \quad \underbrace{\hspace{1.5cm}}_{\text{fraction}}$

$$\Rightarrow \text{Biased Exponent} = 001\ 0000\ 0000\ 1010\ 00 \\ = 16424$$

$$\text{Bias} = 2^{17-1} - 1 = 65535$$

$$\Rightarrow \text{Actual Exponent} = \cancel{655} \ 16424 - 65535 \\ = -49111$$

$$\Rightarrow \text{Decimal number} = (-1)^0 \times (1 + 0.00\ 0101\ 0000\ 0000\ 0010) \\ \times 2^{-49111} \\ = 1.00\ 0101\ 0000\ 0000\ 0010 \times 2^{-49111}$$

The exponent is too small. So, calculator won't be able to convert it.