BRAC UNIVERSITY

Department of Computer Science and Engineering

Examination: **MOCK** Mid Term | Semester: Spring 2025

Duration: 1 Hour 10 Minutes | Full Marks: 25

CSE 340: Computer Architecture

Answer the following questions. Show calculations where required.

Figures in the right margin indicate marks. Understanding the question is part of the examination.

Name:	ID:	Section:

1. CO1 **a)** **Define** Instruction Set Architecture and how it impacts performance. 2

b) Suppose a program is running on a PC with 3.2Ghz AMD Ryzen 5 processor. The program consists of 3 major types of instructions. Their instruction counts and CPI are given below:

Instruction Type	**Instruction Count(x10^9)**	**CPI**
Load	3	2.3
Sub	5	?
Add	2	2.0

If the average CPI of the program is 6.3 then **what** is the CPI of the Sub Instruction? 3

c) Based on the results of the SPEC CPU2000 benchmark conducted on an Intel Core i5 13th Gen processor, the system has an average CPI of 2.4 and an instruction count of 5×10E8 . The system completes 5,4000 clock cycles in 12 seconds, and the reference time is 9,650 seconds.

Find the SPEC ratio. Based on your findings, make a comment on the performance of the processor. 3

2. CO2 **a)** Suppose, A[] is a 64-bit array. **Convert** the following C code to RISC-V code. Assume i, j, and the base address of A[] are located in X21, X22, and X23 respectively. Please remember that you **cannot use multiplication instruction**. Your code should be as optimized as possible. Also, write comments in your code. 4

```
int j = 2;
for(int i = 1; i >= A[j]; i++){
   j = j * 320;
}
```

b) The following table is a visual representation of the instruction memory where each instruction is in sequence. **Identify** and **calculate** the missing values in your answer script, showing all the necessary steps. Finally, fill the following table on this question paper with your calculated values. 2

	Instructions	Machine Code					
i.	ADDI X6, X6, -16				funct3		OP
ii.	SD X6, 0(X7)				funct3		OP

c) **What** is the significance of the funct3 field in terms of Store instruction? 2

d)

`Label1:`	For the second SB type instruction calculate the value of the target location, if the PC = 1012 while executing that instruction.
`BNE x24, X25, break`	
`ADD X5, X5, X6`	
`SLLI x22, X22, 3`	
`LH X6, 32(X22)`	
`SD X7, 8(X21)`	
`BEQ x0, x0, Label1`	
`Break:`	

2

3. CO1 **Convert -**111011.11011 x 2^{12} in 26-bit IEEE-754 format where,

a) Size of the fraction field is 13 bits. **Show** the equivalent Hex representation of your conversions. 2

b) Size of the fraction field is 17 bits. **Show** the equivalent Hex representation of your conversions. 2

c) Suppose you plan to use the converted number in a subsequent calculation where precision is crucial. Given a choice between the two IEEE formats (with 13-bit and 17-bit fraction fields), which format would provide a more accurate conversion for your calculation? Justify. 1

d) When converting a binary number to IEEE754 format, the first step is to normalize the number. What would happen if we skip the normalization step? 2