SET A

BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Mid Term
Duration: 1 hour 15 minutes

Semester: Spring 2023
Full Marks: 25

CSE 340: Computer Architecture

Answer the following questions.
Figures in the right margin indicate marks.
Understanding the question is part of the exam.

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1. CO1 a) Does MIPS use Harvard architecture or Von Neumann architecture? **State** the differences between these two architectures based on what we have learned about MIPS. **3**

b) Consider an implementation of MIPS ISA with a 500 MHz clock and **3**
– each ALU instruction takes 3 clock cycles,
– each branch/jump instruction takes 2 clock cycles,
– each *sw* instruction takes 4 clock cycles,
– each *lw* instruction takes 5 clock cycles.
Also, consider a program that, during its execution, executes:
– x = 200 million ALU instructions
– y = 55 million branch/jump instructions
– z = 25 million *sw* instructions
– w = 20 million *lw* instructions
***Identify** the CPU time.*

c) Suppose you are developing two new machine learning systems where System 1 takes 3 days, and System 2 takes 5 days. System 2 heavily depends on text processing, which takes 67% of the total time. What will be the new execution time for System 2 if you want to improve that specific process by 4 times? **3**

If the Reference time for both System 1 and 2 is 6 days, what is the SPEC Ratio for System 1 and System 2 after the improvement? *Find their Geometric mean.*

2. CO2 a) **Convert** the following MIPS instruction to 32-bit machine code. Show your answer in hex format. **2**

addi $9, $18, -22

Consider the identifying value for the instruction is 66.

b) **Calculate** the branch destination address in hexadecimal for the given instruction: **3**
bne $t8, $s6, Branch1
Consider PC contains 0xC84E190A, and the offset value (in decimal) is 254.

c) Suppose, C[] is a character array. **Convert** the following C code to MIPS code. Assume x, y, and the base address of C[] is located in $s1, $s2, and $s0, respectively. Your code should be as optimized as possible. **5**

```
for (int x = 1; C[x] >= C[x+3]; x = x + 2){
      int y = 0
      while ( y < 10 ) {
            C[y+1] = C[y];
            y++;
      }
}
```

d) **Translate** the following code written in C programming language into MIPS Assembly instructions. You may assume that the values in the variables a and b inside the lost function are stored in the argument registers $a0 and $a1, respectively. Also, the value in the variable z is in $s5. **6**

```
int lost(int a, int b){
    if (a < b){
        int z =  0xCF031A71;
        b = (b * 30) + b;
        if (z == b){
            return b;
        }
        else{
            return z;
        }
    }

    return a;

}
```

Breathe. Smile. It may be a bad day, not a bad life...