Brac University
Department of Computer Science and Engineering
MIDTERM EXAMINATION
Fall 2023
CSE 340: Computer Architecture

Total Marks: 25 *Time Allowed: 1 Hour 20 Minutes*

- **Answer ALL the questions. Numbers in the right margin indicate marks for each question. Understanding the question is part of the exam.**
- **Please mention your student ID, full name, CSE340 section number, and question set on top of your answer script. Please remember that it is a proctored exam so faculty members are monitoring your activity during the exam. If the faculty members detect any suspicious activity, your exam can be canceled. Once you finish your exam you will have 15 minutes to scan and upload your answer script using the given Google Form link.**

1. a. **Define** elapsed time and CPU time. **2**

b. **Explain** the power trend equation. If a new system has 12% less capacitive load and uses only 79% of the voltage and frequency of the old system, what percentage of power utilization can be reduced in the new system compared to the old system? **4**

CO1

c. Suppose a multiplication operation takes 120 seconds in total and among that 17% are serial operations and the rest are parallel operations. If you want to improve the performance by 2.56 times, what improvement do you need to include in the system's parallel operation? **4**

2. a. Write the general format of J-type instruction. Why there is no use of ALU or adder for Jump address calculation? Consider the PC is 0x00000000. **Calculate** the Jump target address of the below MIPS instruction: **3**

```
JAL 120
```

CO2

b. Consider the below set of MIPS codes. Let's assume that $6 = 12 (decimal) and $9 = 4 (decimal), now **calculate** what value $5 will hold in each line and at what memory address (in hex) the final value of $5 will be stored. **4**

```
add $5, $6, $9
sll $5, $5, 3
srl $5, $5, 2
lw $5, 40($6)
```

c. **Store** $X = 12345678_H$ in register $4 using MIPS codes. **3**

d. **Write** MIPS code for the following code. Consider base address of A is in $s0 and X and Y are in registers $s1 and $s2 respectively. Make sure you make optimum utilization of the registers. Please remember that you cannot use MULT instruction. **3**

```
A[3] = 12*X - 7*A[5] + 33*Y - 70;
```

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

```
addi $9, $18, -1
```

Consider the identifying value for the instruction is 35.

"We are what we repeatedly do. Excellence, then, is not an act, but a habit."