



বাংলাদেশ আর্মি ইন্টারন্যাশনাল ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি, কুমিল্লা সেনানিবাস
 BANGLADESH ARMY INTERNATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY (BAIUST), CUMILLA CANTONMENT

Mid Term Examination, Spring 2025
 Department of Computer Science and Engineering
 Level-3 Term-I
 Course Code: CSE-315
 Course Title: Computer Architecture and Design
 Credit Hour: 3.0
 Exam Duration: 1:30 hour
 Full Marks: 90

Notes:

1. Figure on the right of each question indicate marks for respective question.
2. Course Outcomes are:
CO1: Explain the fundamentals of computer design, including processor design, control unit design, and data path implementation.
CO2: Perform Fixed-Point and Floating-Point Arithmetic operations, including addition, subtraction, multiplication, and division.

- 1 (a) A program consists of three parts: **(CO1->C3)** 10

Part A takes 30% of the execution time and is speed up by $2\times$
Part B takes 20% of the execution time and is speed up by $3\times$
Part C is not improved. Solution

Calculate the overall speedup of the program.

- (b) Consider the following performance measurements for a program: **(CO1->C3)** 20

Measurement	CPU 1	CPU 2
Instruction Count	10 billion	12 billion
Clock Rate	4 GHz	3.6 GHz
CPI	1.3	1.0

- i. Compute the MIPS for both CPUs. Which CPU is more efficient according to MIPS?
- ii. Compare the execution times of the two CPUs and identify which completes the task faster

OR

Consider the following performance measurements for a program

Measurement	Computer A	Computer B
Instruction Count	12 Billion	16 Billion
Clock Rate	3.5 GHz	4 GHz
CPI	0.5	1.5

- i. Determine the Execution time and MIPS for this program.
 - ii. Which computer is faster according to the MIPS?
 - iii. If execution time is 30% reduced and CPI is 20% increased for Computer A, then what clock rate should be given for Computer A?
2. (a) Analyze the given MIPS loop below. What is the purpose of this loop? How many times will the loop execute given initial values of $i = 0$, $j = 1$, and $h = 10$? 10

(CO1->C3)

LOOP:

```

add $t1, $s3, $s3
add $t1, $t1, $t1
add $t1, $t1, $s5
lw $t0, 0($t1)
bne $t0, $s5, EXIT
add $s3, $s3, $s4
j LOOP

```

EXIT:

OR

Consider the following MIPS command along with register value.

```

add $t0, $s1, $s2
op = 0
rd = $t0 = 8
rs = $s1 = 17
rt = $s2 = 18

```

Shmt = 0

Funct = 32

Write down the MIPS machine code

- (b) If \$t2 holds the base address of array B and \$s1 corresponds to the variable x, convert the C statement below to MIPS assembly instructions: (CO1->C3) 20

copy B[400] = x * 2 + B[400];

Show the MIPS instructions and comment each step. Also generate the machine code based on following information

Register	Number
\$a0-\$a3	4-7
\$t0-\$t7	8-15
\$s0-\$s7	16-23
add	0
lw	35
sw	43

3. (a) Perform the following arithmetic operation while considering 16 bit MIPS architecture: (CO2->C2) 10

$$12_{10} - 7_{10}$$

OR

Design and illustrate a block diagram of a 1-bit Arithmetic Logic Unit (ALU) capable of performing basic logical and arithmetic operations including **AND, OR, addition, and subtraction**. Clearly label all input and output signals, and indicate the control lines required to select each operation.

- (b) Considering 4 bit architecture to perform the following multiplication operation while considering the minimum memory usage: (CO2->C3) 20

$$7_{10} \times 2_{10}$$