Computer Architecture
Mid Semester Exam
Answer All Questions

24th February, 2022 Maximum Marks: 50

Instructions:

1. A separate assignment tab has been created for mid-semester in the MS Teams class. Write your answers on paper, scan and then submit in this assignment tab of MS Teams before tomorrow 25th Feb., 8:00 AM. Answer sheet must be a single pdf file.
2. Do not forget to mention your Roll number, Name, and Branch in the answer sheet. The name of the submitted copy should be your roll number.

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1. Describe the steps that transform a program written in a high-level language such as C into a representation that is directly executed by a computer processor. [5]
2. If computer A runs a program in 10 seconds and computer B runs the same program in 15 seconds, how much faster is A than B? [5]
3. Translate the following C code to MIPS assembly code. Use a minimum number of instructions. Assume that the value of a, b, i, and j are in registers $s0, $s1, $t0, and $t1, respectively. Also, assume that register $s2 holds the base address of the array D. [10]

```
for (i=0; i<a; i++)
    for (j=0; j<b; j++)
    D [4*j]=i+j;
```

4. For the MIPS assembly instructions below, what is the corresponding C statement? Assume that the variables *f*, *g*, *h*, *i*, and *j* are assigned to registers $s0, $s1, $s2, $s3, and $s4, respectively. Assume that the base address of the arrays A and B are in registers $s6 and $s7, respectively. [10]

```
sll $t0, $s0, 2          # $t0 = f * 4
add $t0, $s6, $t0        # $t0 = &A[f]
sll $t1, $s1, 2          # $t1 = g * 4
add $t1, $s7, $t1        # $t1 = &B[g]
lw $s0, 0($t0)           # f = A[f]
addi $t2, $t0, 4
lw $t0, 0($t2)
add $t0, $t0, $s0
sw $t0, 0($t1)
```

5. Translate the following loop into C. Assume that the C-level integer i is held in register $t1, $t2 holds the C-level integer called result, and $s0 holds the base address of the integer *MemArray*. [10]

```
      addi  $t1, $0, $0
Loop: lw    $s1, 0($s0)
      addi  $s0, $s0, 5
      addi  $t1, $t1, 1
      slti  $t2, $t1, 100
      bne   $t2, $s0, Loop
```

6. Assume $t0 holds the value 0×20000000. What is the value of $t2 after the following instructions? [10]

```
      slt   $t2, $0, $t0
      beq   $t2, $0, ELSE
      j     DONE
ELSE: addi  $t2, $t2, 2
DONE:
```