Computer Architecture
Mid Semester Exam
Set-6

Date: 22-09-2021

Instructions

1. This is a **closed book online proctored** exam.
    a. You should not refer to books, notes or online resources.
    b. You should not discuss questions or answers with anyone (including outsiders)
    c. You should have your camera and microphone **ON** at at all times and no headphones
2. Write the solutions clearly and legibly in A4 sheets, using pen (NOT pencil) and at the end of the exam you should submit the scanned copy of your solutions as explained by the faculty
3. Follow all other instructions given by the faculty during the exam

Descriptive Questions

Note: For programs add comments for any assumptions made
For problems show step-by-step solution

1a. Consider a processor that takes the following execution time for different types of instructions in process A:

Instruction Type	Time taken	Number in process A
Integer arithmetic	**1**	**10**
Float	**3**	**4**
Control	**3**	**8**
Procedure call	**4**	**2**

i. How much performance improvement will be achieved if float instructions are made faster by 10 times?
ii. How much improvement in execution time of procedure call is needed to achieve an overall improvement of 3 times for process A?
iii. How much improvement in execution time of control instructions is needed to achieve 1.5 times speedup in overall execution time of process A?

(5)

1.b A designer is trying to decide between two code sequences(S-1,S-2) for a specific machine. The machine supports three classes of instructions: X(Adds), Y(Jumps), and Z(Loads/Stores).

classes of instructions :,	X	Y	Z
No.of Cycles to execute :	1cc	1cc	3cc

S-1 contains: 100 X's, 100 Y's, and 150 Z's
S-2 contains: 200 X's, 100 Y's, and 40 Z's

a. Which sequence is faster?
b. By how much?
c. What is the CPI of each?

2.a Convert the decimal numbers to 32-bit IEEE 754 floating point [2.5M]

a. 85.1

2.b Perform the addition operation on the following floating point numbers(single precision) and calculate the result. [2.5M]

a. $43390000 and $42820000

3a. Consider the following assembly code for a C for loop:

```
loop:
        pushl %ebp
        movl %esp,%ebp
        movl 0x8(%ebp),%edx
        movl %edx,%eax
        addl 0xc(%ebp),%eax
        leal 0xffffffff(%eax),%ecx
        cmpl %ecx,%edx
        jae .L4
.L6:
        movb (%edx),%al
        xorb (%ecx),%al
        movb %al,(%edx)
        xorb (%ecx),%al
        movb %al,(%ecx)
        xorb %al,(%edx)
        incl %edx
        decl %ecx
        cmpl %ecx,%edx
        jb .L6
.L4:
        movl %ebp,%esp
        popl %ebp
        ret
```

Based on the assembly code above, fill in the blanks below in its corresponding C source code. (Note: you may only use the symbolic variables h, t and len in your expressions below — do not use register names.)

```
void loop(char *h, int len)
{
   char *t;

   for (_____________; ____________; h++,t--) {

      _________________;

      _________________;

      _________________;
   }

   return;
}
```

(5)