Computer Architecture (CS F342) Test-1 Date: 11 September 2020 (Friday) Weightage: 15% Mode: Open Book

The question paper contains a total of 16 questions. The duration of the test is 30 minutes. The exam will start at 4:15 PM and end at 4:45 PM.
Each question carries different points and is mentioned beside each question. Each wrong answer will be awarded a negative of 25%. Please fill in the student information in the first section and then start answering the questions.

* Required

1. Email address *

Student Information

2. Write your name: *

3. Institute Id: *

4. Declaration: I declare that I have not consulted or shared my answers with anyone. I have maintained academic honesty. I am liable to penalization if found otherwise. Write your name below to agree: *

Questions

5. Q1. Assume that a program takes 10 seconds to run on a system having 1.66 Ghz clock frequency. The program consumes 8% of execution time on floating-point operation and remaining 92% on integer operations. The integer operations can be parallelized. The maximum speed-up (Smax) which can be achieved for the system is 1 point

Mark only one oval.

- 1.07
- 0.75
- 12.5
- 10

6. Q2. Assume that a system has a spec rating of 100. The spec rating is decided on 4 floating point operations. If the (approximate) individual spec-ratio for the programs is in the ratio 1:2:3:4, the SPEC-RATIO of the system with respect to the first program is (approx.) 2 points

Mark only one oval.

- 221
- 22
- 45
- 10

7. Q3. Assume that the SPEC rating of system A is 1.5 times the SPEC rating of system B. The SPEC rating of both the systems are decided based on the 4 floating-point operations. The SPEC ratings of the individual programs for system A is in the ratio of 1:2:3:4. Similarly, the spec-ratings of the individual programs for system B is in the ratio of 1:1:1:1. Assuming that the overall SPEC rating of any system is calculated using arithmetic-mean (instead of geometric-mean), the ratio of SPEC rating of two systems w.r.t to the first program is 2 points

Mark only one oval.

- 2/5
- 3/5
- 72/75
- 4/9

8. Q4. Assume that the following code is executed: li $t0, 0xABCD1234. It is well known that the instruction 'li' is a pseudo-instruction and is broken down to two separate native instructions. These native instructions are : 1 point

Mark only one oval.

- lw, lui
- lw, ori
- addi, ori
- lui, ori

9. Q5. Assume the following code shown below. Assume that the code starts from location 2000 (in decimal). The immediate values which will be substituted in the instructions 'beq $t2, $t0, Done' and instruction 'j LOOP' is: 4 points

```
Loop: slt $t2,$0,$t1
      beq $t2,$t0,Done
      subi $t1,$t1,1
      addi $s2,$s2,2
      j Loop
Done:
```

Mark only one oval.

- 3, 500
- 3, 2000
- 4, 500
- 2020, 2000

10. Q6. Suppose the register $s0 has the hexadecimal number 0XFFFF FFFF, and $s1 has the hexadecimal number 0X0000 0000, then the values of the registers $t0 and $t1 after the following two instructions will be: 4 points

```
slt $t0, $s0, $s1
sltu $t1, $s0, $s1
```

Mark only one oval.

- 0, 0
- 0, 1
- 1, 0
- 1, 1

11. Q7: The value of X in the MIPS instructions for the following high-level code will be: A[12]= c+ A[8] MIPS code: lw $t0, X($s1) # s1 contains the base address and A is an integer array. 1 point

Mark only one oval.

- 8
- 12
- 0
- 32

12. Q8. The range of address for conditional branches in MIPS architecture is: 1 point

Mark only one oval.

- Address between 0 and 64K-1
- Address between 0 and 256K-1
- Address upto about 32K before branch and 32K after branch
- Address upto about 128K before branch and 128K after branch

13. Q9. Assume that the following code is executed to store the frame pointer, and the return address of the caller function. Which instruction can be used to restore the caller's frame pointer? 2 points

```
Proc A:
        sub $sp,$sp,12
        sw  $s0,($sp)
        sw  $ra,8($sp)
        sw  $fp,4($sp)
        addi $fp,$sp,8
```

Mark only one oval.

- lw $ra, ($fp)
- lw $s0, ($fp)
- lw $fp, -4($fp)
- lw $fp, -8($sp)

14. Q10. The instruction which allocates 12 bytes of stack space in a stack frame is: 2 points

Mark only one oval.

- addi $sp, $sp, -12
- addi $sp, $sp, 12
- addi $sp, $sp, -3
- addi $sp, $sp, 3

15. Q11. Suppose that we are considering an enhancement to the processor of a server used for web-serving. The new CPU is 10 times faster on computation in the web serving application than the original processor. Assuming that the original CPU is busy with computation 40% of the time and is waiting for i/o 60% of the time, what is the overall speedup gained by incorporating the enhancement ? 2 points

Mark only one oval.

- 1.22
- 1.56
- 1.66
- 1.90

16. Q12. Two processors A and B have clock frequencies of 700 Mhz and 900 Mhz, respectively. Suppose A can execute an instruction with an average of 3-steps and B can execute with an average of 5-steps. For the execution of the same instruction which processor is faster? 2 points

Mark only one oval.

- Processor-A
- Processor-B
- Both take the same time
- Will depend on the number of the instructions in the program

17. Q13. Which of the following operations may lead to overflow for A-B (subtraction) operation? 2 points

Mark only one oval.

- A=0 and B>0
- A=0 and B<0
- A>0 and B=0
- A<0 and B=0

18. Q14. The number of shift operations that will be required for multiplying two numbers of m and n bits, respectively, using the method of shift-and-add operations is: 1 point

Mark only one oval.

- n
- m
- n-1
- Will depend on the number of 1's in the multiplier n

19. Q15. The number of add and subtract operations required when multiplying the numbers 14 X -19 is: 2 points

Mark only one oval.

- 2, 2
- 2, 3
- 3, 2
- 3, 3

20. Q16. Which of the following instructions do not cause exceptions on overflow? 1 point

Mark only one oval.

- add, addu
- addi, addu
- addu, addiu
- sub, subu

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