Department of Computer Science and Engineering
FINAL EXAMINATION
Summer 2023
CSE 340 / EEE410: Computer Architecture

Total Marks: 40 Time Allowed: 2 Hours

- **Answer ALL the questions**
- **At the end of the exam return your answer script along with your question**

Name: _____ ID: _____ Section: _____

1 a. Multiply 0.721 and 0.112 using IEEE 754 single precision floating point representation. Also, **show** the status of the result (overflow or underflow). Consider 7 decimal digits when you are converting from decimal to binary. **3**

b. **Convert** -29.412 into IEEE 754 floating point representation. Consider you have a register that is 18-bit in length and in the register, one bit is reserved for the sign of the number, the following four bits are for the exponent, and the rest for the fraction part. Show the equivalent Hex representation of your conversion. **3**

CO1 c. Consider X=0x7ABC2000 and Y=0x37DDC000, and **perform** X+Y using IEEE 754 single precision floating point representation. **4**

d. **Justify** your answer briefly: **2*1.5**

i. What is the reason for not having a sign bit in fraction and also at exponent part in IEEE 754 floating point format?

ii. PC is required for every instruction but EPC is required in special circumstances. Is it true or false, justify?

2 a. How does the assembler handle the below situations: **3**

i. bne $10, $11, 0xAABBC000 (offset is greater than 16-bit)

ii. addi $5, $6, 0xAABBC000 (constant is greater than 16-bit)

CO2

b. **Write** the MIPS instructions for the following code snippets. Suppose the base of arrays A and F are in $s0 and $s4 respectively and i and n are stored in $s1, $s2. Please remember that you can not use the multiplication instruction and your MIPS code should be optimized. **2*3**

I.
```
if (A[4] == A[6])
        F[5] = 5*A[3] - 7*A[2] - 10;
```

II.
```
for (i = 0; i < n; i++)
        A[i] = A[i]*12;
```

c. If PC = 0x44000024 **calculate** the branch target address for the instruction **3**

bne $5, $6, 260

Your answer should show the detailed calculations along with the diagram.

3 a. **Draw** a pipeline diagram showing an example of a structural hazard, and explain why there will be a structural hazard. **3**

b. **Design** a single cycle datapath for the below instruction. **3**

ori $10, $11, 1004

c. **Explain** and **illustrate** the differences between single cycle datapath and pipelining for a sequence of 3 instructions. **2**

CO3 d. Consider the code sequence given below and answer the following questions.

```
1. lw $10, 40($11)
2. add $5, $10, $7
3. sub $3, $7, $4
4. sll $5, $5, 3
5. lw $13, 48($5)
6. lw $13, 32($13)
```

2+1+4

i. How many clock cycles are required for the above code sequence in case of an ideal pipeline (no hazard) and **calculate** average CPI.
ii. How many data hazards are there in the given code sequence?
iii. Apply only *stall + forwarding* to overcome the data hazards. **Calculate** the total clock cycles and average CPI required after applying the method. Your answer should contain the necessary diagram.