

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

L-3/T-1 CSE306: Computer Architecture Sessional

Time: 30 Minutes

Total Marks: 35

Name: _____

Student ID: _____

* You have to answer all the questions.

* For any missing information/ values, make realistic assumptions and mention those in your answer.

Answer the Multiple Choice Questions (1-5) in the following table:

[5x1 = 5 Marks]

Question No.	1	2	3	4	5
Answer					

1. A float-type variable is assigned the decimal value of -14.25. What would be the exponent (in decimal)? Standard IEEE 754 format is given in question 6.
- a. 3

b. 131

c. -124

d. 130
2. Normalizing 1111011.01110001 and then rounding to 5 digits after the binary point would result in _____ .
- a. 11.11100×2^5

b. 1.1111×2^6

c. 1.11101×2^6

d. Both (a) and (b)
3. Which flags out of overflow flag and carry flag (borrow in this case) should be set if you subtract 1000 from 0000 (i.e., perform $0000 - 1000$) on a 4-bit ALU?
- a. OF

b. CF

c. Both OF and CF

d. None of OF and CF
4. Which operation is performed in a 4-bit adder if we provide a number A in the first input, all 1's in the second input, and set input carry C to zero?
- a. Transfer A

b. Increment A

c. Decrement A

d. Complement A
5. Which of the following is only true for load word (lw) instruction?
- a. The data memory will be accessed.

b. The ALU will be used to find the memory address.

c. The MemRead control signal will be 1.

d. The RegWrite control signal will be 1.

6. In IEEE 754 format, each single precision floating point has the following representation.

Sign	Exponent (Bias 127)	Fraction
1 bit (MSB)	8 bits	23 bits

Answer the following questions. For questions (a) and (b), you may leave your answer in powers of 2. You have to explain your answer with necessary calculations.

- a. How many numbers can we represent in the interval [10,16) using the above format? **[4 Marks]**
- b. If we decide to convert two fraction bits to exponent bits, how many denormalized numbers do we have in the new format? Denormal numbers have the following property. **[3 Marks]**

Sign	Exponent	Fraction
0/1	All Zero (00...00)	Nonzero

- c. In your sessional assignment, the floating point representation had 12 exponent bits and 19 fraction bits. Briefly discuss the precision-range trade-off in that format compared to the standard format shown above. **[3 Marks]**

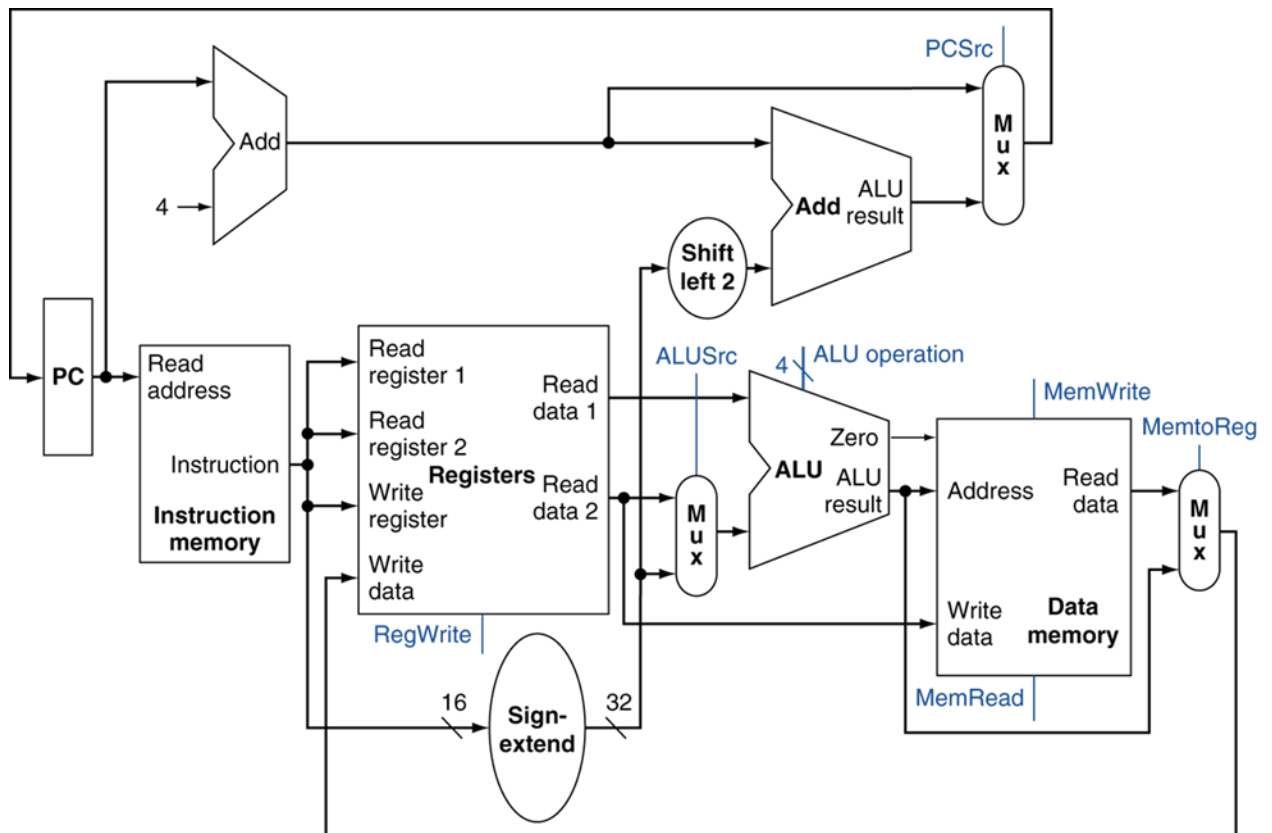
7. Design a simplified 4-bit ALU using 4-bit adder(s) (IC 7483) and additional gates/ICs as needed that supports the following four functions. Assign control signals to functions in a way that your design is simplified. You don't need to implement flags. **[5 Marks]**

Function	Output	cs1	cs0
Increment A	$F = A + 1$		
Decrement A	$F = A - 1$		
Add B to A	$F = A + B$		
Subtract B from A	$F = A - B$		

8. Suppose you are implementing a 4-bit ALU using 4-bit adder(s) (IC 7483). Explain how you can implement the overflow flag (OF). **[5 Marks]**

9. In the single-cycle MIPS implementation, you generally have separate instruction and data memory (cache). Now consider that suddenly the memory (cache) became so costly that you can only afford one. How will you change the implementation if you have only one memory (cache) for instruction and data? You are not required to draw any diagram. **[5 Marks]**

10. The single-cycle MIPS implementation below can only implement instructions like *lw, sw, add, sub, and, or, beq, j*.



You have to add a new instruction as follows:

Instruction: **LWI Rt, Rd(Rs)**

Interpretation: $\text{Reg}[\text{Rt}] = \text{Mem}[\text{Reg}[\text{Rd}] + \text{Reg}[\text{Rs}]]$

Which new functional blocks (if any) and control signals (if any) do we need for this instruction? Make the necessary changes to the implementation to support this new instruction. **[5 Marks]**