

United International University Department of Computer Science and Engineering

CSE 313: Computer Architecture

Mid Term Examination Set: A Time: 1 Hour 45 Minutes

- (a) Determine whether **overflow** occurs in the following **signed** operations in a 4-bit Computer Architecture with detailed calculations.
 - [3]

[4]

[2]

- (i) 8 (-2)
- (ii) 9 3
- (iii) -5 + (-6)
- (b) Show the detailed step of simulations for the **Optimized Multiplication Algorithm** for [3] the following multiplication: 110111×110001
- (c) You have to divide 1101 by 0101. Find out the content of Remainder Register after the Third step of the division algorithm that uses the following block diagram at Figure 1. Show all necessary calculations.

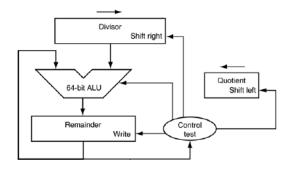


Figure 1: Division Algorithm Block Diagram

- (a) A given application written in Java runs 15 seconds on a desktop processor. A new Java compiler is released that requires only 0.6 as many instructions as the old compiler. Unfortunately, it increases the CPI by 1.1. Calculate how fast can we expect the application to run using this new compiler?
 - (b) Calculate the **Execution Time** of the program with the following instructions on a 2 GHz [3+2]processor.

	Arithmetic	Load	Store	Branch
$\overline{\text{IC}}$	50	110	80	16
CPI	1	1	4	2

We want to run the program 2 (two) times faster. Calculate how much we need to improve the **CPI** of **Arithmetic Instructions** for achieving the target.

- (c) Explain how has the **Power Wall** affected the computer designs. Write down the solution [2+1]that was implemented by Computer Architects to solve this crisis.
- [3] (a) A student of CSE, UIU has just learnt C programming who has no idea how the instructions of C programming are represented in memory. So he asked for your help. Your task is to convert the following C instructions into equivalent Machine Code in order to help your junior.

```
F = A + B - C;

Arr[20] = Arr[5] - F;
```

You **must use** the following Reference Table 1 for required opcode and funct codes.

Instruction	Op Code	Funct Code
ADD	0	32
SUB	0	34
LW	35	-
SW	85	-

Table 1: Instruction Reference

(b) Now imagine after knowing MIPS, he wants to have **similar structure** for both I-type and R-type instructions. Write down 2 (two) **problems** that he would face.

[5]

4. Consider the following code segments. Write down equivalent **MIPS code** for the following program.

```
int main()
{
    int n = 4, m = 5;
    int result = add(n, m);
    return 0;
}

int add(int n, int m)
{
    if(n == 0) return 0;
    else return m+add(n-1, m);
}
```