CSE340: Computer Architecture

Assignment 1
Chapter 1&2

Question - 1:

What do you understand by "**Performance Via Prediction**" in terms of computer architecture?

Question - 2:

 a. Explain Amdahl's Law in your own words.
 b. Can you relate/connect Amdahl's law with any of the design principles, mentioned below? Explain the reason with an example.

	Design Principle
1	Performance via Prediction
2	Performance via Pipelining
3	Make the common case faster
4	Use Abstraction to Simplify Design

Question - 3:

You work as a cost analyst for a semiconductor company that manufactures wafers. Your team is currently facing some challenges with pricing, as it seems that the production of each wafer is incurring a loss despite initial cost estimations.

Wafer and Die Specifications:
Each wafer has a radius of 50 cm. Each die on the wafer is 1 mm in height and 2 mm in width. The usable die rate per wafer, is estimated to be 65%.

Initial Cost per Die: After calculating the initial cost per die, you arrive at $5.095. Adding a fixed cost of $0.50, the total base cost per die is $5.595.

Cost per Wafer: The total cost for 1570 dies comes to $8,784.5, but after adjusting for yield, the effective cost per die increases to $7.83, bringing the adjusted total to $12,293.1.

Selling Price:
To cover costs and make a profit, the company plans to sell each die at its production cost plus an additional $5.
The Problem:

Despite this pricing strategy, the company is still experiencing a loss on each wafer produced.

Based on this scenario, what could be causing the loss? Are there additional factors in the wafer area, die area, or yield that might not be fully accounted for?

Question - 4:

We are building a calculator. Below is the program of the calculator app converted to assembly language,

Line No.	Instruction	Line No.	Instruction
1	add	10	sub ....
2	add	11	mul ....
3	add	12	sub ....
4	add	13	sub ....
5	mul	14	add ....
6	addi	15	addi ....
7	add	16	sub ....
8	add	17	mul ....

9	add	18	sub ....

CPI for add, sub, mul, and addi instructions are respectively 2, 3, 4, and 5. The duration of a clock cycle is 3s.

a. What is the total number of instructions in the above-mentioned program?

b. What is the execution time of this program?

c. What is the Clock rate?

d. If you want to make the system faster and you can only speed up one type of instruction, which instruction would you choose and why?

e. Suppose you want to reduce the current execution time by 1.2 times. What improvement factor would be required for the chosen instruction in question d?

Question - 5:

Given a machine code, what do we understand by looking at the **Opcode** field?

Question - 6:

Suppose you have converted LD X9, 10[X21] to its equivalent RISC-V machine code. Now based on which **field** machine will understand the size of the data being loaded into register X9?

Question - 7:

What is a Program Counter? Explain the importance of a Program Counter with example(s).

Question - 8:

```
if ( A[3] != A[6]){
    if (A[3] == 0) {
        A[3] = A[3] + 2;
    }else{
        A[6] = A[6] / 16;
    }
}else{
```

    A[6] = A[6] * 8
}

a) Construct the equivalent RISC-V code of the above mentioned C code.

b) Base addresses of array A and B are in register X20 and X21.
From your converted codes, pick any instruction from each of the three formats(R, I, S) and convert them into their corresponding binary values.