# CSD211: Computer Organization and Architecture
# Quiz-1

**Instructions:**

- This question paper contains four sections: Generic, Performance, Amdahl's Law, and Assembley code. You have to attempt **only one question from Performance, Amdahl's Law, and Assembley code section**.
- You have to write your answers in the provided space.
- There is no partial marking. It means only complete answers will be evaluated.

**Generic**

1. Flynn's Taxonomy are as following(2 marks):

2. Differentiate(4 marks)

| Complex Instruction Set Computer(CISC) | Reduced Instruction Set Computer(RISC) |
|---|---|

**Performance(5 marks each)**

1. Three processor making companies C1, C2 and C3 release modifications to the three major components (X, flushleftY and Z) of their processors to improve the execution time. The fraction of the total execution time utilized by a running application on X, Y and Z are 25%, 55% and20%, respectively. The speedup gained for the components X, Y and Z corresponding the individual companies are outlined below. Calculate the speedup obtained for the processors belonging to each individual companies. Rank the companies in terms of the speedup of their processors.

| Proccesor | X | Y | Z |
|---|---|---|---|
| C1 | 1.2 | 0.3 | 1.6 |
| C2 | 0.8 | 1.5 | 2.1 |
| C3 | 1.8 | 0.6 | 1.2 |

2. Let us assume that a system executes the following instruction mixes (ALU, Load, Branch,Store) with the associated CPI as shown in the table below. The clock frequency of the system is 1 GHz. A computer architect was assigned the task of improving the performance by re-designing the multiply unit of the processor. With the new multiplier design, the architect was able to bring down the CPI of the multiply instructions to 6, which was originally 8. How much overall performance improvement will be achieved after this modification given that the percentage of multiply instructions is 23% of all the ALU instructions?

| Type | X | Y |
|---|---|---|
| ALU | 47% | 6.7 |
| Load | 19% | 7.9 |
| Branch | 20% | 5.0 |
| Store | 14% | 7.1 |

Answer:

**Amdahl's Law(5 marks each)**

1. We are considering an enhancement to the high performance processor of a web server. The enhanced version of CPU is 25 times faster on search queries than the old processor. The Old processor is busy with search queries 70% of the time, what is the speedup gained by integrating the enchanced CPU?

2. Intel added a new floating point unit to the the power cpu. After modification in the circuit new CPU became 10 times faster. Limitation of the power is the I/O cound server which consumes 60% time for I/O. What will be the overall speed up of the system.

3. Memory operations currently take 30% of execution time. A new widget called a "cache" speeds up 80% of memory operations by a factor of 4. A second new widget called a "L2 cache" speeds up 1/2 the remaining 20% by a factor or 2. What is the total speed up?

Answer:

**Assembly Code(4 marks each)**

Given Program is written for the following expression:

$$X = (A - B) * (((C - D)/F)/G)$$

$$If(X == 0), P = \frac{(X + Y) * (Z + 2Y)}{(K * X)} else, P = \frac{X * (Z - K)}{(Z + 2X)} \quad (1)$$

1. Re-write the code and minimize the number of registers that can be used to represent them individually. You can use registers used in the 1st expression again in the 2nd and 3rd also.
2. Try to reduce the number of lines in code without violating the logic.
3. Replace MVI in line 15 with a command that will do a similar operation i.e., (2Y)

Listing 1: 8085 Code

```
1      SUB R1, A, B        Answer:
2      SUB R2, C, D
3      DIV R3, R2, F
4      DIV R4, R3, G
5      MUL X, R1, R4
6      CMP X, #0
7      JE L1
8      SUB R, Z, K
9      MUL R2, R1, X
10     MUL R3, X, #2
11     ADD R4, Z, R3
12     DIV R5, R2, R4
13     MOV P, R5
14     HLT
15 L1: ADD R2, X, Y
16     MVI R3, #2
17     MUL R4, R3, Y
18     ADD R4, R4, Z
19     MUL R5, R2, R4
20     MUL R6, K, X
21     DIV R7, R5, R6
22     MOV P, R7
23     HLT
```