# CSC 325: Computer Organization & Assembly Language – FALL 2022

## Assignment No.04

**Class / Instructor:** BCS - 6 / Taimur Shahzad

**Deadline:** January 02, 2023 **Max. Marks:** 15

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**1- [CLO-4]** Suppose there is a wristwatch with an embedded computer system. Since the computer is tiny and only provides a few features, it has a very slow clock which runs at 2kHz. What is the cycle time for this system in seconds?

**2- [CLO-4]** Consider two machines X and Y. Machine X runs at 150 MHz while Machine Y runs at 250 MHz. Suppose we have divided the instruction set into four classes of instructions each of which takes different number of cycles to execute as given below:

| Class | Machine X | Machine Y |
|---|---|---|
| A | 5 | 5 |
| B | 8 | 9 |
| C | 6 | 7 |
| D | 9 | 3 |

Consider a program that requires 15 instructions belonging to class A, 10 belonging to class B, 18 belonging to C and 23 belonging to class D to complete its execution. Which machine will execute the program faster?

**3- [CLO-4]** Assume that a certain program is made up of 50% arithmetic instructions, 20% loads and stores, 20% jumps, and 10% other instructions. If arithmetic operations take 8 cycles, loads and stores take 10 cycles, jumps take 6 cycles and others take 4 cycles, what is the average clock cycles per instruction (CPI)?

**4- [CLO-4]** Suppose a program with 3,200,000 instructions is to be executed on a computer with a clock that runs at 1.6 GHz. How long will the program take if:

a) the average CPI is 4 cycles?
b) the average CPI is 20 cycles?

**6- [CLO-4]** Consider the following specs for a direct mapped cache:

- The cache holds 16K bytes of data
- Each block holds 32 bytes of data
- Physical addresses are 32 bits long

How many bits for tag, line no, and offset are needed to support references to this cache?

**7- [CLO-4]** Suppose you have a pipelined machine with a 5-stage pipeline and a program with 1000 instructions is to be executed on it. If each stage of a pipeline takes 1 cycle, what is the speedup gained by pipelining compared to execution of the program on the same machine without the pipelining?