**COMP 305-Computer Organization - 2022 Midterm Exam**

**Q1.** CPU Time of an application during the execution is calculated by the following formula:



There are two computers; CompA and CompB with 3GHz and 2GHz clock frequencies respectively. These computers are using the same ISA but different compilers. There are two types of instructions in the given ISA, TypeA and TypeB. In the table below, for an application compiled for CompA and CompB, the instruction distribution and number of cycles to execute each type of instruction is given. Find which computer executes the given application faster and what is its speedup compared to the other computer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | CompA | | CompB | |
|  | CPI | #instructions | CPI | #instructions |
| TypeA | 1 | 50000 | 2 | 60000 |
| TypeB | 10 | 10000 | 5 | 1000 |

**Q2)** What is the compiled versions of the following code in MIPS? (Note that i is in x1, k is in x2 and the base address of Array is in x3)

while ( i != 0){

k = Array[i];

i--;

Array[i] = k+1;

i--;

}

**Q3.** Convert given RISC-V instructions to binary format.

a) slli x2, x1, 4

b) ld x2, 16(x3)

c) jalr x0, 0(x1)

d) bne x9, x24, loop # The value of loop is 1024 in decimal

e) sub x1, x1, x2

**Q4.** Draw the abstract figure of a microprocessor which executes only add, ld, sd instructions in RISC-V ISA. The microprocessor should implement following steps.

* Take the next instruction from instruction memory by using the address of the instruction
* Calculate the address of the next instruction (Note that there is no branch operation)
* Take the source operands from the register file or from the instruction
* Make the calculation in ALU
* Access memory for loading/storing data with the correct information
* Update register file with the result