

CPU Performance

A clock cycle is a single tick of the CPU's internal clock, during which a basic instruction can be carried out. The CPU uses this regular pulse to synchronize and control the execution of instructions.

Clock Period: The time duration of one cycle

Clock Frequency: How many cycles occur per second

CPU Time = amount of CPU clock cycles \times Clock Cycle Time (Period)

CPU Time = amount of CPU clock cycles / Clock Rate (Frequency)

Execution Time is further defined by instruction count, the total number of instructions a program executes, and Cycles Per Instruction (CPI). The CPI reflects how different instructions consume varied cycles, which reflects the CPU's design, and is affected by the instruction mix (proportion of different types of instructions)

The computation of CPU performance involves the equation:

CPU Time = Instruction Count \times CPI \times Clock Cycle

This formula is important because it connects various core components of Performance, offering insight into how efficiency can be optimized.

Components of performance include:

- **Instruction Count:** The number of instructions executed by the CPU.
- **Clock Cycle:** Typically documented as part of system specifications, it defines the duration of one cycle of clock events in the CPU.
- **Cycles Per Instruction (CPI):** An average measurement reflecting the mean number of cycles taken per instruction. This depends largely on instruction mix, which is the frequency and type combination of instructions being executed.

CPI in more detail highlights the weighted average where each instruction types frequency and cycle cost contribute to the overall CPI.

CPI Example

Alternative compiled code sequences using instructions in classes A, B, C

Class	A	B	C
CPI for class	1	2	3
IC in sequence 1	2	1	2
IC in sequence 2	4	1	1

Sequence 1: IC = 5

Sequence 2: IC = 6

Clock Cycles

Clock Cycles

$= 2 \times 1 + 1 \times 2 + 2 \times 2$

$= 4 \times 1 + 1 \times 2 + 1 \times 2$