30-6-2020

The Role of performance:

1. **Response time:** Also called execution time. The total time required for the computer to complete a task including disk access, memory accesses, I/O activities, operating system overhead CPU execution time, and so on.

2. **throughput:** Also called bandwidth. Another measure of performance, it is the number of tasks completed per unit time. একটা sheet prit আছে। দেখব $\boxed{ST1}$

3. **Relative performance:** comparison between 2 or more computer's speed of program execution.

4. **Measuring Execution time:**

5. **CPU time:** Also called CPU time. The actual time the CPU spends computing for a specific task.

6. **CPU clocking, instruction count and CPI:**

Defination

Now কিছু বিষয়ঃ

CPU execution time: Also called CPU time.

The actual time the CPU spends computing for a specific task.

User CPU time: The CPU time spent in a program itself

System CPU time:

The CPU time spent in the operating system performing tasks on behalf of the program.

clock cycle: (Also called tick, clock tick, clock period, clock, or cycle.)

clock cycle is the time for one clock period, usually of the processor clock, which runs at a constant rate.

clock period: The length of clock cycle.

Computer performance (time এর দিক থেকে ধরে)

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Based on Equation I: to improve performance one can either:

1. reduce the number of cycles for a program

or,

2. reduce the clock cycle time, or, equivalently,

3. increase the clock rate

Execution Time: counts everything from start to finish.

elapsed time = CPU time + wait time (I/O, other program)

CPU time = user CPU time + system CPU time

Our focus: User CPU time or CPU execution time or, simply, execution time

5-7-2020

Definition of performance : Time is the measure of computer performance. The computer that performs the same amount of work in the least time is the fastest.

উদা:

1. $$\text{performance}_X = \frac{1}{\text{Execution time}}$$

Now let, $\text{performance}_x > \text{performance}_y$

$$\therefore \frac{1}{\text{Execution time}_x} > \frac{1}{\text{Execution time}_y}$$

Example math: 1

Q. If Afia's computer runs a program in 10 seconds and Tahmid's computer runs the same program in 15 seconds, whose computer is faster by how much?

Ans:

$$performance_A = \frac{1}{10} = 0.1$$

$$performance_T = \frac{1}{15} = 0.0666$$

Afia's computer faster by $= \frac{0.1}{0.0666} = 1.5$ times.

Clock cycles

is a sequence of cycles.

$$\frac{\text{seconds}}{\text{program}} = \frac{\text{cycles}}{\text{program}} \times \frac{\text{seconds}}{\text{cycle}}$$

clock rate (Hz, MHz, GHz, cycles per second)

cycle time/ clock cycle time (seconds per cycle)

$1\,MHz = 10^6\,Hz$ | $1\,Hz = 10^{-6}\,MHz$

$1\,GHz = 10^9\,Hz$ | $1\,Hz = 10^{-9}\,GHz$

$1\,\text{second} = 10^9$ nanoseconds | $1\,\text{sec} = 10^3$ Millisecond

<u>Example:</u> $1\,MHz = 10^6\,Hz$ or 10^6 cycles/sec

$$200\,MHz = \frac{1}{200 \times 10^6} \times 10^9 = 5 \text{ nanoseconds}$$

nano convention.

Performane Equation I :

$$\text{CPU execution time for a program} = \text{CPU clock cycles for a program} \times \text{clock cycle time}$$

$$= \frac{\text{CPU clock cycle for a program}}{\text{clock rate}} .$$

How many cycles are required for a program? sheet 3 lecture 2-ও
আমার আছে।

Example Math 2: Our favorite program runs in 10 sec
cpu time
on computer A, which has a 400 Mhz clock
Clock rate
We are trying to help a computer designer build a new machine B, that will run this program in 6 seconds. The designer can use new
cpu time
technology to substantially increase the clock rate, but has informed us that this increase will affect the rest of the CPU design, causing machine B to require 1.2 times as many clock cycles as machine A for the same program. What clock rate should be?

Ans: $\text{cpu time}_A = 10 \text{ sec}$

$\text{clock rate}_A = 400 \text{Mhz}$

Eq 1 공식 4.

$$10 = \frac{\text{cpu clock cycles}_A}{400 \times 10^6}$$

$\text{cpu clock cycles}_A = 4 \times 10^9$

cpu time B = 6 sec

$\therefore \text{clock cycles}_B = 1.2 \times \text{clock cycle}_A$

$$\therefore \text{clock rate} = \frac{1.2 \times 4 \times 10^9}{6}$$

Eq 1 공식 4

$= 800 \times 10^6 \text{ Hz}$

$= 800 \text{ Mhz}$

Instruction Performance:

CPU clock cycles = Instruction for a program × Average clock cycles per Instruction

Instruction for a program → Tota number of instructions

Average clock cycles per Instruction → CPI

We know from Eq 1,

CPU time = CPU clock cycles × cycle time

CPI (clock cycles per instruction CPI):

Average number of clock cycles per instruction for a program or program fragment.

instruction count: The number of instructions executed by the program.

Example 3: Suppose we have two implementations of the same instruction set architecture. Computer A has a clock cycle time of 250 ps and a CPI of 2.0 for some program, and computer B has a clock cycle time of 500 ps and a CPI of 1.2 for the same program. Which computer is faster for this program and by how much?

Ans: we know, CPU clock cycles = Instruction for a program × CPI

$$\text{CPU clock cycles}_A = I \times 2.0$$

$$\text{CPU clock cycles}_B = I \times 1.2$$

we again know,

$$\text{CPU time} = \text{CPU clock cycles} \times \text{clock cycle time}$$

$$\text{CPU time}_A = I \times 2 \times 250 = (500I) \text{ sec}$$

$$\text{CPU time}_B = I \times 1.2 \times 500 = (600I) \text{ sec}$$

$$\therefore \frac{\text{CPU performance}_A}{\text{CPU performance}_B} = \frac{600I}{500I} = 1.2$$

$\therefore$ computer A 1.2 times faster.

CPI finding Math sheet থেকে দেখো

সূত্র : $CPI = \dfrac{\text{CPU clock cycles}}{\text{Instruction count}}$