

# Computer Architecture

Fall, 2017

Week 2

2017.09.18

[group12]

1.

$$\text{CPUTime} = \frac{\text{Instruct.Count} \times \text{CPI}}{\text{ClockRate}}$$

而這三個係數的會受到下列哪些因素影響？

有影響的請畫(O)。

|                        | <b>Clock Rate</b> | <b>Instruction Count</b> | <b>CPI</b> |
|------------------------|-------------------|--------------------------|------------|
| <b>Instruction Set</b> | —                 | —                        | —          |
| <b>Program</b>         | —                 | —                        | —          |
| <b>Compiler</b>        | —                 | —                        | —          |
| <b>Technology</b>      | —                 | —                        | —          |
| <b>Organization</b>    | —                 | —                        | —          |

解答：

|                        | <b>Clock Rate</b> | <b>Instruction Count</b> | <b>CPI</b> |
|------------------------|-------------------|--------------------------|------------|
| <b>Instruction Set</b> | X                 | <u>X</u>                 | <u>X</u>   |
| <b>Program</b>         | —                 | <u>X</u>                 | <u>X</u>   |
| <b>Compiler</b>        | —                 | <u>X</u>                 | <u>X</u>   |
| <b>Technology</b>      | <u>X</u>          | —                        | —          |
| <b>Organization</b>    | <u>X</u>          | —                        | <u>X</u>   |

[group4]

2.

2. What is the difference between a general-purpose computer and an embedded computer system?

Solution:

They differentiate according of their purpose. General purpose computers are designed to perform many operations, and those operations can be reconfigured for a new different purpose, an embedded system in the other hand is meant to be for some specific predefined task.

[group13]

3.

1. 衡量電腦效能有哪兩個常用的指標？其意義為何？如果更換更快的 CPU 以及增加更多的 CPU 分別對這兩個指標有何影響？

答：

Response Time：完成一個工作所需的時間。

Throughput：單位時間所能完成的工作。

更換更快的 CPU 能縮短 Response Time，也能增加 Throughput；

增加更多 CPU 能增加 Throughput，但是不一定能減少 Response Time

[group9]

4.

QUESTION 2:

Put the following things into three kinds of computer.

1.PC

2.SERVERS

3.EMBEDDED COMPUTER

(A)Personal Digital Assistants

(B)microprocessor

(C)CD PLAYER

(D )washing machine

(E)Laptop

(F)Amazon server

(G)supercomputers

ANS:

1.PC

(E)Laptop

2.SERVERS

(F)Amazon server

(G)supercomputers

3.EMBEDDED COMPUTER

(A)Personal Digital Assistants

(B)microprocessor

(C)CD PLAYER

(D )washing machine

[group1]

5.

Q1:已知某 processor 執行某特定工作時費時 0.5s，若該項工作包含  $4 \times 10^9$  個 Instruction，且平均 CPI 為 1.25，試問：clock rate 為多少？如果有一方法可以使執行時間縮減為原來的一半，但卻會使原本的工作量增加 1.5 倍，那新的 clock cycle time 會是原來的多少倍？

A: 10GHZ

1/3

[group6]

6.

Question1:

Marissa is currently comparing 2 phones, one is Xiaomi Note 2 and the other one is OnePlus 5. She looked up the review for each phone on cnet.com and compared each of them. For Xiaomi Note 2, it's written on the web that it has Octa-core 2.0 GHz Cortex-A53 processor. Then, she tried a small experiment by inputting a complicated equation in the scientific calculator application in the phone and it took 3 seconds to finish the calculation. On the other hand, for OnePlus 5, it's written that it has 2GHz octa-core processor and half of Xiaomi Note 2 Clock Cycle. Since she wants a faster phone, help her decide which phone is suitable for her.

Ans1:

$CPU\ TIME_{(OnePlus\ 5)} = 1.5s$

Therefore, OnePlus 5 is much faster than Xiaomi Note 2 by 1.5 seconds.

[group8]

7.

Q1: Two processors A and B have clock frequencies of 900 Mhz and 1100 Mhz respectively. Suppose A can execute an instruction with an average of 7 clocks and B can execute with an average of 9 clocks. For the execution of the same instruction which processor is faster ?

- a) A
- b) B
- c) Both take the same time
- d) Insufficient information

Answer: a

[group10]

8.

1

問：一隻程式在一台有 2 顆 CPU 的電腦上執行，第一顆 CPU 花了 A 個 cycle，第二顆 CPU 花了 B 個 cycle（平行執行），CPU 的頻率為 x，請問這隻程式的 CPU time 是幾秒？

答： $(A+B)/x$

[group12]

**9.**

Problem 2:

Suppose that we are considering an enhancement that runs 10 times faster than the original machine but is usable only 40% of the time. What is the overall speedup gained by incorporating the enhancement?

Ans:  $1/0.64$

[group14]

**10.**

Q :

PPT 中的摩爾定律數據圖的資料只統計到 2000 年，那摩爾定律到未來依舊適用嗎？

A :

雖然摩爾定律成功預測了 20 世紀後半的 IC 產出量，但隨著電晶體越做越小，其受到的物理限制便越加明顯。

電晶體變小，閘極也會變小，越接近奈米尺度，量子穿隧(quantum tunneling)就越容易發生，導致漏電流或是損毀閘極。

另外，緊密排列的電晶體也容易產生寄生電容，可能使元件的反應不如預期。因此，我們認為摩爾定律不能再以 18 個月為界定，還必須考慮各方面的限制。