COMPUTER SCIENCE
(CH01 to 02 – Basic & Intro)

A – Why using Machines ?

Human cannot handle too simple but tedious and repetitive jobs (太簡單但乏味與重複又重複的工作). Please refer to the movie: Modern Times, Charlie Chaplin (差利·卓別靈的電影: 《摩登時代》) got mental break down due to the doing the repetitive jobs in a factory.

B - What is a computer ?

It comes from the word “Compute”, and it means to calculate, it has 3 general purposes:

1. Data processing – A lot of records to be sorted, it is tedious work. Data processing also involves searching, it will be very difficult if doing it manually. E.g.: A airline or student database.

ID	NAME	CLASS	MARK	GENDER
1	John Deo	Four	75	female
2	Max Ruin	Three	85	male
3	Arnold	Three	55	male
4	Krish Star	Four	60	female
5	John Mike	Four	60	female
6	Alex John	Four	55	male
7	My John Rob	Five	78	male
8	Asruid	Five	85	male
9	Tes Qry	Six	78	male
10	Big John	Four	55	female

2. High Speed Calculation – E.g.: to control the fuel flows (must be in synch.) for a rocket with multiple boosters, e.g.: Saturn V Rocket (土星 5 號火箭).

3. Storing data, we need to store the results e.g.: SD cards, Hard Disks and Magnetic Tapes

Backup Storage Tape Drive & Tape

SD Cards & SSD

3.5” SATA Hard Disk (Desktop)

C - Overview of Computer Generations

1st Generation - Vacuum Tubes (真空管): These rudimentary components were the heart of the first generation of computers, forming the essential building blocks of computation.

2nd Generation – Transistors (電晶體; 俗稱: 原子粒): Far more efficient than vacuum tubes, transistors brought about a significant advance in computing technology, commonly known as atomic particles.

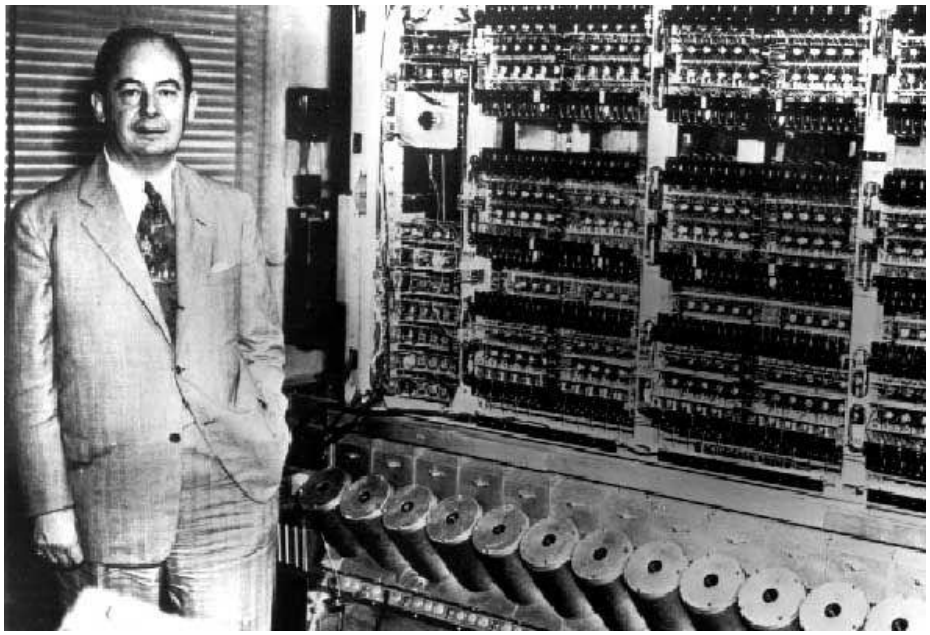
3rd Generation - Silicon Chips (矽片/晶片): These small, thin pieces of material served as the foundation for electronic devices, ushering in a new era of miniaturization & increased power.

4th Generation - Advanced Silicon Chips: This period saw the creation of Integrated Circuits (ICs 集成電路), Very High-Speed Integrated Circuits (VHSICs 超高速集成電路), Microprocessors (微形處理器), a major leap in computing capability and speed.

5th Generation - This era features the advancements of the fourth generation, integrated with Artificial Intelligence, and the melding of Von Neumann and Parallel Architectures.

The primary objectives driving the development of these technologies are to create computers that are increasingly compact, faster, more intelligent, and more energy efficient.

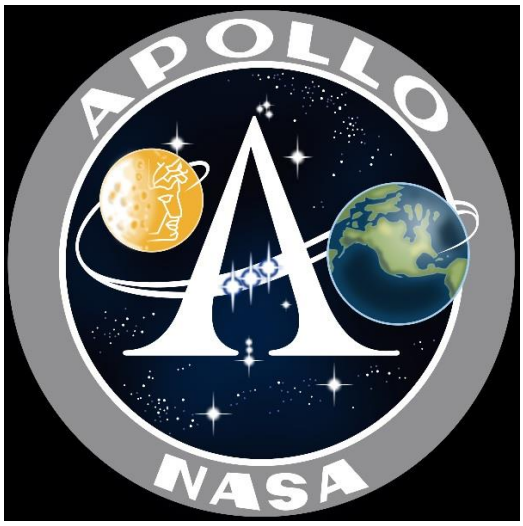
D – John Von Neumann (The Pioneer of Modern Computer)



Mr. John Von Neumann & the very first electronic computer (ENIAC)

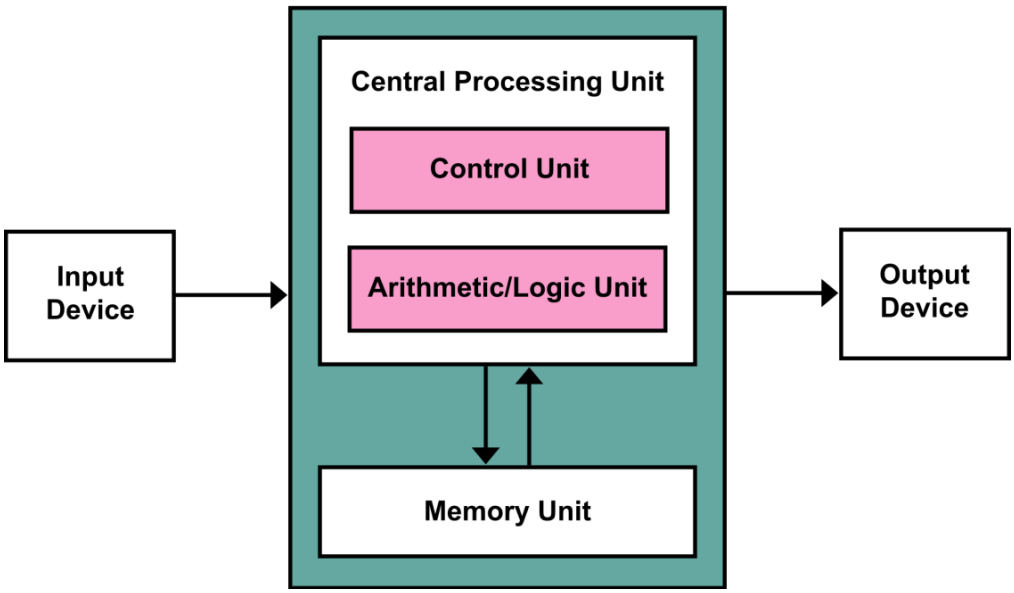
John Von Neumann (約翰·馮紐曼; pronounces as: Von Noi Man) is a Hungarian scientist, and he designed the modern computer architecture or the hardware standard. What kind of a components or parts (組件) should have inside of computers? Very Often people called John Neumann as the father of modern computers

E – Another Famous Modern Scientist



Names with the word: "Von" usually comes from Germany, Austria, or Hungary, e.g.: Dr. Wernher Von Braun (華納·馮布朗), Saturn 5 Rocket Designer in the Apollo Project.

F - Von Neumann Machine/ Architecture (馮紐曼機器或馮紐曼架構)



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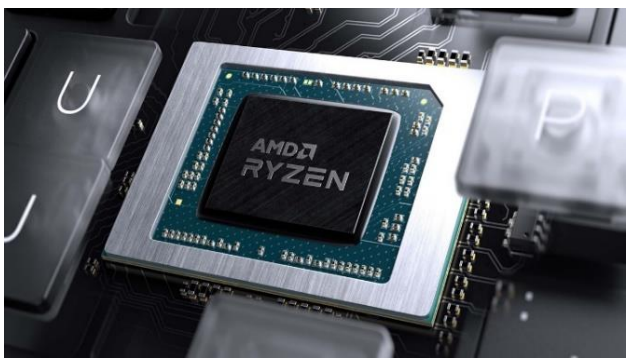
1. Input units (輸入裝置) – A device or hardware to accept data, e.g.: Keyboard, Mouse, and Joystick (game controller) etc.

2. Output units (輸出裝置) – A device or hardware to send out data, E.g. Monitor (screen), printer and speaker etc. I/O is the abbreviation of inputs and outputs.

3. ALU (算術與邏輯單元) – It stands for Arithmetic and Logic Unit, it is inside of a CPU (Central Process Unit; 中央處理器), it has 2 major functions:

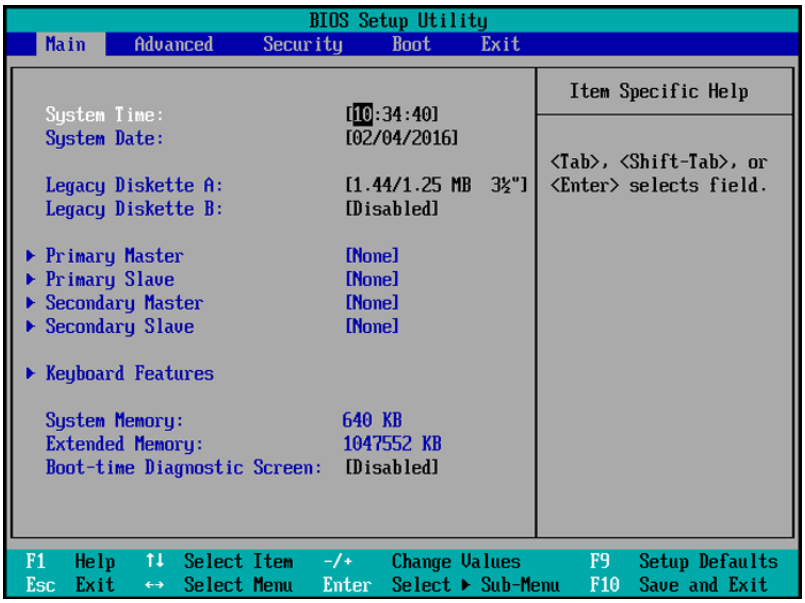
   i. In Logic - print (10 < 2); **Output: False**

   ii. In Mathematic - print (10 + 5); **Output: 15**

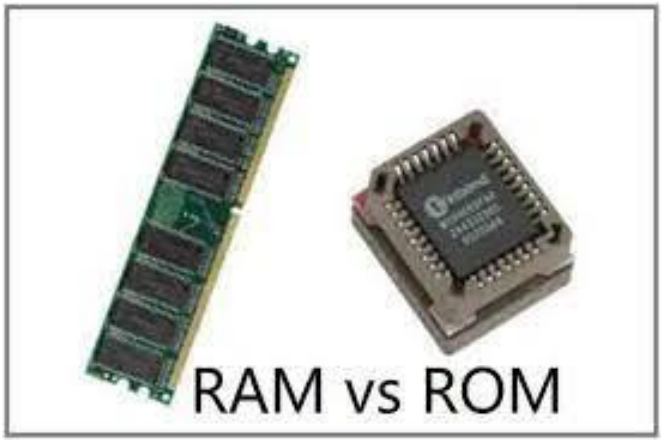


4. Memory unit (記憶體) – There are 3 major kinds:

   i. ROM (唯讀記憶體) - It stands for Read Only Memory, where the System Software are stored.



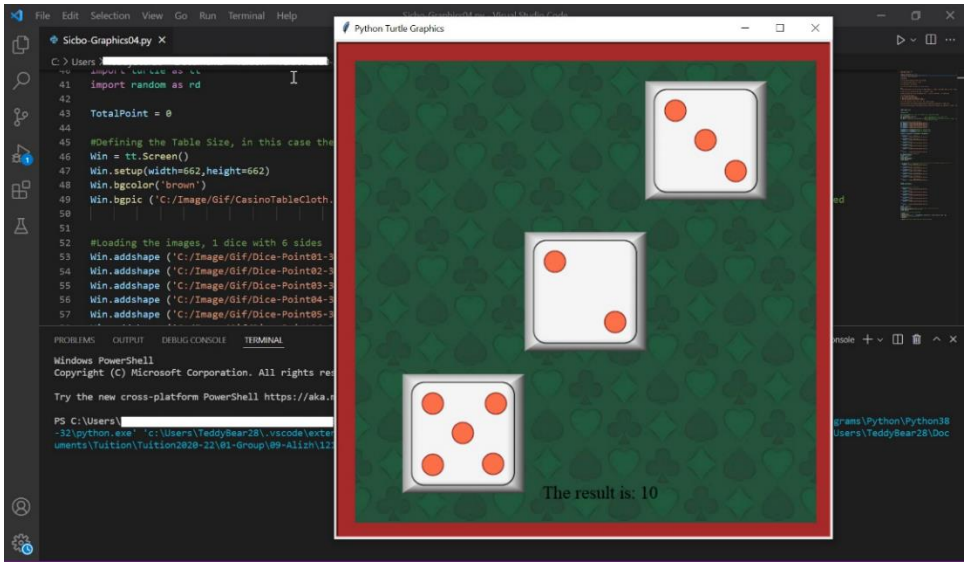
   ii. RAM (隨機存取記憶體) – It stands for Random Access Memory, it is used to as temporary storage because RAM is much faster than direct access files from Secondary Storage, RAM however volatile, it means the memory will be gone when the power is off, so remember to save your work before shutting your computer. E.g.: 16GB, 32GB and 64GB.



   iii. Secondary Storage (輔助儲存體) - Sometimes known as Auxiliary Memory (輔助記憶體), e.g.: HDD, Magnetic Tape & SSD etc., please refer page 2.

G – What is Software Development & Why ?

Computers are dumb or useless without software or programs, software development involves programming and coding. **If we say, "Hardware" is the body, then "Software" is like the soul (如果說:《硬件》是身體，接著的《軟件》就是靈魂。).**



*A **Sic Bo** (骰寶) game (sometimes known as **Large or Small**), written in Python.*

Note: I frequently utilize the Sic Bo (a graphics-based game) as a project within my Computer Science Tuition course. The creation of a game like this encompasses three distinct areas of expertise:

1. Mathematics - Particularly the concept of Probability, which is central to the workings of any game of chance.

2. Programming - Python serves as our language of choice due to its versatility and simplicity, making it ideal for a wide range of applications, including game development.

3. Multimedia - The creation of game elements, such as the dice and casino table, requires understanding and proficiency in multimedia design and manipulation.

H – Python

Python will be used as a teaching tool, it a high-level and sophisticated computer language which is widely used in AI and Data Analysis areas.

Also, Python comes with many different packages, such as: Math, Matplotlib, Numpy, Pygame and Panda etc. etc. I will provide more information in the later chapters.

I – Python Mathematical Operators

Operator	Name/ Description	Syntax
+	Addition	x + y
-	Subtraction	x – y
*	Multiplication (Astra symbol)	x * y
/	Division (Forward Slash symbol)	x / y
%	Modulus (o get the remainder)	x % y
**	Exponentiation (power)	x ** y
//	Floor division	x // y

J – Python Simple Operations

1. Direct Command vs Computer Program:

```
print (35000 * 13)  #Yearly salary
```

Output: 455,000

```
monthly_salary = 35000 # variables have meaning names &
num_of_month = 13      # used underscore (_) to separate them
print (monthly_salary * num_of_month) #Yearly salary
```

Output: 455,000

2. Other Samples:

```
# E.g. 1 (Floor Division)
x = 15
y = 2
print(x // y) # To truncate the Quotient
```

Output: 7 it is like truncation; the sys removes the 0.5

```
# E.g. 2 (Modulus Calculation):
x = 15
y = 2
print(x % y) # To calculate remainder
```

Output: 1

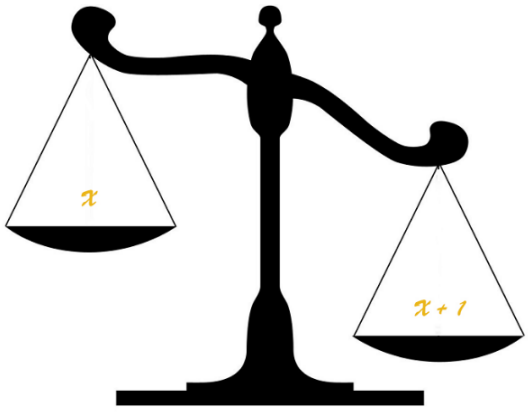
```
# E.g. 3 (Power Calculation):
base = 2
power = 3
print(base ** power) # It means 2 to the power 3

Output: 8
```

Note: We use (#, we call that Harsh or Sharp) to comment a statement, this internal documentation.

K – Assign vs Equal

In Mathematical point of view:

x = 1	It makes sense
x = x +1	It does NOT make sense



However, in a programing point of view, it makes sense.

```
x = 1
x = x +1 # It means it is a counter.
```

The value of x increases according to time, for instance if x is a stopwatch counter, x = x + 1 could mean second = second + 1

To assign a value into a variable:

1. In Pseudocode, we use the arrow sign (←)
2. In Pascal, we use the column & equal signs (:=)
3. In Python, we use equal (=) for assigning a value and double equal (==) for comparison, please refer to the following programs:

```
# E.g. 1:

x = 6   # It is like to put no. 6 into a carton box called: x
y = 7

if x == y:
   print ("x & y have the same value.")
else:
   print ("x & y have the different value.")
```

Output: x & y have the different value.

```
# E.g. 2:

a = 6
b = 7
print (a == b)
```

Output: False

L – Suggested Programming Style

```
#Name: <Your Name>

# Language used: Python ver. 3.8.6
# O/S used: Windows 10 (64 Bit)
# File Name(s): <program_name>.py

# Program Desc: <Describe what the program does >

# To make the output screen tidy
import os         #To use O/S package and in this case is Win Dos
os.system('cls')  #To clear screen, Win Dos = cls and Linux = Clear
```