Chapter 1: Introduction to general computing

1. Definitions

1.1. INFORMATIC

The term INFORMATIC is a term resulting from the contraction of the two words "Information" and "automatic".

We have two main concepts:

a) ***Automatic processing*:** It represents the sequence of operations (instructions) performed by software (program).

Instruction: (or command): Order given by the user (or Program) to the computer.

Example : in Microsoft Word changing the size of a text is an operation (It's automatic processing).

b) ***Information*:** means anything that can be processed by a machine (computer). In other words, the facts and knowledge deduced from the data

Data: Is the processed information.

Example:text, number, image, sounds, video…

➢ So, computer science is the science of automatic processing of information using automatic machines (computers).

1.2.Computer

A computer is an automatic (programmable) information processing machine. It can process various types of information (texts, drawings, images, sounds) but internally all this information is converted into digital form.

2. Representation of information

- All communications inside the computer are done with electrical signals
- These electrical signals have only two states:
  - 0: off (no electrical signal).
  - 1: on (presence of electrical signal).
- So the computer manipulates information in binary form
- A unit of information (0 or 1) is called **a bit** (**b**inary dig**it**).

Why binary digits?

a) ***Decimal system:*** It's a base 10 number system.

- ✓ Origin: ten fingers in the hands
- ✓ Representation: 10 different symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Example: representation of a number (580):

5 hundreds, 8 tens, 0 ones

Math equivalent: $\mathbf{5} * 10^2 + \mathbf{8} * 10^1 + \mathbf{0} * 10^0$

b) ***The Binary System:*** It is a base 2 number system.

- easier and more reliable to read an electrical signal
- representation: two states **0** (false) and **1** (true)

Example : representation of number 6 : **110**

Mathematical equivalent: $\mathbf{1} * 2^2 + \mathbf{1} * 2^1 + \mathbf{0} * 2^0$

Some Conversions:

Decimal	binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101

So the representation of a character = the combination of several bits. The most used combination is that corresponding to 8 bits witch call **byte**.

3. Computer system

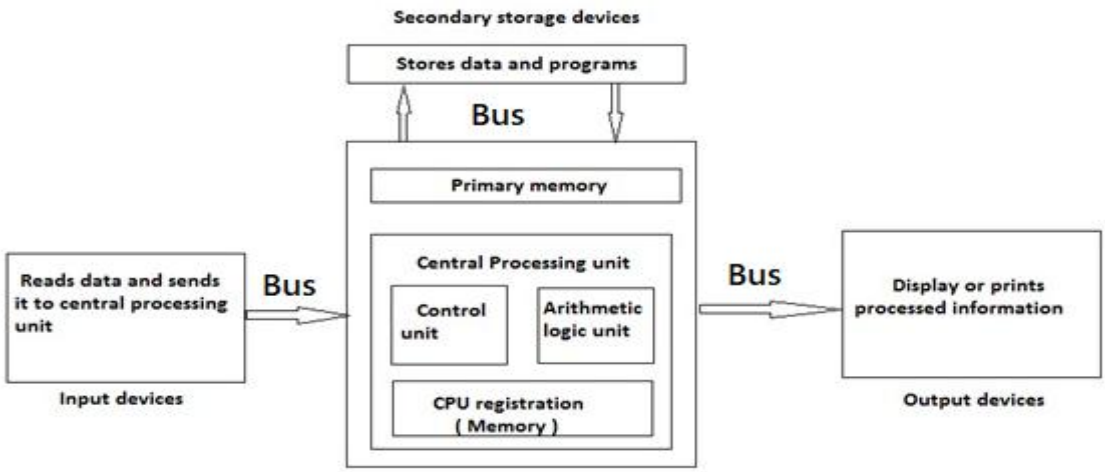
This is the set of software and hardware means necessary to meet the computer needs of users.

A computer system is made of two parts: Hardware and Software.

3.1. Hardware:

It is all the hardware that makes up the computer and its peripherals.

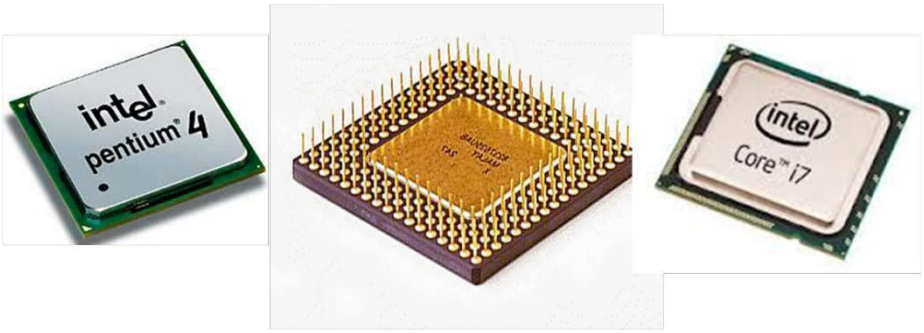
All current computers are based on the following Von Neumann model (1903-1957):



a) Central unity :

The central unit consists of a processor and a primary memory:

➢ **The processor (central processing unit):**it is the "brain" of the computer. its role is to execute the programs stored in central memory by loading the instructions, decoding them and executing them one after the other.



The processor mainly comprises a command and control unit (CCU) and an arithmetic logic unit (ALU):

✓ **Control Unit (CU):** It is the intelligent part of the microprocessor. It makes it possible to seek the instructions of a program located in the RAM memory, to interpret them and then to route the data to the ALU in order to process them.

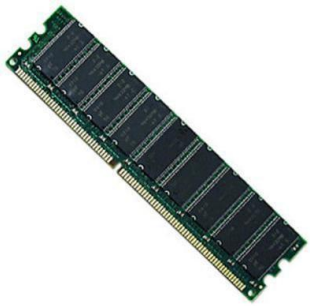
✓ **Arithmetic Logic Unit (ALU):**It is made up of a set of circuits (memory registers) responsible for performing arithmetic operations (addition, subtraction, multiplication, division) and logical operations.

➢ **Main memory:** The primary memory is a basic component of the computer, without which any functioning becomes impossible. Its role is to store the data before and during their processing by the processor.

There are essentially 02 types of internal memories:

✓ ROM (Read Only Memory): is a dead and non-volatile memory that can only be read. it contains information needed to start the computer.

✓ RAM (Random Access Memory): is a random access memory (in which the processor can read and write) and volatile (empty when the computer is turned off). it contains the programs and data being processed.



➢ The capacity of a memory can be measured in the number of bytes available such as:

Unit	Symbol	Value
1 byte	(o)	8 bit ($8 = 2^3$)
1 kilobyte	(KB)	2^{10}bytes = 1024 bytes
1 Megabyte	(MB)	1024 kilobytes
1 gigabyte	(GB)	1024 Megabytes

b) Secondary or auxiliary memories:

Are storage media that are used to permanently store information (they keep the information even in the absence of electric current). Unlike main memory, secondary memories are slow. To do this, an existing program on the hard disk must be loaded into central memory to be executed.

Examples:hard drive, floppy disk,The disk blank, and the CD-ROM… c)
Peripherals:

Are the organs of the computer allowing it to communicate with the outside. There are 03 types of peripherals:

➢ Input Devices: allow the computer to receive information (keyboard, mouse, microphone, scanner, etc.)

➢ Output devices: provide information to the computer (screen, printer, burner, plotter, speaker, etc.)

➢ Input/output peripherals: allow the computer to exchange information in both directions (floppy disk drive, modem, etc.)

d) The buses:

A bus is a set of electrical lines allowing the transmission of signals (information) between the various components of the computer.

3.2. The software :(software):

The automatic processing of information or data by computer is based on tools called Software (or programs).

a) **Computer program:** A computer program is a list of commands telling a computer what it should do. It comes in the form of one or more sequences of instructions, which must be executed in a certain order by aprocessor.
Example: program that calculate an average, password checking program…

b) **Software:** Set of programs and data that cooperate with each other to provide a service to the user.
Two types of Software are installed on a computer:

- **Basic software (operating system):** set of programs which manages the operation of the microcomputer with respect to its peripherals and which provides a "bridge" between the user and the physical machine
  Examples: MS-DOS, Windows, Mac-OS, Linux, etc.
- **Application software (application programs):**Programs that perform tasks that users expect from computers, these are programs developed usually by software companies (groups of engineers) or by users themselves (in the case of simple programs).
  Examples:
  - Office software: Word processing (Word), Spreadsheet (Excel)…
  - Messaging and communication software via a network, the Internet.
  - Programming software: Dev C++, Eclipse (for Java), Delphi, etc.

4. Computer languages

In order to be able to communicate with a computer, developers designed several ***programming languages***, without it, we will not be able to manipulate a computer or transmit instructions to it. There are several classifications of its languages, but the one we are interested in is the following:

4.1. Machine language

Machine language also called binary language, it is with this language that computers work. It consists of using two states (represented by the numbers 0 and 1) to encode information (text, images, sound, etc.)

In machine language, the programmer must enter every command and all data in binary form.

Example: 11001010 00010111 11110101 00101011. (Instruction in ***machine language*****).**

4.2. Assembly language

*assembly language*is a low-level language close to machine language which can be directly interpreted by the computer's microprocessor while remaining readable by a human being.

The assembler was created to facilitate the work of programmers. It consists in representing the combinations of bits used in binary language by easy-to-remember symbols: each instruction expressed in machine language, the programmer coding his programs in assembly language, these are then transcribed by software called assembler in machine language, then executed by the computer.

Example :

MOV AX, 5 **(instruction1 in assembly language)**

ADD DX, 1 **(instruction2 in assembly language)**

4.3. Evolved language (high level language)

We designate by evolved language all the languages being situated above the low level languages (machine language, assembler). The high level language is a language that accomplishes a lot for a minimum of code and programming effort, there is a whole package of them , we cite as an example: Pascal, Java, C, C++, C#, Visual Basic (or VB), Delphi, Python, Perl, PHP, JavaScript, VBscript, ASP …etc.

These languages are called advanced because they hide the complexity of programming. Unlike assembly language which is very close to machine language, they offer layers that make the hardware abstract; to write Internet messaging software, you don't need to know the brand of the network card or the modem. Another thing the assembler does not use advanced structures such as loops (while, for) and conditions (if, switch), but it constitutes an integral part in the languages evolved.

The syntax of advanced languages is very simplified, there are, for example, words in English (if, do while, switch, integer, string) so it is more accessible and understandable to people than the assembler itself witch is more accessible than machine language. In advanced languages, commands are entered using the keyboard, or from a program in memory. They are then intercepted by a "compiler" program, which translates them into machine language.

Example:

X=Y+5; **(**instruction in C++ language)

X:=Y+5; **(**instruction in Pascal language)