Introduction to Computer Science

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Basic concepts of computer science

- ***Computer science*** *merges scientific and technical disciplines, dealing with automatic data processing, storing and transmission; it also deals with design, construction and handling of technical resources, necessary for these purposes.*
- ***Algorithm*** *is a finite set of precise instructions for accomplishing some task which, given an initial state, will result in a corresponding recognisable end state.* ***Computer algorithm*** *specifies steps for the computer to perform in a specific order leading to solution of a predefined task.*
- ***Computer program*** *is an algorithm implemented in a specific fomalized language.*

- ***Computer*** *automatically processes subsequent program instructions stored in computer memory*

Data processing by the computer

Computer, hardware, software

Hardware*: The hardware consists of the computer physical equipment.*

Software*: Software is another name for the computer programs.*

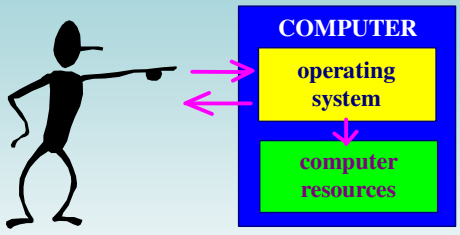
Software

General classification:

- ***systems software*** *– "background" software,*
- ***applications software*** *– "end-user " software.*

The most important systems software program is the ***operating system****, which interacts between the applications software and the computer. It includes programs that manage all the computer internal resources: hardware, software and information.*

Computer System



Operating system helps the user to communicate with the computer

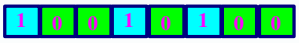
Binary system

*Data and instructions are represented electronically with a **binary** or two-state **numbering system**, which consists of only two digits – 0 and 1.*

*Each 0 or 1 is called a **bit** - short of binary digit.*

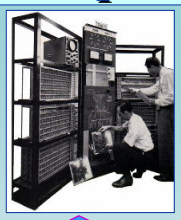
*A group of 8 bits is called **byte**.*

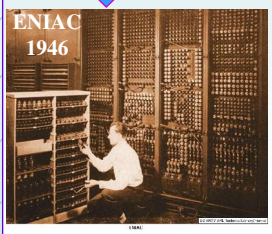
*In order to represent numbers, letters, and special characters **binary coding schemes** are used. The most popular are **ASCII** and **EBCDIC.** Each character is represented by one byte of information.*



One byte of information

Computers generations





1946 **first** 1956 **second** 1963 **third** 1981 **fourth**

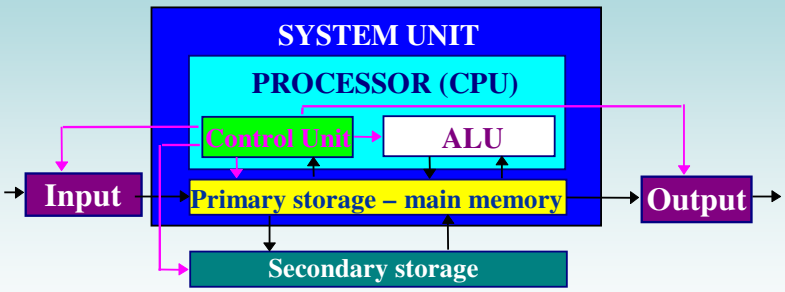
lamps — **transistors** — **MSI integrated circuits** — **LSI & VLSI integrated circuits**

mainframe computers

personal computers

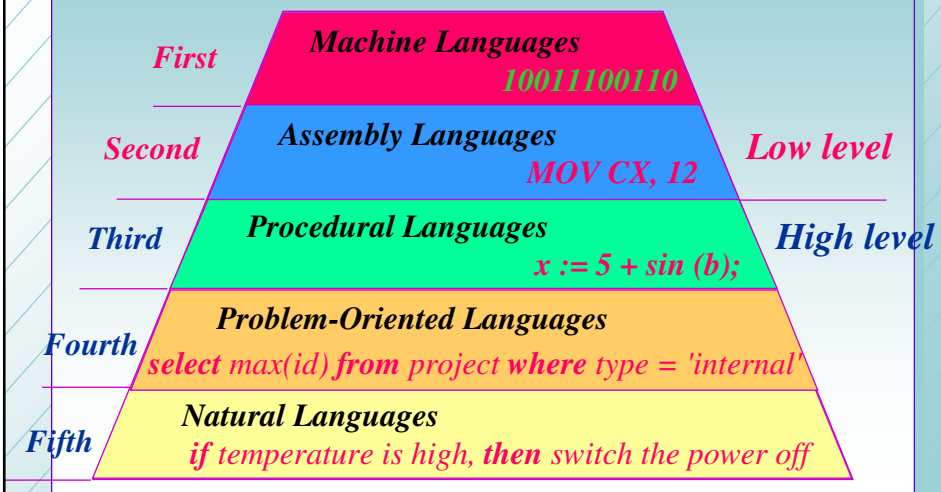
fifth & sixth generations

Personal computer

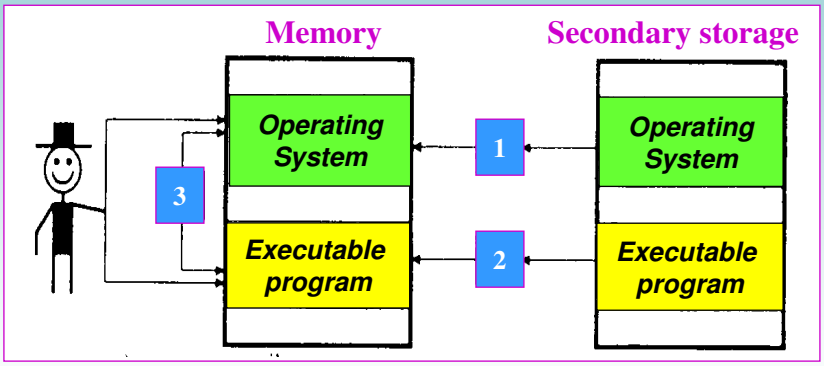


Functional block diagram of the computer

Generations of Programming Languages



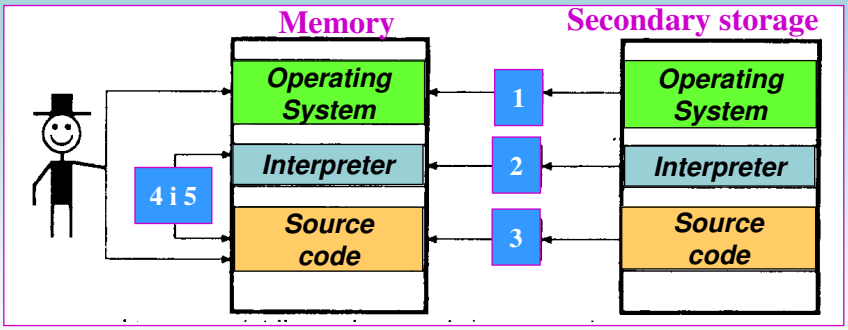
Procedures for running and executing programs



Executable program running:

1 – operating system loading and running,
2 – program loading, 3 – program executing.

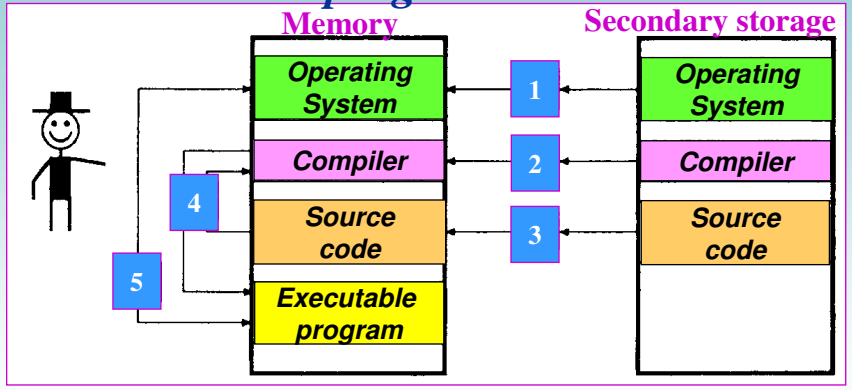
Procedures for running and executing programs



Source code, translation by an interpreter:

1, 2, 3 – loading of the operating system, translator and the program,
4 – translation, 5 – program executing.

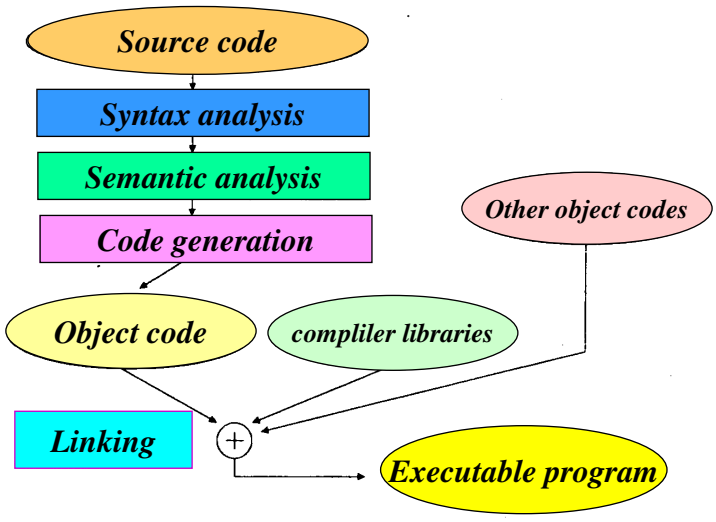
Procedures for running and executing programs



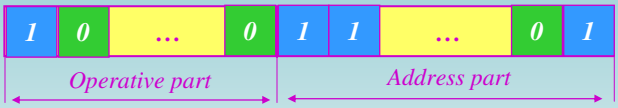
Source code, translation by a compiler:

1, 2, 3 – loading of the operating system, translator and the program, 4 – translation, 5 – program executing.

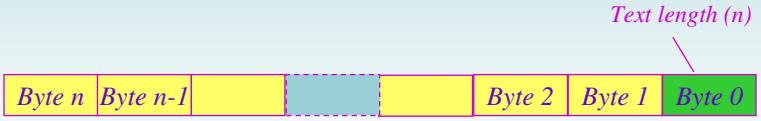
Compiling phases



Binary representation of a program and data



Representation of a processor instruction

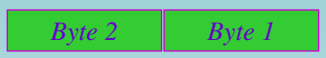


Number of bytes = (number of characters n) + 1

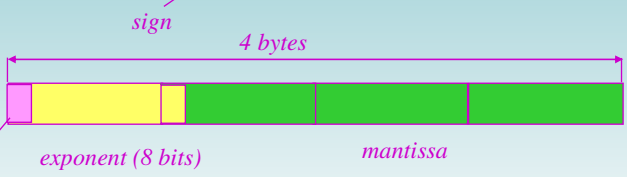
An example of text recording format

Binary representation of numbers

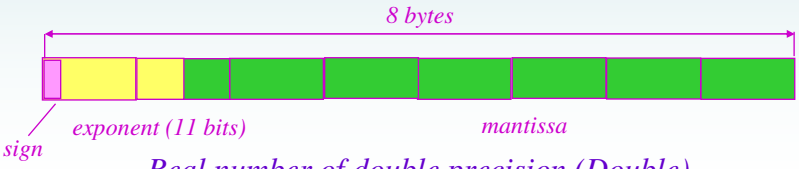
Natural number



Integer number



Real number of single precision (Single)



Real number of double precision (Double)

IEEE Standard 754 Floating Point Numbers

Single (Float)

$$L = (-1)^s 2^{(c-127)}(1.m), \quad \text{if } 0 < c < 255$$

$$L = (-1)^s 2^{-126}(0.m), \quad \text{if } c = 0 \text{ i } m \neq 0$$

$$L = 0, \quad \text{if } c = 0 \text{ i } m = 0$$

$$L = (-1)^s Inf, \quad \text{if } c = 255 \text{ i } m = 0$$

$$L = NaN, \quad \text{if } c = 255 \text{ i } m \neq 0$$

Double

$$L = (-1)^s 2^{(c-1023)}(1.m), \quad \text{if } 0 < c < 2047$$