ENGINEERING COMPUTER PROGRAMMING
(INTRODUCTION TO COMPUTER AND PROGRAMMING)
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WHAT IS COMPUTER

A **computer** is an electronic device that can

- **Receive** information
- **Perform** processes
- **Produce** output
- **Store** info for future use
HARDWARE VS. SOFTWARE

Hardware – the physical parts that make up the computer
- CPU, memory, disks, CD-ROM drives, printer

Software – computer programs and applications
- Operating system, word processor, games, etc.
HARDWARE

- Monitor (output)
- Speaker (output)
- System unit (processor, memory...)
- Storage devices (CD-RW, Floppy, Hard disk, zip, ...)
- Printer (output)
- Scanner (input)
- Keyboard (input)
- Mouse (input)
WHAT ARE THE PRIMARY COMPONENTS OF A COMPUTER?

Input devices

**Central Processing Unit**
- control unit and arithmetic/logic unit

Memory

Output devices

Storage devices
INPUT DEVICES

Keyboard
Mouse
Microphone
Scanner
Camera
...

The central processing unit (CPU) is the “brain” of the computer.

- Interprets instructions to the computer (control unit)
- Performs the arithmetic and logical processing (ALU)
Memory, also called Random Access Memory or RAM, stores:

- Instructions waiting to be executed
- Data needed by those instructions
- Results of processed data

Any information stored in RAM is lost when the computer is turned off.

Data in memory is stored as binary digits (bits) e.g. 011100011010

1 BYTE = 8 bits

1 byte usually stores 1 text character
AMOUNT OF RAM IN COMPUTERS

We measure the size of memory by telling how many bytes in can hold

- 1 kilobyte = \(2^{10}\) bytes = 1024 bytes
- 1 megabyte = \(2^{20}\) bytes = \(~\)1 million bytes
- 1 gigabyte = \(2^{30}\) bytes = \(~\)1 billion bytes
- 1 terabyte = \(2^{40}\) bytes = \(~\)1 trillion bytes

- One megabyte can hold approximately 500 pages of text information
Output devices make the information resulting from the processing available for use

- Printer – produces a hard copy of your output
- Screen – produces a soft copy of your output
- Speaker, etc.
STORAGE DEVICES

Auxiliary storage devices are used for permanent storage of data

- Hard disks
- Floppy disks
- Compact discs – CD and DVD drives
- Flash cards
HARD DISKS

Permanent storage that is inside of the computer and not portable
Consists of several platters which spin very fast
Typical hard disks range from 300GB to 10Tera
COMPACT DISKS

CD-ROM (read only memory)
CD-RW (rewritable)
DVD-ROM
DVD+RW

Typical CD’ can store about 700MB
Typical DVD’ can store up to 17GB
FLASH CARDS

Advantages:
- Small, easy to carry around
- High memory capacity – up to 128GB

Note
- There are several different factors of flash cards, including Compact Flash, SmartMedia and PCMCIA
SOFTWARE

A computer program or software tells it exactly what to do
A computer program is a set of instructions to the computer
The computer does one instruction at a time
Computer software is the key to productive use of computers. Software can be categorized into two types:

- System software
- Application software
The most important system software is the operating system
- Windows, DOS, Apple, Unix, Linux

An OS is a computer program that
- Controls the hardware of the computer
- Enables you to communicate with the computer
Application software consists of programs that tell a computer how to produce information. Some of the more commonly used packages are

- Word processing
- Electronic spreadsheet
- Database
- Presentation graphics
**PROGRAM**

*Series of instructions* to a computer to accomplish a task

Instructions must be written in a way the computer can understand

Programming languages are used to write programs
PROGRAMMING LANGUAGE

Hardware

Machine Language

Assembly Language

High-Level Language (HLL)

Expressive
Human-oriented

4th-generation languages, application-specific languages, …

Primitive
Machine-oriented

Hardware

0000 1001 1101 0110 1010 1111 0101 1000
1010 1111 0101 1010 0000 1001 1100 0110
1100 0110 1010 1111 0101 1000 0000 1001
0101 1000 0000 1001 1100 0110 1010 1111
PROGRAMMING LANGUAGE

4th-generation languages, application-specific languages, … ???

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Once a program has been written, it must be executed (run)

Some programming languages (like Java or C++) require the code to be compiled (translated to binary) before it can be executed

**Compile** – the conceptual process of **translating** source code into a CPU-executable binary target code
Others (like JavaScript, Python) are interpreted meaning that each command is translated into separately when the program is actually run.

**Interpretation** is the conceptual process of running high-level code by an interpreter.
COMPILERS VERSUS INTERPRETERS

Compilers
- Fix decision that can be taken at compile time
  - Error checking, Static allocation, Code optimization
- Compilation leads to better performance in general

Interpreters
- Facilitates interactive debugging and testing
  - Procedures can be invoked from command line by a user
  - Variable values can be inspected and modified by a user
WRITE A PROGRAM

Decide what step are needed to complete the task

Write the steps in pseudocode (Written in English generally) or as a flow chart

Translate into the programing language

Try out the program and “debug” it if necessary
Like the instructions for a recipe
List of step written in English
Must be in the right sequence
- Bake the cake after mixing it up?

Example of the program that adds two numbers
- Start
- Get two numbers
- Add them
- Print the answer
- End