Batna2 University

Faculty of Maths and Computer Science

Mathematics and Computer Science Common Core Department

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Algorithms and data structure1

Course Map :

Chapter 1: Introduction

Chapter 2: Simple Sequential Algorithm

Chapter 3: Conditional structures (in algorithmic language and in C)

Chapter 4: Loops (in algorithmic language and in C)

Chapter 5: Arrays and Strings

Chapter 6: Custom Types

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Chapter 1

Introduction

1 Brief history of computing
2 Introduction to algorithms

This chapter aims to briefly present what computer science is, then to present the subject of this course, which is algorithms.

1. Introduction

1.1. Computing

Computer science is the science of automatic processing of information through the computer, i.e. automating the information that we manipulate. Its purpose is to develop and formulate the set of commands, orders or instructions allowing the computer to be controlled and oriented during the processing.

1.2. Information

Information is a set of events that can be communicated to the computer. It can be : text, sound, image, video, etc.

1.2. computer

The computer is a very powerful device that can process information with a very high speed, a high degree of precision and has the ability to store all this information. The computer can receive data as input, then perform operations on this data according to a program, and finally provide results as output.

The computer is made up of two parts: the hardware part and the software part. The combination of these two parts forms what is called: computer system.

1.1.1. Hardware part

It is the physical and tangible part of the computer system. It is divided into:

a. central unit
b. peripheral devices

1.1.2. Central unit (UC)

It is the central functional element of any computer and is where most of the information processing takes place. Inside we find as main component what is called the motherboard. On the motherboard we find all the electronics of the computer, as main components we find the microprocessor (CPU) and the internal memory.

The microprocessor is the brain of the computer, i.e. it is responsible for any operation carried out inside the computer (e.g. printing a page, drawing a table, listening to a song, making a calculation, send an email, etc.). Conventionally, the processor is composed of three parts:

- The logic unit, whose mission is to perform logic-type operations (greater, lower, equal, intersection (AND), union (OR), etc.);
- The arithmetic unit, capable of carrying out mathematical operations;

- The command and control unit, allowing to control the operation of the computer

There are basically two kinds of internal memory: RAM and ROM.

stands for random-access memory

- RAM is a common computing acronym that stands for random-access memory. Sometimes it's called PC memory or just memory. In essence, RAM is your computer or laptop's short-term memory. It's where the data is stored that your computer processor needs to run your applications and open your files. This memory is called RAM because its content is always changing, it is purely volatile, which means it will not retain data if there is no power. It is therefore important to save data to the storage device before the system is turned off.
- ROM is the memory that contains a program necessary for starting the computer (BIOS), it is called read-only memory since its contents never change by a simple user (neither modify, nor delete, nor add).

Since RAM cannot save user information (volatile memory), as well as ROM (read only memory), then where can one save for example a whole day's work from? this is where the so-called storage media (or external memories, auxiliary memories, mass memories) come into play.

- **Storage media:** used to save information. Examples: hard disk, floppy disk drive, removable disk drive (Zip or other), CD-ROM drive or burned DVD, USB key, external hard drive, etc.
- **Peripherals :** It is any accessory that can be connected to a computer. The connection is made by means of cables plugged into specific ports (openings) usually located at the back of the central unit. We distinguish :
  - **Input devices:** They allow information to be conveyed from the outside world to the computer's memory. Exp: keyboard, mouse, scanner, microphone, barcode reader, optical.
  - **Output devices:** allow information to be transferred from the computer's memory to the outside world. Exp: the screen, the printer, the audio speakers.

1.1.3. Software part

Software is a set of instructions, data or programs used to operate computers and execute specific tasks. It is the opposite of hardware, which describes the physical aspects of a computer.

The two main categories of software are application software and system software. An application is software that fulfills a specific need or performs tasks.

System software is designed to run a computer's hardware and provides a platform for applications to run on top of.

Other types of software include programming software, which provides the programming tools software developers need; middleware, which sits between system software and applications; and driver software, which operates computer devices and peripherals.

computer program, detailed plan or procedure for solving a problem with a computer; more specifically, an unambiguous, ordered sequence of computational instructions necessary to achieve such a solution.

Software is generally a set of programmes designed to perform a complex task or process automatically

A machine can host any number of software packages. However, an operating system is the basic software that must be installed for the first time. An operating system was a set of programmes that ensured the operation of all the hardware components of a computer and man-machine communication. Exp: MS-DOS (Microsoft Disk Operating System), Windows 95, Windows 98, 2000, XP, vista, Unix and Linux. Once man can

communicate with computer, what can he do with this machine? → It is the application software that tells him what he wants to do.

Application software is designed for specific tasks, and each application software has a specific task.

- Example of computer applications :
- MS Word.....word processing
- MS Excel.....financial and graphical analysis.
- MS Power Point.....computer-assisted presentation.
- Real one Player.....to play music
- CD playback
- Chat, e-mail, Messenger, ...
- **Programming: the subject of this course**

In this course, we try to answer these three questions:

1 What is programming?
2 Why program?
3 How do you program?

In short, we can say:

Programming is all the activities involved in designing, producing, testing and maintaining programmes.

A programme is a sequence of instructions or operations designed to solve a given problem, to relieve human effort, to save time and more particularly to avoid errors.

To program, we first need to know and master what is known as an algorithm. Algorithms are the basis of programming, which will follow you throughout your studies.

If we want to give the definition of an algorithm, we say that it is similar to that of a program? so what's the difference?

An algorithm is a sequence of finite, ordered instructions or operations for solving a given problem, written in the user's language (a language that is not understood by the computer), whereas a programme is written in a language that is understood by the computer; this language is called the programming language.

We can say that a programme is an algorithm translated into a programming language.

We will look all these concepts in more detail in the chapters that follow.