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Basic Concepts and computer Evaluation

Lecture 1

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1. What is computer definition?

A **computer** is an electronic machine or device that performs processes, calculations and operations based on instructions provided by a user. It has the ability to accept data (input), process it, and then produce outputs as desired. Computer is a machine that performs tasks or calculations according to a set of instructions, or programs. Compared to those early machines, today's computers are amazing. Not only are they thousands of times faster, they can fit on your desk, in your lap, or even in your pocket. Computers work through an interaction of hardware and software.

Hardware is physical component of a computer system. It is a tiny rectangular chip inside the computer called the central processing unit (CPU), or microprocessor. It is the "brain" of computer— the part that translate instructions and performs calculations. Hardware items such as monitor, keyboard, mouse, printer, and other items are often called hardware devices.

The operating system (OS) is system software that manages computer and the devices connected to it. OS is responsible for management and coordination of activities and the sharing of the limited resources of computer. The OS acts as a host for other application software.

"Get up, stand up: don't give up the fight!"

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S. No.	Parameters	Hardware	Software
1.	Basic Definition	Hardware is a physical part of the computer that causes the processing of data.	Software is a set of instructions that tells a computer exactly what to do.
2.	Development	It is manufactured.	It is developed and engineered.
3.	Dependency	Hardware cannot perform any task without software.	The software can not be executed without hardware.
4.	Process of creating	Electronic and other materials are used to create hardware.	Created by utilizing a computer language to write instructions.
5.	Tangible	Hardware is tangible as hardware is a physical electronic device, that can be touched.	Software is intangible as we can see and also use the software but can't touch them.
6.	Durability	Hardware typically wears out over time.	The software does not wear out with time. However, it may contain flaws and glitches.
7.	Types	It has **four** main categories: input devices, output devices, storage, and internal components.	It is mainly divided into System software and Application software.
8.	Virus effect	Hardware is not affected by computer viruses.	Software is affected by computer viruses.

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9.	**Transfer**	It cannot be transferred from one place to another electrically through the network.	It can be transferred via a network means.
10.	**Machine-Level language**	Only machine-level language is known to be understood by hardware.	The program accepts human-readable input, interprets it in machine-level language, and sends it to hardware for additional processing.

11.	**Replacement**	If hardware is damaged, it is replaced with a new one.	If the software is damaged, its backup copy can be reinstalled.
12.	**Failures**	Dust, overheating, humidity and other factors are commonly responsible for hardware failures.	Overloading, systematic error, major-minor version error, and other factors are commonly responsible for software failures.
13.	**Examples**	Ex: Keyboard, Mouse, Monitor, Printer, CPU, Hard disk, RAM, ROM, etc.	Ex: MS Word, Excel, PowerPoint, Photoshop, MySQL, etc.

2. Types of Computers

1. **Analog Computers –** Analog computers are built with various components such as gears and levers, with no electrical components. One advantage of analogue computation is that designing and building an analogue computer to tackle a specific problem can be quite straightforward.
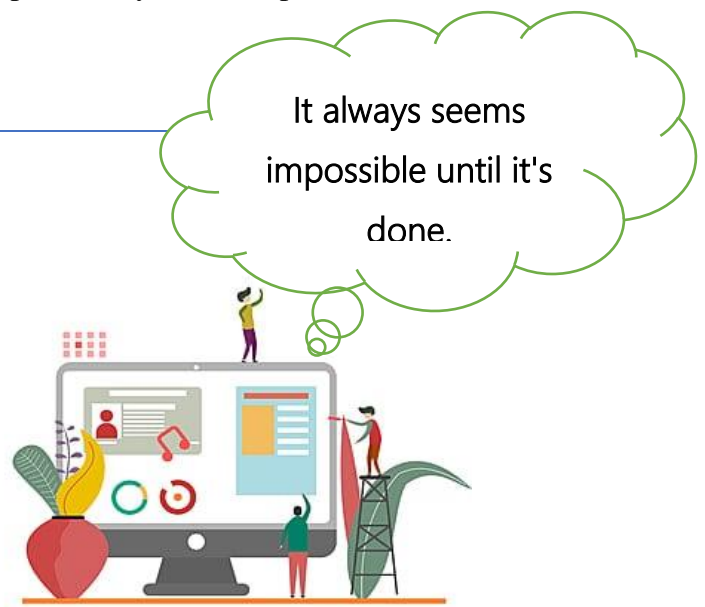
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2. **Digital Computers –** Information in digital computers is represented in discrete form, typically as sequences of 0s and 1s (binary digits, or bits). A digital computer is a system or gadget that can process any type of information in a matter of seconds. Digital computers are categorized into many different types. They are as follows:

   a. **Mainframe computers –** It is a computer that is generally utilized by large enterprises for mission-critical activities such as massive data processing. Mainframe computers were distinguished by massive storage capacities, quick components, and powerful computational capabilities. Because they were complicated systems, they were managed by a team of systems programmers who had sole access to the computer. These machines are now referred to as servers rather than mainframes.

   b. **Supercomputers –** The most powerful computers to date are commonly referred to as supercomputers. Supercomputers are enormous systems that are purpose-built to solve complicated scientific and industrial problems. Quantum mechanics, weather forecasting, oil and gas exploration, molecular modelling, physical simulations, aerodynamics, nuclear fusion research, and cryptoanalysis are all done on supercomputers

   c. **Minicomputers –** A minicomputer is a type of computer that has many of the same features and capabilities as a larger computer but is smaller in size. Minicomputers, which were relatively small and affordable, were often employed in a single department of an organization and were often dedicated to a specific task or shared by a small group.

   d. **Microcomputers –** A microcomputer is a small computer that is based on a microprocessor integrated circuit, often known as a chip. A microcomputer is a system that incorporates at a minimum a microprocessor, program memory, data memory, and input-output system (I/O). A microcomputer is now commonly referred to as a personal computer (PC).

   e. **Embedded processors –** These are miniature computers that control electrical and mechanical processes with basic microprocessors. Embedded processors are often simple in design, have limited processing capability and I/O capabilities, and need little power.

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Ordinary microprocessors and microcontrollers are the two primary types of embedded processors. Embedded processors are employed in systems that do not require the computing capability of traditional devices such as desktop computers, laptop computers, or workstations.

3. **Hybrid Computers** __ Hybrid computers are the combination of both the above computers i.e. analog & digital computers. They have the features of both devices. Hybrid computer has the speed of analog computers and has the accuracy of digital computers. These devices are used to convert data from digital to analog and analog to digital. These devices are mainly used scientific calculation, in hospitals to measure heartbeat, etc.. Read more at: https://www.dtechy.com/classification-of-computers/#Hybrid_Computers

3. Uses/Applications of Computer

- Banking
- Education
- Industries
- Entertainments
- Hospitals
- Business
- Defence
- Science and Research
- Data processing

> It always seems impossible until it's done.

4. Capabilities of Computer

- Speed
- Storage capacity
- Accuracy
- Diligence
- Versatility

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5. Computer Organization and Architecture

Computer Architecture refers to those attributes of a system that have a direct impact on the logical execution of a program. Example:

- the instruction set
- the number of bits used to represent various data types
- I/O mechanisms
- memory addressing techniques

Computer Organization refers to the operational units and their interconnections that realize the architectural specifications. Examples are things that are transparent to the programmer:

- control signals
- interfaces between computer and peripherals
- the memory technology being used

> **So, for example, the fact that a multiply instruction is available is a computer architecture issue. How that multiply is implemented is a computer organization issue**

6. Structure and Function

- Structure is the way in which components relate to each other
- Function is the operation of individual components as part of the structure

• All computer functions are:

- **Data processing**: Computer must be able to process data which may take a wide variety of forms and the range of processing.
- **Data storage**: Computer stores data either temporarily or permanently.
- **Data movement**: Computer must be able to move data between itself and the outside world.
- **Control:** There must be a control of the above three functions.

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7. Data and Information Definitions

Data can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing by human or electronic machine. Data is represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9) or special characters (+,-,/,*,<,>,= etc.)

Data processing is the re-structuring or re-ordering of data by people or machine to increase their usefulness and add values for a particular purpose. Data processing consists of the following basic steps - input, processing, and output. These three steps constitute the data processing cycle.
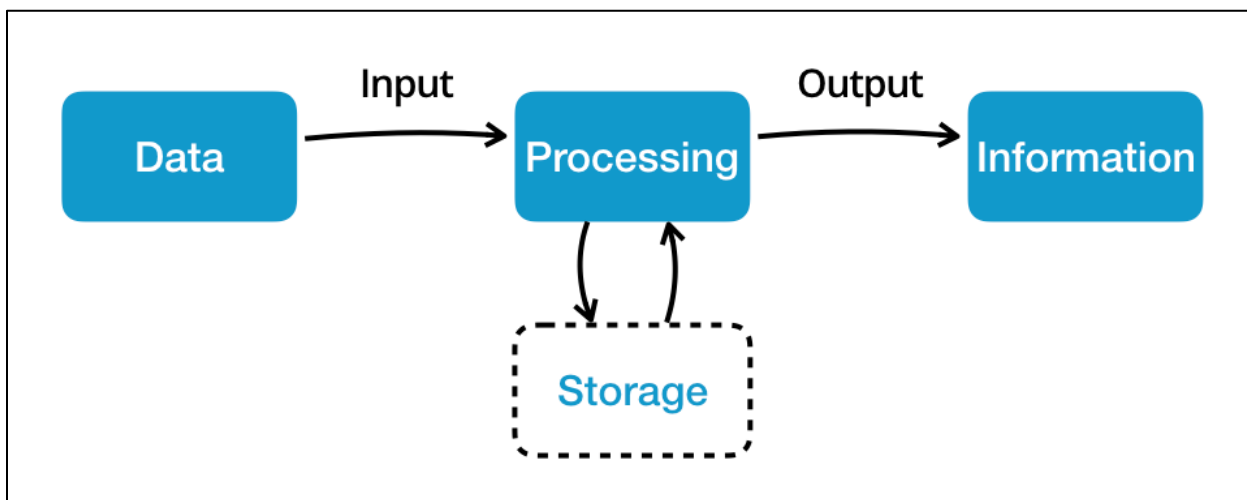
1. **Input** − In this step, the input data is prepared in some convenient form for processing. The form will depend on the processing machine. For example, when electronic computers are used, the input data can be recorded on any one of the several types of input medium, such as magnetic disks, tapes, and so on.

2. **Processing** − In this step, the input data is changed to produce data in a more useful form. For example, pay-checks can be calculated from the time cards, or a summary of sales for the month can be calculated from the sales orders.

3. **Output** − At this stage, the result of the proceeding processing step is collected. The particular form of the output data depends on the use of the data. For example, output data may be pay-checks for employees

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Information is organized or classified data, which has some meaningful values for the receiver. Information is the processed data on which decisions and actions are based. For the decision to be meaningful, the processed data must qualify for the following characteristics:

- **Timely** − Information should be available when required.
- **Accuracy** − Information should be accurate.
- **Completeness** − Information should be complete.

8. A brief history of computers generations?

We are currently on the fifth generation of computers. So let us look at the important features of these five generations of computers.

- **1st Generation:** This was from the period of 1940 to 1955. This was when machine language was developed for the use of computers. They used vacuum tubes for the circuitry. For the purpose of memory, they used magnetic drums. These machines were complicated, large, and expensive. They were mostly reliant on batch operating systems and punch cards. As output and input devices, magnetic tape and paper tape were implemented. For example, ENIAC, UNIVAC-1, EDVAC, and so on.

- **2nd Generation:** The years 1957-1963 were referred to as the "second generation of computers" at the time. In second-generation computers, COBOL and FORTRAN are employed as assembly languages and programming languages. Here they advanced from vacuum tubes to transistors. This made the computers smaller, faster and more energy-efficient. And they advanced from binary to assembly languages. For instance, IBM 1620, IBM 7094, CDC 1604, CDC 3600, and so forth.

- **3rd Generation:** The hallmark of this period (1964-1971) was the development of the integrated circuit. A single integrated circuit (IC) is made up of many transistors, which increases the power of a computer while simultaneously lowering its cost. These

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computers were quicker, smaller, more reliable, and less expensive than their predecessors. High-level programming languages such as FORTRON-II to IV, COBOL, and PASCAL PL/1 were utilized. For example, the IBM-360 series, the Honeywell-6000 series, and the IBM-370/168.

- **4th Generation:** The invention of the microprocessors brought along the fourth generation of computers. The years 1971-1980 were dominated by fourth generation computers. C, C++ and Java were the programming languages utilized in this generation of computers. For instance, the STAR 1000, PDP 11, CRAY-1, CRAY-X-MP, and Apple II. This was when we started producing computers for home use.

- **5th Generation:** These computers have been utilized since 1980 and continue to be used now. This is the present and the future of the computer world. The defining aspect of this generation is artificial intelligence. The use of parallel processing and superconductors are making this a reality and provide a lot of scope for the future. Fifth-generation computers use ULSI (Ultra Large Scale Integration) technology. These are the most recent and sophisticated computers. C, C++, Java,.Net, and more programming languages are used. For instance, IBM, Pentium, Desktop, Laptop, Notebook, Ultrabook, and so on.