Chapter 01

Introduction to Computers

Computer Fundamentals - Pradeep K. Sinha & Priti Sinha

Learning Objectives

In this chapter you will learn about:
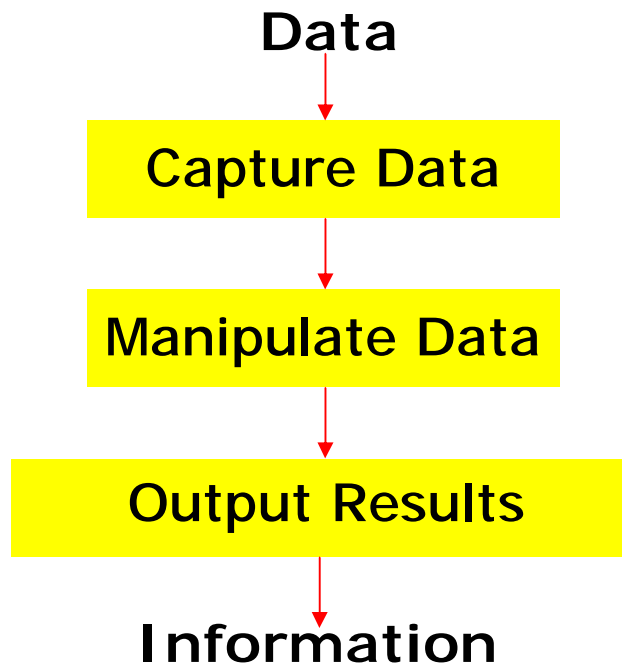
§ Computer

§ Data processing

§ Characteristic features of computers

§ Computers' evolution to their present form

§ Computer generations

§ Characteristic features of each computer generation

Computer

- § The word computer comes from the word "compute", which means, "to calculate"

- § Thereby, a computer is an electronic device that can perform arithmetic operations at high speed

- § A computer is also called a *data processor* because it can store, process, and retrieve data whenever desired

Data Processing

The activity of processing data using a computer is called *data processing*

Data

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Capture Data

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Manipulate Data

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Output Results

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Information

Data is raw material used as input and *information* is processed data obtained as output of data processing

Characteristics of Computers

1) **Automatic**: Given a job, computer can work on it automatically without human interventions

2) **Speed**: Computer can perform data processing jobs very fast, usually measured in **microseconds** (10^{-6}), **nanoseconds** (10^{-9}), and **picoseconds** (10^{-12})

3) **Accuracy**: Accuracy of a computer is consistently high and the degree of its accuracy depends upon its design. Computer errors caused due to incorrect input data or unreliable programs are often referred to as *Garbage-In-Garbage-Out* (GIGO)

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Characteristics of Computers

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4) **Diligence**: Computer is free from monotony, tiredness, and lack of concentration. It can continuously work for hours without creating any error and without grumbling

5) **Versatility**: Computer is capable of performing almost any task, if the task can be reduced to a finite series of logical steps

6) **Power of Remembering**: Computer can store and recall any amount of information because of its secondary storage capability. It forgets or looses certain information only when it is asked to do so

Characteristics of Computers

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7) No I.Q.: A computer does only what it is programmed to do. It cannot take its own *decision* in this regard

8) No Feelings: Computers are devoid of emotions. Their judgement is based on the instructions given to them in the form of programs that are written by us (human beings)

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Evolution of Computers

- § Blaise Pascal invented the first *mechanical adding machine* in 1642

- § Baron Gottfried Wilhelm von Leibniz invented the first *calculator for multiplication* in 1671

- § *Keyboard machines* originated in the United States around 1880

- § Around 1880, Herman Hollerith came up with the concept of *punched cards* that were extensively used as input media until late 1970s

Evolution of Computers

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§ *Charles Babbage* is considered to be the father of modern digital computers

   § He designed "Difference Engine" in 1822

   § He designed a *fully automatic analytical engine* in 1842 for performing basic arithmetic functions

   § His efforts established a number of principles that are fundamental to the design of any digital computer

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Some Well Known Early Computers

§ The Mark I Computer (1937-44)

§ The Atanasoff-Berry Computer (1939-42)

§ The ENIAC (1943-46)

§ The EDVAC (1946-52)

§ The EDSAC (1947-49)

§ Manchester Mark I (1948)

§ The UNIVAC I (1951)

Computer Generations

§ "*Generation*" in computer talk is a step in technology. It provides a framework for the growth of computer industry

§ Originally it was used to distinguish between various hardware technologies, but now it has been extended to include both hardware and software

§ Till today, there are five computer generations

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Computer Generations

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Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some representative systems
First (1942-1955)	§ Vacuum tubes § Electromagnetic relay memory § Punched cards secondary storage	§ Machine and assembly languages § Stored program concept § Mostly scientific applications	§ Bulky in size § Highly unreliable § Limited commercial use and costly § Difficult commercial production § Difficult to use	§ ENIAC § EDVAC § EDSAC § UNIVAC I § IBM 701
Second (1955-1964)	§ Transistors § Magnetic cores memory § Magnetic tapes § Disks for secondary storage	§ Batch operating system § High-level programming languages § Scientific and commercial applications	§ Faster, smaller, more reliable and easier to program than previous generation systems § Commercial production was still difficult and costly	§ Honeywell 400 § IBM 7030 § CDC 1604 § UNIVAC LARC

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Computer Generations

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Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Third (1964-1975)	§ ICs with SSI and MSI technologies § Larger magnetic cores memory § Larger capacity disks and magnetic tapes secondary storage § Minicomputers; upward compatible family of computers	§ Timesharing operating system § Standardization of high-level programming languages § Unbundling of software from hardware	§ Faster, smaller, more reliable, easier and cheaper to produce § Commercially, easier to use, and easier to upgrade than previous generation systems § Scientific, commercial and interactive on-line applications	§ IBM 360/370 § PDP-8 § PDP-11 § CDC 6600

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Computer Generations

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| Generation (Period)	Key hardware Technologies	Key software technologies	Key characteristics	Some rep. systems
Fourth (1975-1989)	§ ICs with VLSI technology § Microprocessors; semiconductor memory § Larger capacity hard disks as in-built secondary storage § Magnetic tapes and floppy disks as portable storage media § Personal computers § Supercomputers based on parallel vector processing and symmetric multiprocessing technologies § Spread of high-speed computer networks	§ Operating systems for PCs with GUI and multiple windows on a single terminal screen § Multiprocessing OS with concurrent programming languages § UNIX operating system with C programming language § Object-oriented design and programming § PC, Network-based, and supercomputing applications	§ Small, affordable, reliable, and easy to use PCs § More powerful and reliable mainframe systems and supercomputers § Totally general purpose machines § Easier to produce commercially § Easier to upgrade § Rapid software development possible	§ IBM PC and its clones § Apple II § TRS-80 § VAX 9000 § CRAY-1 § CRAY-2 § CRAY-X/MP

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Computer Generations

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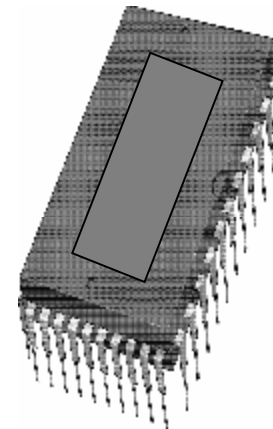| Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1989-Present)	§ ICs with ULSI technology § Larger capacity main memory, hard disks with RAID support § Optical disks as portable read-only storage media § Notebooks, powerful desktop PCs and workstations § Powerful servers, supercomputers § Internet § Cluster computing	§ Micro-kernel based, multithreading, distributed OS § Parallel programming libraries like MPI & PVM § JAVA § World Wide Web § Multimedia, Internet applications § More complex supercomputing applications	§ Portable computers § Powerful, cheaper, reliable, and easier to use desktop machines § Powerful supercomputers § High uptime due to hot-pluggable components § Totally general purpose machines § Easier to produce commercially, easier to upgrade § Rapid software development possible	§ IBM notebooks § Pentium PCs § SUN Workstations § IBM SP/2 § SGI Origin 2000 § PARAM 10000

Electronic Devices Used in Computers of Different Generations
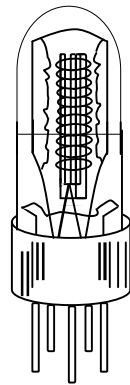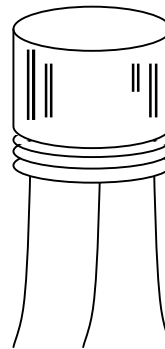
(a) A Vacuum Tube   **(b) A Transistor**   **(c) An IC Chip**

Key Words/Phrases

§ Computer
§ Computer generations
§ Computer Supported Cooperative Working (CSCW)
§ Data
§ Data processing
§ Data processor
§ First-generation computers
§ Fourth-generation computers
§ Garbage-in-garbage-out (GIGO)
§ Graphical User Interface (GUI)
§ Groupware
§ Information

§ Integrated Circuit (IC)
§ Large Scale Integration (VLSI)
§ Medium Scale Integration (MSI)
§ Microprocessor
§ Personal Computer (PC)
§ Second-generation computers
§ Small Scale Integration (SSI)
§ Stored program concept
§ Third-generation computers
§ Transistor
§ Ultra Large Scale Integration (ULSI)
§ Vacuum tubes