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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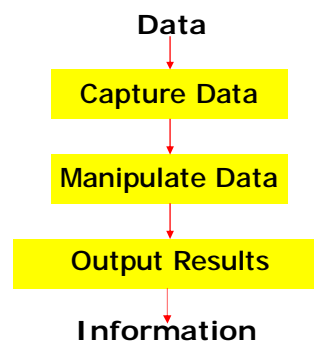
Information

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

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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

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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

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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)

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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
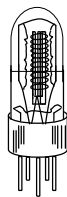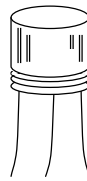
(a) A Vacuum Tube   (b) A Transistor   (c) An IC Chip

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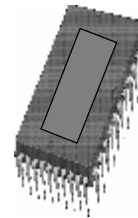
Key Words/Phrases

- 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

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