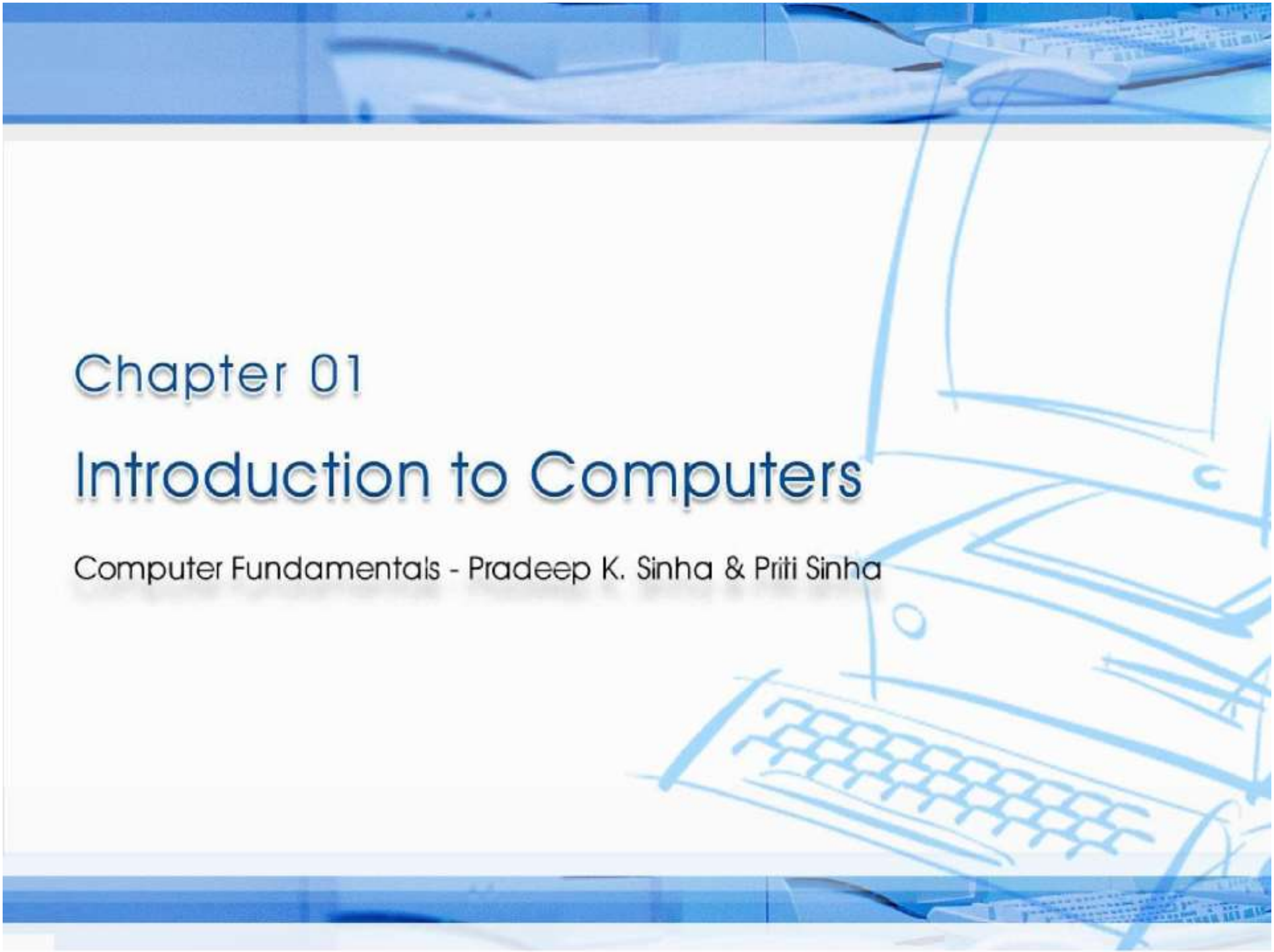


Chapter 01

Introduction to Computers

Computer Fundamentals - Pradeep K. Sinha & Priti Sinha

Learning Objectives

In this chapter you will learn about:

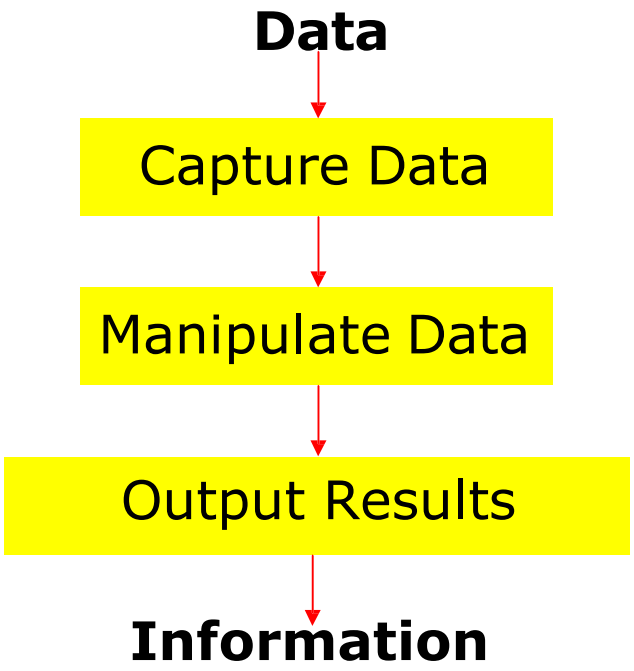
- Computer
- Data processing
- Characteristic features of computers
- Computers' evolution to their present form
- Computer generations
- Characteristic features of each computer generation

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 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

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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

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 the 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

SSI - Small Scale integration : Upto 100 transistors
MSI Medium Scale integration: Upto 500 transistors
LSI - Large Scale integration: Upto 10000 transistors
VLSI - Very Large Scale integration: More than 10000 transistors

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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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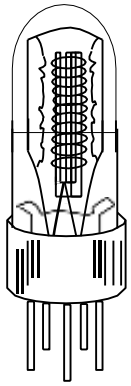
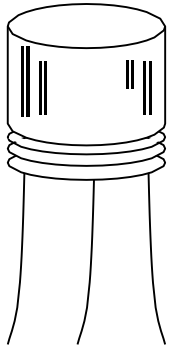
Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1989-Present)	▪ ICs with ULSI technology ▪ Larger capacity main memory, hard disks with RAID support ▪ Optical disks as portable read-only storage media ▪ Notebooks, powerful desktop PCs 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

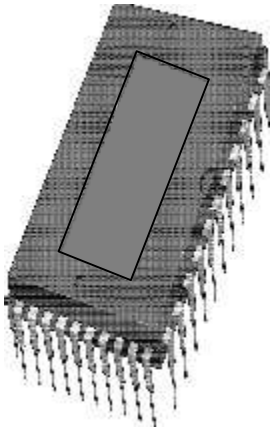
Electronic Devices Used in Computers of Different Generations



(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