

# Learning Objectives

## **In this chapter you will learn about:**

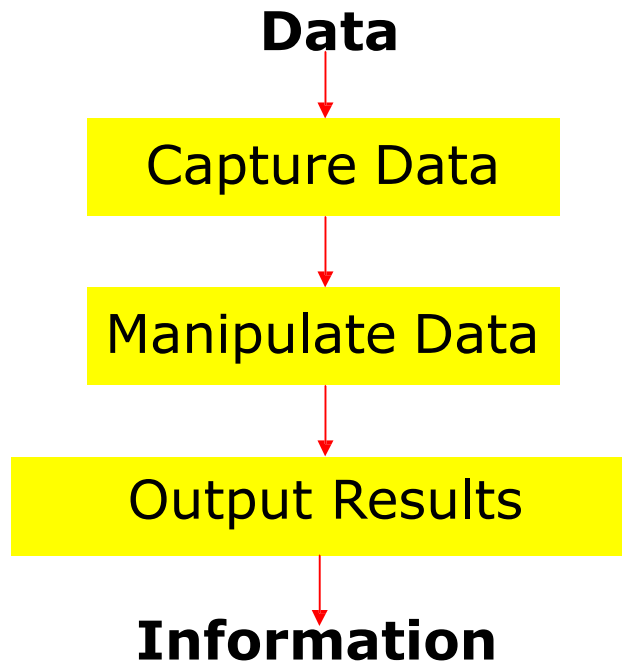
- Computer
- Data processing
- Characteristic features of computers
- Computers' evolution to their present form
- Computer generations
- Characteristic features of each computer generation

# 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 loses 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 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)	<ul style="list-style-type: none"> <li>▪ Vacuum tubes</li> <li>▪ Electromagnetic relay memory</li> <li>▪ Punched cards secondary storage</li> </ul>	<ul style="list-style-type: none"> <li>▪ Machine and assembly languages</li> <li>▪ Stored program concept</li> <li>▪ Mostly scientific applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ Bulky in size</li> <li>▪ Highly unreliable</li> <li>▪ Limited commercial use and costly</li> <li>▪ Difficult commercial production</li> <li>▪ Difficult to use</li> </ul>	<ul style="list-style-type: none"> <li>▪ ENIAC</li> <li>▪ EDVAC</li> <li>▪ EDSAC</li> <li>▪ UNIVAC I</li> <li>▪ IBM 701</li> </ul>
Second (1955-1964)	<ul style="list-style-type: none"> <li>▪ Transistors</li> <li>▪ Magnetic cores</li> <li>▪ Magnetic tapes</li> <li>▪ Disks for secondary storage</li> </ul>	<ul style="list-style-type: none"> <li>▪ Batch operating system</li> <li>▪ High-level programming languages</li> <li>▪ Scientific and commercial applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ Faster, smaller, more reliable and easier to program than previous generation systems</li> <li>▪ Commercial production was still difficult and costly</li> </ul>	<ul style="list-style-type: none"> <li>▪ Honeywell 400</li> <li>▪ IBM 7030</li> <li>▪ CDC 1604</li> <li>▪ UNIVAC LARC</li> </ul>

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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)	<ul style="list-style-type: none"> <li>▪ ICs with SSI and MSI technologies</li> <li>▪ Larger magnetic cores memory</li> <li>▪ Larger capacity disks and magnetic tapes secondary storage</li> <li>▪ Minicomputers; upward compatible family of computers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Timesharing operating system</li> <li>▪ Standardization of high-level programming languages</li> <li>▪ Unbundling of software from hardware</li> </ul>	<ul style="list-style-type: none"> <li>▪ Faster, smaller, more reliable, easier and cheaper to produce</li> <li>▪ Commercially, easier to use, and easier to upgrade than previous generation systems</li> <li>▪ Scientific, commercial and interactive on-line applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ IBM 360/370</li> <li>▪ PDP-8</li> <li>▪ PDP-11</li> <li>▪ CDC 6600</li> </ul>

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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)	<ul style="list-style-type: none"> <li>▪ ICs with VLSI technology</li> <li>▪ Microprocessors; semiconductor memory</li> <li>▪ Larger capacity hard disks as in-built secondary storage</li> <li>▪ Magnetic tapes and floppy disks as portable storage media</li> <li>▪ Personal computers</li> <li>▪ Supercomputers based on parallel vector processing and symmetric multiprocessing technologies</li> <li>▪ Spread of high-speed computer networks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Operating systems for PCs with GUI and multiple windows on a single terminal screen</li> <li>▪ Multiprocessing OS with concurrent programming languages</li> <li>▪ UNIX operating system with C programming language</li> <li>▪ Object-oriented design and programming</li> <li>▪ PC, Network-based, and supercomputing applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ Small, affordable, reliable, and easy to use PCs</li> <li>▪ More powerful and reliable mainframe systems and supercomputers</li> <li>▪ Totally general purpose machines</li> <li>▪ Easier to produce commercially</li> <li>▪ Easier to upgrade</li> <li>▪ Rapid software development possible</li> </ul>	<ul style="list-style-type: none"> <li>▪ IBM PC and its clones</li> <li>▪ Apple II</li> <li>▪ TRS-80</li> <li>▪ VAX 9000</li> <li>▪ CRAY-1</li> <li>▪ CRAY-2</li> <li>▪ CRAY-X/MP</li> </ul>

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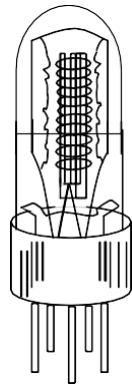
# Computer Generations

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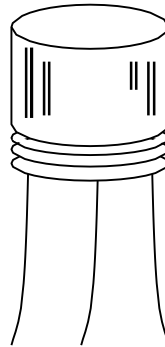
Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1989- Present)	<ul style="list-style-type: none"> <li>▪ ICs with ULSI technology</li> <li>▪ Larger capacity main memory, hard disks with RAID support</li> <li>▪ Optical disks as portable read-only storage media</li> <li>▪ Notebooks, powerful desktop PCs and workstations</li> <li>▪ Powerful servers, supercomputers</li> <li>▪ Internet</li> <li>▪ Cluster computing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Micro-kernel based, multithreading, distributed OS</li> <li>▪ Parallel programming libraries like MPI &amp; PVM</li> <li>▪ JAVA</li> <li>▪ World Wide Web</li> <li>▪ Multimedia, Internet applications</li> <li>▪ More complex supercomputing applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ Portable computers</li> <li>▪ Powerful, cheaper, reliable, and easier to use desktop machines</li> <li>▪ Powerful supercomputers</li> <li>▪ High uptime due to hot-pluggable components</li> <li>▪ Totally general purpose machines</li> <li>▪ Easier to produce commercially, easier to upgrade</li> <li>▪ Rapid software development possible</li> </ul>	<ul style="list-style-type: none"> <li>▪ IBM notebooks</li> <li>▪ Pentium PCs</li> <li>▪ SUN Workstations</li> <li>▪ IBM SP/2</li> <li>▪ SGI Origin 2000</li> <li>▪ PARAM 10000</li> </ul>



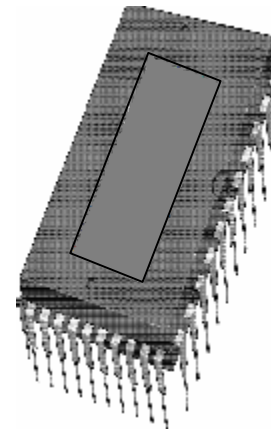
## Electronic Devices Used in Computers of Different Generations



(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