



Chapter 01

Introduction to Computers

Computer Fundamentals - Pradeep K. Sinha & Priti Sinha

Learning Objectives

In this chapter you will learn about:

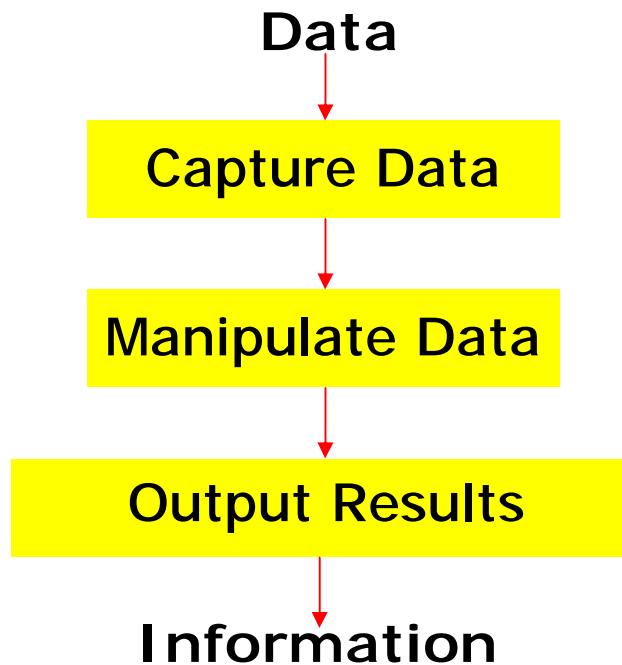
- § Computer
- § Data processing
- § Characteristic features of computers
- § Computers' evolution to their present form
- § Computer generations
- § Characteristic features of each computer generation

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 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"> § Vacuum tubes § Electromagnetic relay memory § Punched cards secondary storage 	<ul style="list-style-type: none"> § Machine and assembly languages § Stored program concept § Mostly scientific applications 	<ul style="list-style-type: none"> § Bulky in size § Highly unreliable § Limited commercial use and costly § Difficult commercial production § Difficult to use 	<ul style="list-style-type: none"> § ENIAC § EDVAC § EDSAC § UNIVAC I § IBM 701
Second (1955-1964)	<ul style="list-style-type: none"> § Transistors § Magnetic cores § Magnetic tapes § Disks for secondary storage 	<ul style="list-style-type: none"> § Batch operating system § High-level programming languages § Scientific and commercial applications 	<ul style="list-style-type: none"> § Faster, smaller, more reliable and easier to program than previous generation systems § Commercial production was still difficult and costly 	<ul style="list-style-type: none"> § 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)	<ul style="list-style-type: none"> § ICs with SSI and MSI technologies § Larger magnetic cores memory § Larger capacity disks and magnetic tapes secondary storage § Minicomputers; upward compatible family of computers 	<ul style="list-style-type: none"> § Timesharing operating system § Standardization of high-level programming languages § Unbundling of software from hardware 	<ul style="list-style-type: none"> § 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 	<ul style="list-style-type: none"> § 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)	<ul style="list-style-type: none"> § 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 	<ul style="list-style-type: none"> § 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 	<ul style="list-style-type: none"> § 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 	<ul style="list-style-type: none"> § IBM PC and its clones § Apple II § TRS-80 § VAX 9000 § CRAY-1 § CRAY-2 § CRAY-X/MP

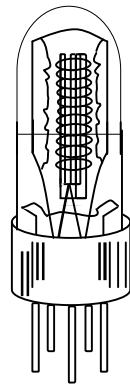
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Computer Generations

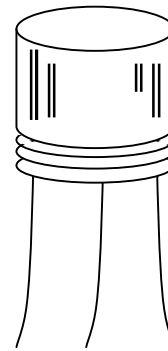
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Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1989-Present)	<ul style="list-style-type: none"> § ICs with ULSI technology § Larger capacity main memory, hard disks with RAID support § Optical disks as portable read-only storage media § Notebooks, powerful desktop PCs and workstations § Powerful servers, supercomputers § Internet § Cluster computing 	<ul style="list-style-type: none"> § Micro-kernel based, multithreading, distributed OS § Parallel programming libraries like MPI & PVM § JAVA § World Wide Web § Multimedia, Internet applications § More complex supercomputing applications 	<ul style="list-style-type: none"> § 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 	<ul style="list-style-type: none"> § IBM notebooks § Pentium PCs § SUN Workstations § IBM SP/2 § SGI Origin 2000 § PARAM 10000

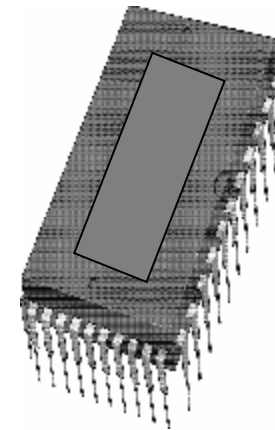
Electronic Devices Used in Computers of Different Generations



(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