



# *Basics of Computer Science*

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## About the Tutorial

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Computer Science is one of the disciplines of modern science under which, we study about the various aspects of computer technologies, their development, and their applications in the present world.

Likewise, Computer Science includes a wide range of topics such as the development of Computer Technology (hardware and software), application of Computer technology in today's life, information technology, computer threat, computer security, etc. However, we have segregated this tutorial into different chapters for easy understanding.

## Audience

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This tutorial is designed exclusively for the students preparing for the different competitive exams including **civil services, banking, railway, eligibility test**, and all other competitive exams of such kind.

## Prerequisites

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It is a very basic tutorial that assumes no prior knowledge on any concepts related to Computer Science. Hence, there are no prerequisites whatsoever. This tutorial is entirely based on **reliable sources including books, relevant articles, and facts (taken from the official websites)**.

## Copyright & Disclaimer

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# 1. Basics of Computer Science – Fundamental Concepts

A computer is basically a programmable machine capable to perform arithmetic and logical operations automatically and sequentially. It is also known as a data processor, as it can store, process, and retrieve data as per the wish of the user.



Data processing involves the following three activities:

- Input of data
- Manipulation/processing of data
- Giving output (i.e. management of output result)
- In computer system, data is arranged orderly and systematically.

The term “computer” is derived from a Latin term “compute,” which means ‘to calculate.’ Initially, the computer system had been designed to calculate; it was intended to be a computing device. However, over a period of time, this device technically advanced; at present, it can perform a wide range of desirable works apart from data processing.

## **Major Functions of Computer System**

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Following are the core functions of a computer system:

- A computer accepts the command and/or data as input given by the user.
- A computer follows the instructions and stores the data given by the user.



- A computer processes the data as per the instructions given by the user.
- A computer gives the desirable results in the form of output.

## Salient Features of Computer System

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Following are the salient features of a Computer System:

- **Automation** – The operating system of a computer system is automatic, as no human intervention is required; simply you need to give the command and then it will do the work automatically.
- **Speed** – Depending upon the power of the computer, it can perform, it can take Millions of instructions per second.
- **Storage** – A computer system can store enormous quantity of data in different format. The storage capacity of a computer system is normally expressed in terms of Kilobytes (KB), Megabytes (MB), Gigabytes (GB), or Terabytes (TB).
- **Accuracy** – The accuracy of a computer system is very high.
- **Versatility** – A computer system is capable of performing a wide range of tasks.
- **Diligence** – A computer neither get tired nor lose concentration.
- **Reliability** – As a computer system always gives accurate result; therefore, its reliability is very high.
- **Vast memory** – A computer system can have a wide range of memory which can recall the desired data at any point of time.

## Evolution of Computer System

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The present Computer System has evolved after centuries of efforts from different intellectuals who contributed their works during different periods of time.

**Abacus** is (most likely) considered as the earlier counting device.

Let us now read about the innovators who contributed immensely in the development of a computer system.

### John Napier

Napier was a Scottish mathematician who invented logarithms.

Further, Napier also invented a computing device, which consisted of sticks with numbers imprinted on them. Napier named sticks 'bones,' as they were made up of bones.

### **Blaise Pascal**

Pascal was a French mathematician who invented a machine based on gear wheels, which helped greatly in calculation.

### **Charles Babbage**

Babbage was an English Polymath, Mathematician, Mechanical Engineer, Philosopher, and Inventor. In 1822, he developed a machine capable to calculate the successive difference of expression and prepared a table which helped him in his calculations.

### **Lady Ada Lovelace**

Lovelace was an English mathematician, who researched on Babbage's work. She has given the concept that 'computers can be programmed'. Her work helped a great deal in the advancement of computer system.

### **John Atanstoff**

With the assistance of Berry, John Atanstoff developed the Atanstoff Berry Computer (more popular as ABC) in 1937. It marked the beginning of the development of electronic digital computer.

### **John Mauchly and Eckart**

In 1947, John Mauchly and Eckart developed the first large scale Electronic Digital Computer. It was called the Electronic Numerical Integrator and Calculator (ENIAC).

### **Maurice V. Wilkes**

In 1949, Wilkes (at Cambridge University) designed Electronic Delay Storage Automatic Calculator (EDSAC). It was the first computer that started its operating system on the stored program concept.

## 2. Basics of Computer Science – Role of Computer in Today's World

In today's world, for almost every activity whether personal (for example, operating personal savings bank account) or business-related (for example, selling any product or services); in some or the other way, we rely on the computer system.

Due to the growing dependency on computers, every small and big organizations and other business companies have started offering computer-based service. Furthermore, the advancement of communications, electronic service networks, and multimedia have opened a new door for corporates by providing an effective way of business processing, payment transfer, and service delivery.

### **Advantages of Computers in Business**

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Following are the major advantages of introducing computer system in business:

#### **Independency**

As computers help in making the business automated, the businesses are becoming more and more independent. No more, there is the need to put man-power for every work, as with the help of computer most of the works can be automated. Starting from ticket booking to a luxury car manufacturing, everything is automated.



#### **Cost Cutting**

A number of business are based online in recent times; therefore, there is no need to open business branch in every city, rather having one centralized inventory can make the business easier. There is no need to employ many man-power.

## Marketing

With the use of computer system with Internet facility, it is very simple to make a business global in a given period of time. Website, email, social media websites, online advertisements, etc. are the important tools of online marketing.



## Huge Transaction Capacity

A number of tasks are being done by computer including ticket booking to money transactions; this increases the transaction capacity.

## **Huge Storage Capacity**

Normally, most of the businesses need to store and maintain huge data and other records; manually, it is very difficult to maintain, but the use of computer not only increases the storage capacity, but also facilitates the processing and retrieval of data anytime.

## **Improvement of Productivity & Efficiency**

As most of the tasks in almost every industry has become automated, it has now become much easier to manufacture a huge bulk of products in very less time. Through computer technology, services also became faster and easier.

## **High Accuracy**

There is hardly any scope of errors in an automated system; however, if any error occurs, it is largely a human error.

## **Ease of Data Sharing**

Data sharing has now become very simple just the way it is simple to link one computer system to another.

## **Competition**

The applicability of computer technology has increased competition; now, the customers can avail support 24x7.

## **Enhanced the Security System**

Computer also helps keep the data of businesses secure. However, this security can face threats too. For instance, if someone hacks the system or there is a virus attack, it can have the potential to damage all the data that is secured.



# 3. Basics of Computer Science – Computer System

A computer system is an integrated form of different components that work together to give a desirable result. It has different component and each works for a specific purpose; however, they generate a common result as required by the user.



## Components of Computer System

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Let us now understand the following basic components of a computer system.

- Hardware
- Software
- Humanware
- Firmware
- Bridgware

### Hardware

The physical components collectively form the hardware of a computer system. Hardware comprises of the equipment that helps in the working system of the computer.

Following are the different types of hardware components (which have specific functions):

- **Monitor:** It displays (visual) the result.
- **CPU:** It is the Central Processing Unit that controls the computer's functions and transmits data.
- **Motherboard:** It is mainly accountable to establish communication between components and transmission of information.
- **RAM:** It is the Random Access Memory and responsible for the storage of programs that are currently running and also stores data temporarily.
- **Hard Disk Drive:** It is a permanent memory storage device.
- **Floppy Disk Drive:** It is hardly being used in recent times.
- **Optical disks:** It is a device that also store data. For example, CD, DVD, etc.

## Input & Output Device

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The following table categorically lists down the input and output device:

Input Device	Output Device	Input Device	Output Device
Mouse	Monitor	Microphone	Speaker
Keyboard	Printer	Camera	Earphone
Scanner	Projector	Trackball	Monitor
Touchpad	Plotter	Joystick	Monitor

## Software

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The hardware components can only function when software components are added to the computer system. Software is a program that performs different commands given by a user.

Software is an intangible part of hardware and controls the sequence of operations.

### Types of Software

Depending on the basic features and functionality, software can be categorized as:

- Operating Systems (OS)
- Application Software (AS)
- E-accessibility Software

Let us now discuss the software components in brief.

## Operating System

This software helps to load the basic program automatically as soon as the computer is started. Following are the major types of operating system:

Operating Software	Examples
Microsoft Windows	XP, Vista, etc.
Mac OS X	Panther, Cheetah, Snow leopard, etc.
Linux	Debian, Ubuntu, Fedora, Knoppix, etc.

## Application Software

The software, which can be used on an installed operating system, is known as application software. Following are the significant examples of application software:

Application Software	Examples
Office programs	Microsoft Office, OpenOffice, LibreOffice, etc.
Web browser	Internet Explorer, Mozilla Firefox, Google Chrome, Opera, Safari, etc.
Antivirus Program	Norton, McAfee, Quick Heal, Avira, Kaspersky, etc.

## E –accessibility Software

The E-accessibility software components additional facilities to users such as:

- Voice recognition software
- Screen reader
- Magnifying tool
- On-screen keyboard
- Video games
- Learning software, etc.



## 4. Basics of Computer Science – Programing Languages

The computer system is simply a machine and hence it cannot perform any work; therefore, in order to make it functional different languages are developed, which are known as programing languages or simply computer languages.

Over the last two decades, dozens of computer languages have been developed. Each of these languages comes with its own set of vocabulary and rules, better known as syntax. Furthermore, while writing the computer language, syntax has to be followed literally, as even a small mistake will result in an error and not generate the required output.

Following are the major categories of Programming Languages:

- Machine Language
- Assembly Language
- High Level Language
- System Language
- Scripting Language

Let us discuss the programming languages in brief.

### **Machine Language or Code**

This is the language that is written for the computer hardware. Such language is effected directly by the central processing unit (CPU) of a computer system.

### **Assembly Language**

It is a language of an encoding of machine code that makes simpler and readable.

### **High Level Language**

The high level language is simple and easy to understand and it is similar to English language. For example, COBOL, FORTRAN, BASIC, C, C+, Python, etc.

High-level languages are very important, as they help in developing complex software and they have the following advantages:

- Unlike assembly language or machine language, users do not need to learn the high-level language in order to work with it.
- High-level languages are similar to natural languages, therefore, easy to learn and understand.
- High-level language is designed in such a way that it detects the errors immediately.

- High-level language is easy to maintain and it can be easily modified.
- High-level language makes development faster.
- High-level language is comparatively cheaper to develop.
- High-level language is easier to document.

Although a high-level language has many benefits, yet it also has a drawback. It has poor control on machine/hardware.

The following table lists down the frequently used languages:

<b>SQL</b>
<b>Java</b>
<b>Javascript</b>
<b>C#</b>
<b>Python</b>
<b>C++</b>
<b>PHP</b>
<b>IOS</b>
<b>Ruby/Rails</b>
<b>.Net</b>

## 5. Basics of Computer Science – Hardware & Software

The following table highlights the points that differentiate a hardware from a software.

<b>Hardware</b>	<b>Software</b>
It is the physical component of a computer system.	It is the programming language that makes hardware functional.
It has the permanent shape and structure, which cannot be modified.	It can be modified and reused, as it has no permanent shape and structure
The external agents such as dust, mouse, insects, humidity, heat, etc. can affect the hardware (as it is tangible).	The external agents such as dust, mouse, insects, humidity, heat, etc. cannot affect (as it is not tangible).
It works with binary code (i.e., 1's to 0's) .	It functions with the help of high level language like COBOL, BASIC, JAVA, etc.
It takes in only machine language, i.e., lower level language.	It takes in higher level language, easily readable by a human being.
It is not affected by the computer bug or virus.	It is affected by the computer bug or virus.
It cannot be transferred from one place to other electronically.	It can transfer from one place to other electronically.
Duplicate copy of hardware cannot be created.	A user can create copies of a software as many as he wishes.

## 6. Basics of Computer Science – Analog and Digital

The following table highlights the basic differences between analog and digital:

<b>Analog</b>	<b>Digital</b>
Its functions on physical analog system.	It functions on discrete numbers system.
The calculations in this system are primarily converted to equations and later converted into electrical signals.	The calculations in this system are converted into binary numbers (i.e., 1s and 0s).
To function, it requires physical analog.	To function, it requires discrete numbers.
It gives output in the form of 'graph'.	It gives output in the form of discrete values.
Accuracy comparatively is less.	Accuracy is very high.
Performs at a low speed.	It performs at a very high speed.
Difficult to make changes, as it is less flexible.	It is highly flexible.
It has memory of low capacity.	It has memory of high capacity.
Its application is limited to certain applications.	Its application is applicable to a number of applications.
It is hardly applicable for the business applications.	It is very much suitable for the business applications.
It cannot process alpha-numeric data.	It can process alpha-numeric data.
It requires RF technology.	It requires IP networking.
Static channel assignment.	Automatic channels exist as required.

# 7. Basics of Computer Science – Operating System

An operating system is the fundamental basis of all other application programs. Operating system is an intermediary between the users and the hardware.

Operating system controls and coordinates the use of hardware among application programs. The major services of an operating system are:

- Memory management
- Disk access
- Creating user interface
- Managing the different programs operating parallel
- Likewise, it controls and manage the hardware's working



## Applications of Operating System

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Following are the major *applications* of an operating system:

- An operating system is accountable for the formation and deletion of files and directories.
- An operating system manages the process of deletion, suspension, resumption, and synchronization.
- An operating system manages memory space by allocation and de-allocation.

- An operating system stores, organizes, and names and protects the existing files.
- Further, an operating system manages all the components and devices of the computers system including modems, printers, plotters, etc.
- In case, if any device fails, the operating system detects and notify.
- An operating system protects from destruction as well as from unauthorized use.
- An operating system facilitates the interface to user and hardware.

## Types of Operating System

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Following are the major types of operating system:

- Disk Operating System (DOS)
- Windows Operating System
- Unix Operating System

Let us now discuss each operating system in detail.

## Disk Operating System

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MS-DOS is one of the oldest and widely used operating system. DOS is a set of computer programs, the major functions of which are file management, allocation of system resources, providing essential features to control hardware devices.

DOS commands can be typed in either upper case or lower case.

## Features of DOS

Following are the significant features of DOS:

- It is a single user system.
- It controls program.
- It is machine independence.
- It manages (computer) files.
- It manages input and output system.
- It manages (computer) memory.
- It provides command processing facilities.
- It operates with Assembler.

## Types of DOS Commands

Following are the major types of DOS Command:

- **Internal Commands:** Commands such as DEL, COPY, TYPE, etc. are the internal commands that remain stored in computer memory.
- **External Commands:** Commands like FORMAT, DISKCOPY, etc. are the external commands and remain stored on the disk.

## Windows Operating System

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The operating system window is the extension of the disk operating system.

It is the most popular and simplest operating system; it can be used by any person who can read and understand basic English, as it does not require any special training.

However, the Windows Operating System requires DOS to run the various application programs initially. Because of this reason, DOS should be installed into the memory and then window can be executed.

## Elements of Windows OS

Following are the significant element of **Windows Operating System (WOS)**:

- Graphical User Interface
- Icons (pictures, documents, application, program icons, etc.)
- Taskbar
- Start button
- Windows explorer
- Mouse button
- Hardware compatibility
- Software compatibility
- Help, etc.

## Versions of Windows Operating System

Following are the different versions of Windows Operating System:

Version	Year	Version	Year
Window 1.01	1985	Windows XP Professional x64	2005

Windows NT 3.1	1993	Windows Vista	2007
Windows 95	1995	Windows 7	2009
Windows 98	1998	Windows 8	2012
Windows 2000	2000	Windows 10	2015
Windows ME	2000	Windows Server 2016	2016
Windows XP	2001		

## Unix Operating System

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The Unix Operating System is the earliest operating system developed in 1970s. Let us consider the following points relating to the Unix Operating System:

- It is an operating system that has multitasking features.
- It has multiuser computer operating systems.
- It runs practically on every sort of hardware and provides stimulus to the open source movement.
- It has comparative complex functionality and hence an untrained user cannot use it; only the one who has taken training can use this system.
- Another drawback of this system is, it does not give notice or warn about the consequences of a user's action (whether user's action is right or wrong).



## 8. Basics of Computer Science – Internet

Internet is a system that interconnects the different computer systems across the world. It uses the Internet protocol suite to link devices located in different corners of the world.

The Internet system carries an extensive range of information resources and services including World Wide Web (WWW), telephony, electronic mail, etc. It uses standard internet protocols, such as TCP/IP and HTTP, etc.



An internal web comprises of all Hypertext Transfer Protocol (HTTP) nodes on a private network; for example, an organization's LAN or WAN.

### Features of Internet

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Let us now discuss the features of Internet. The features are described below:

#### Accessibility

An Internet is a global service and accessible to all. Today, people located in a remote part of an island or interior of Africa can also use Internet.

#### Easy to Use

The software, which is used to access the Internet (web browser), is designed very simple; therefore, it can be easily learned and used. It is easy to develop.

## Interaction with Other Media

Internet service has a high degree of interaction with other media. For example, News and other magazine, publishing houses have extended their business with the help of Internet services.

## Low Cost

The development and maintenance cost of Internet service are comparatively low.

## Extension of Existing IT Technology

This facilitates the sharing of IT technology by multiple users in organizations and even facilitates other trading partners to use.

## Flexibility of Communication

Communication through Internet is flexible enough. It facilitates communication through text, voice, and video too. These services can be availed at both organizational and individual levels.

## Security

Last but not the least, Internet facility has to a certain extent helped the security system both at the individual and national level with components such as CCTV camera, etc.



## Internet Software

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Internet Software comprises of all the tools needed for networking through computer. Following are a few important components of the Internet Software:

- Transmission Control Protocol/ Internet Protocol (TCP/IP)
- Dialer Software
- Internet Browser

## Internet Applications

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Internet applications are server-based applications. Following are a few Internet Applications:

- World Wide Web (WWW)
- Electronic mail (e-mail)
- File Transfer Protocol (FTP)
- Telnet (i.e., log-in to the computer located remotely)
- Internet Relay Chat (IRC) (Real time video chatting)

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