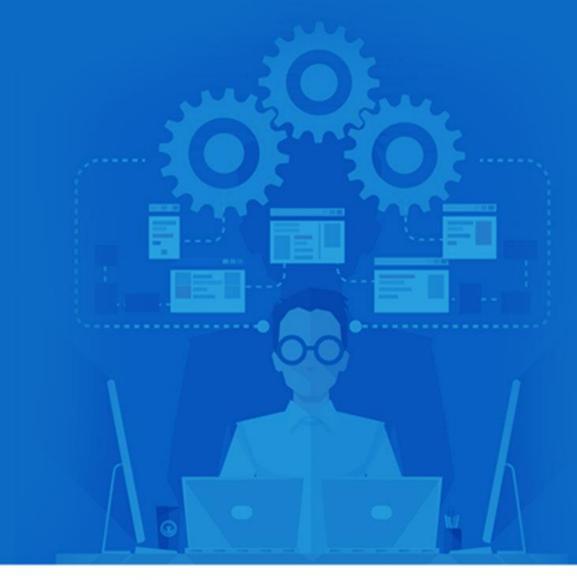
# **COMPUTER FUNDAMENTALS**

basics of personal computers







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# **About the Tutorial**

Computer is an advanced electronic device that takes raw data as an input from the user and processes it under the control of a set of instructions (called a program), produces a result (output), and saves it for future use. This tutorial explains the foundational concepts of computer hardware, software, operating systems, peripherals, etc., along with how to get the most value and impact from computer technology.

# What is Computer Fundamentals?

Computer fundamentals is all about the learning of the basic concepts of computers, such as introduction, types, components, memory, etc. The knowledge of computer fundamentals is required to operate computers and use their applications.

## **Key Topics in Computer Fundamentals**

Some of the key topics of computer fundamentals are:

- Introduction to Computers
- Components of a Computer
- Input Devices
- Output Devices
- Data Storage and Memory
- Computer Memory Units
- Different Types of Data Storage
- Computer Architecture (<u>CPU</u>, <u>ALU</u>, and CU)
- Software
- Basics of Operating System
- Basics of Networks

# **Advantages of Computers**

Computers provide various advantages, like speed and efficiency in processing and analyzing large amounts of data in a fraction of the time. They can automate repetitive tasks and can store vast amounts of information with quick access to it. They also perform complex calculations and have good problem-solving, decision-making, and multitasking with cost savings, as they help save a lot of paperwork and paper, which is ultimately good for the environment. Another advantages is that they also provide good data security and backup with global reach.

Read the chapter Computer Advantages and Disadvantages to learn the advantages and disadvantages of using computer systems in detail.

# **Applications of Computers**

As there are numerous <u>applications of computers</u>, they provide various applications in various fields in today's fast-paced world.

- It reduces the use of human work in various business and industrial areas, therefore increasing productivity as well as maintaining huge amounts of data.
- In the education sector, computers provide online learning and easy access to study materials in the form of digital resources, e-books, journals, etc.



- In healthcare, it manages a vast number of patient records, tracks patient health with the help of medical software and artificial intelligence (AI).
- In communication and entertainment, it provides instant communication through social media, collaboration tools, and global connectivity.
- In science and research, computers process large datasets for scientific research, and enhanced digital platforms lead to faster discoveries and advancements.
- Computers in finance and accounting help track financial transactions, manage accounts, and analyze market trends.
- And else in government and public administration, transportation, agriculture, and security and defense, overall it helps in a wide range of tasks to improve various aspects of modern life.

# Why Learn Computer Fundamentals?

Learning computer fundamentals is necessary to operate a computer and to know fundamental skills to work on the different computer applications.

#### **Audience**

This computer fundamentals tutorial has been prepared for beginners as well as advanced learners who want to deal with computers. The tutorial is also very useful for undergraduate students of computer science, engineering, business administration, management, science, commerce, and arts, where an introductory course on computers is a part of the curriculum.

After completing this tutorial, you will find yourself at a moderate level of expertise in the knowledge of computer basics from where you can take yourself to the next level.

# **Prerequisites**

Knowledge of computers is not a prerequisite to follow the contents of this tutorial. This tutorial assumes no background in Computers or Computer programming.

# **Computer Fundamentals FAQs**

# 1. Is any prior experience necessary to begin learning computer fundamentals?

No, there is no need for any prior knowledge to start learning computer basics. You can learn here from scratch even if you have no prior knowledge of computers. The basics are designed for beginners, and as you go along, you will slowly learn and get your hands on a computer. Thus, it is perfectly fine to start with the basics whether you are new to technology or just need a refresh.

## 2. From where should I begin when learning the fundamentals of computers?

Firstly, you should start with basic components, like <u>hardware</u> (CPU, <u>RAM</u>, storage, etc.) and their workings. Then go for operating systems like <u>Windows</u> or <u>macOS</u>, where you can learn how to navigate, manage files, and customize settings. Then further go for practice, using common software applications like word processors, spreadsheets, and web browsers. And then further you can go for more advanced topics as you progress.



# 3. How can I apply my knowledge of computer fundamentals in both my personal life and professional career?

You can apply your knowledge of computer fundamentals for both personal and professional use. Personally, a basic understanding of computers will help you to manage files; the use of software like <u>word processors</u> and <u>spreadsheets</u> will keep you more organized by handling your daily tasks, activities, and planning. Professionally, this will help you in creating reports, analyzing data, organizing emails, collaborating with colleagues, and ensuring the security of your work.

# 4. Can mastering computer fundamentals benefit me in creative fields such as art or design?

Yes, it definitely benefits you a lot in creative fields like art or design. A basic knowledge of computers will make your work more efficient with design software like Adobe Photoshop, Illustrator, or other creative tools. It lets you manage files and folders, organize your projects, and troubleshoot any technical issues that might come up.

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# **Table of Contents**

	About the Tutorial	
	Audience	i
	Prerequisites	i
	Copyright & Disclaimer	ii
	Table of Contents	iv
1.	Computer - Overview	1
2.	Computer - Advantages and Disadvantages	4
3.	Classification of Computers	6
4.	Computer - Applications	13
5.	Computer - History and Evolution	18
6.	Characteristics of Computer System	20
7.	Origin of Computing	23
8.	Computer - Generations	26
9.	Types of Computers	30
10.	Computer - Components	33
11.	Computer - Central Processing Unit (CPU)	53
12.	Computer - Input Devices	56
13.	Computer - Output Devices	74
14.	Computer - Memory Units	88
15.	Computer - Arithmetic Logic Unit (ALU)	89
16.	Computer - Hardware	91
17.	Computer - Motherboard	94
18.	Computer - Random Access Memory (RAM)	99
19.	Computer - Read Only Memory (ROM)	104
20.	Computer - Graphics Processing Unit (GPU)	108
21.	Computer - Power Supply Unit (PSU)	112
22.	Computer - Software	116



23.	Computer - Software Types	118
24.	Computer - NAND Flash Memory	125
25.	Computer - NVMe Memory	129
26.	Computer - CompactFlash Card	131
27.	Computer - Data Storage & Memory	135
28.	Computer - Types of Data Storage	148
29.	Computer - Hard Disk Drives (HDD)	150
30.	Computer - Solid State Drives (SSD)	154
31.	Computer - Optical Storage (Discs)	157
32.	Computer - Memory Cards	160
33.	Computer - Cloud Storage	165
34.	Computer - Memory	170
35.	Computer - Cache Memory	175
36.	Computer - VRAM	179
37.	Computer - Internet and Intranet	182
38.	Computer Fundamentals - Internet	184
39.	Computer Fundamentals - Extranet	193
40.	Computer Fundamentals - Websites	198
41.	Computer Fundamentals - Word Processors	203
42.	Computer Fundamentals - Spread Sheet	209
43.	Computer Fundamentals - Power Presentations	215
44.	Computer Fundamentals - E-mail Tools	224
45.	Types of Computer Ports	229
46.	Computer - Number System	238
47.	Computer - Number Conversion	241
48.	Computer Fundamentals - Data and Information	246
49.	Basics of Computer Networking	250
50.	Basics of Computer Operating System	258



# Computer Fundamentals Tutorial

51.	Computer Fundamentals - Keyboard Shortcut Keys	.263
52.	Computer Fundamentals - Antivirus	.270
53.	Computer Fundamentals - Virus	273
54.	How to Buy a Computer?	.278
55.	Computer - Available Courses	283



# 1. Computer - Overview

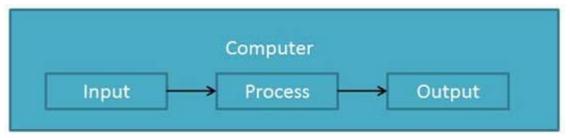
Today's world is an information-rich world and it has become a necessity for everyone to know about computers. A computer is an electronic data processing device, which accepts and stores data input, processes the data input, and generates the output in a required format.

The purpose of this tutorial is to introduce you to Computers and its fundamentals.

#### **Functionalities of a Computer**

If we look at it in a very broad sense, any digital computer carries out the following five functions –

- Step 1 Takes data as input.
- **Step 2** Stores the data/instructions in its memory and uses them as required.
- **Step 3** Processes the data and converts it into useful information.
- **Step 4** Generates the output.
- **Step 5** Controls all the above four steps.



# **Advantages of Computers**

Following are certain advantages of computers.

#### **High Speed**

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the picosecond.
- It can perform millions of calculations in a few seconds as compared to man who will spend many months to perform the same task.

#### Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are 100% error free.
- Computers perform all jobs with 100% accuracy provided that the input is correct.

#### **Storage Capability**

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity than human beings.



- It can store a large amount of data.
- It can store any type of data such as images, videos, text, audio, etc.

#### Diligence

- Unlike human beings, a computer is free from monotony, tiredness, and lack of concentration.
- It can work continuously without any error and boredom.
- It can perform repeated tasks with the same speed and accuracy.

# Versatility

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.
- This machine can be used to solve the problems related to various fields.
- At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

#### Reliability

- A computer is a reliable machine.
- Modern electronic components have long lives.
- Computers are designed to make maintenance easy.

#### Automation

- Computer is an automatic machine.
- Automation is the ability to perform a given task automatically. Once the computer receives a program i.e., the program is stored in the computer memory, then the program and instruction can control the program execution without human interaction.

#### Reduction in Paper Work and Cost

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up the process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.
- Though the initial investment for installing a computer is high, it substantially reduces the cost of each of its transactions.

# **Disadvantages of Computers**

Following are certain disadvantages of computers.

#### No I.Q.

- A computer is a machine that has no intelligence to perform any task.
- Each instruction has to be given to the computer.
- A computer cannot take any decision on its own.

#### Dependency

• It functions as per the user's instructions thus it is fully dependent on humans.



#### **Environment**

• The operating environment of the computer should be dust free and suitable.

# No Feeling

- Computers have no feelings or emotions.
- It cannot make judgment based on feeling, taste, experience, and knowledge unlike humans.



# 2. Computer - Advantages and Disadvantages

A computer is an electronic device. It performs computation on inputted data by processing it. It is a cutting-edge device that can store large amounts of data, process it, and give desired results. Its results are accurate if the inputted data is correct, which makes it more popular at this time. In today's time, computers are almost used in every domain, like education, research, medicine, law, retail, companies, etc.

Due to the popularity and usage of computers, there is no shelter in saying that today everyone has become dependent on them. There are some advantages and disadvantages to computers.

# **Advantages of Computers**

- **Speed** Computers can execute programs quickly. Thousands of instructions can execute in milliseconds or seconds.
- **Accuracy** Computers can perform very complex computations accurately in a very short time. If a user inputs the correct data to the computer, it gives accurate results that can be used in decision-making.
- **Storage** Computers can store large amounts of data permanently. The data is saved in files, which can be accessed at any time; these files are saved for a long time period until a user deletes them.
- **Power of Remembering** A computer stores data permanently. It forgets or loses certain information only when asked to do so.
- **Versatility** A computer is a versatile device. It can run different programs simultaneously.
- **Diligently** A computer can do the assigned task diligently. A computer can work for hours without getting tired. Hence, it can do thousands of complex computations with the same accuracy.
- **Automation** A computer is an automated device. It works without human intervention.
- **No I.Q.** A computer does not have its own I.Q.; it carries out the predetermined tasks and does not take its own decisions.
- **No Feelings** A computer does not have emotions. It works as per the given instructions by users.

# **Disadvantages of Computers**

- **Health Issues** Working long hours on computers leads to health issues. Students play games and access related applications for a long time and this leads to serious health problems.
- **Spread of Pornography** The growing trend of the internet has spread pornography. In today's time, pornography is a big threat to society and the youth.
- **Virus and hacking attacks** Viruses are unwanted programs that enter computers through networks or the internet. These programs may steal information or damage computers. Sometimes these lock the application programs of the computer to affect its working.
- No IQ Computers cannot make their own decisions. Its functioning depends on human interventions.

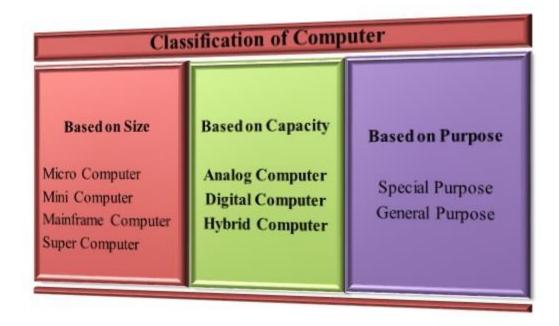


- **Negative effect on the environment** The increasing use of computers and automated devices has posed a major threat to the environment.
- **Crashed Networks** Hackers may destroy the network, which affects the overall working of the existing system. In today's time, most of the data is on servers, so destroying the network may be a serious threat to communication.
- **Online cybercrimes** The practice of using a computer to facilitate unlawful activities including fraud, the trafficking of child pornography and other items of intellectual property, identity theft, and privacy violations is known as cybercrime. The relevance of cybercrime, particularly over the Internet, has increased as the computer is most widely used in business, entertainment, and government.
- **Data and information violation** A breach of confidentiality occurs when information is given to a third party without the data owner's authorization. The owner of the data has the right to file for legal action to recover the potential losses.



# 3. Classification of Computers

A computer can be classified based on its size, capacity, and purpose. The following diagram illustrates different types of computers as per their size, capacity, and purpose.



### Computer's classification based on Size

As per the size, a computer can be broadly classified as follows -

- Micro Computer
- Mini Computer
- Mainframe Computer
- Super Computer

#### **Micro Computer**

Microcomputers, also known as personal computers (PCs), are a type of computer designed for individual use. They are distinguished by their compact dimensions, small size, processing power, compatibility, internet connectivity, portability, low price, and versatility. In the 1970s and 1980s, microcomputers gained popularity and became more popular in the modern computing era.





Fig: Micro Computer

- **Size** Microcomputers are small in size. These are portable.
- **Example** Some of the popular microcomputers are laptops and desktops, standard PCs, mobile phones, and notebooks.
- Why microcomputer?

  Microcomputers have become an important part of modern life. They have had a big impact on society, companies, education, and related areas.
- **Uses of Microcomputers** Microcomputers are most widely used in education and learning, entertainment and media, innovation and creativity, research and science, healthcare and medicine, home automation, remote work, and ecommerce and online shopping.

#### Minicomputer

A minicomputer is a type of computer that is smaller in size than large computers. It possesses all the capabilities of a large computer. Hence, it is a midsize multi-processing system capable of supporting up to 250 users simultaneously.



Fig: Mini Computer

- **Size** Its size falls between mainframes and microcomputers. It is smaller than mainframe computers and larger than microcomputers.
- **Example** Some of the popular minicomputers are the PDP-11, IBM's AS/400e, Honeywell 200, and TI-990.
- Why a Mini Computer? Mini computers are also known as mini PCs or small-form-factor (SFF) computers. These have impressive computing capabilities, high performance, connectivity options, portability, and versatility features.
- **Uses of Minicomputers** Minicomputers are most widely used in scientific computations, engineering, business transaction processing, file handling, and database management.



#### Mainframe computer

The mainframe is very large and an expensive computer capable of supporting hundreds or even thousands of users simultaneously. The mainframe executes many programs concurrently and supports their simultaneous execution.



Fig: Mainframe Computer

- **Size** Mainframe computers can vary in size. Their size generally depends on their specifications and the specific model being considered.
- **Example** Some of the popular mainframe computers are IBM zSeries mainframes (BM z14 and IBM z15), Unisys ClearPath, Fujitsu GS21 Series, and Hitachi VOS3.
- Why a mainframe computer?
  - The processing capacity of mainframes is frequently measured in MIPS (million instructions per second) or other units. This enables them to process a large volume of transactions and perform extensive data processing.
- **Uses of Mainframe** Mainframe computers are most widely used in finance, government, healthcare, and more.

#### Supercomputer

A supercomputer is a special type of computer that is more powerful and capable of highperformance computing. It is specifically designed to compute complex and intensive tasks that regular computers cannot do efficiently. The features of super computers are as follows:

• **Size** – Supercomputers can vary in size, from small clusters of computers to massive installations. A supercomputer may contain 10, 100, 1000, or more computers that all work together.





#### Fig: Super Computer

- **Example** Some of the popular supercomputers are Fugaku, Google Sycamore, Baidu's quantum supercomputer, and Sierra.
- Why Supercomputer?
  - A supercomputer's processing speed is exceptional and can perform billions of calculations per second. Multiple processors work in parallel mode to execute tasks, which makes processing powerful.
  - Supercomputers are specially built using specialized hardware like GPUs (Graphics Processing Units) or TPUs (Tensor Processing Units), which are used in graphics rendering or machine learning tasks.
  - Supercomputers represent the pinnacle of computing power, and these are very expensive and are employed for specialized applications.
- **Uses of the Supercomputer** Supercomputers are most widely used in scientific research, data analysis, weather forecasting, scientific simulations, graphics, fluid dynamic calculations, nuclear energy research, electronic design, and the analysis of geological data.

#### Computer's classification based on Capacity

As per the capacity, a computer can be broadly classified as follows -

- Analog Computer
- Digital computer
- Hybrid computer

#### **Analog Computer**

A computer that uses physical means like mechanical or hydraulic components to do the computation rather than electronic circuits is called an analog computer. These computers work with continuous data and can manage physical quantities efficiently. They are particularly good at solving differential equations and simulating dynamic systems.



Fig: Analog computer

In lieu of numbers, an analog computer performs arithmetic operations based on measurable quantities, such as mechanical movement or the rotation of gears. In analog computers, data is processed as continuous signals for its operation, whereas in digital computers, data is transmitted as discrete signals (or discontinuous signals).



#### **Digital Computer**

A digital computer is a type of computer that represents and processes data using discrete, distinct values.



Fig: Digital computer

In digital computers, data is processed using binary numbers 0 and 1. These computers are designed to perform arithmetic calculations, complex data processing, and manipulation. The main components of a digital computer are input, processing, and output.

#### **Hybrid Computer**

A hybrid computer is a type of computer system that integrates the features and capabilities of both analog and digital computers. This integration allows the hybrid computer to perform various tasks efficiently by leveraging the strengths of both digital and analog technologies.



Fig: Hybrid computer

The main components of a hybrid computer are the analog and digital components –

**Analog Component** – Analog components in a hybrid computer can process real-world data like voltage, current, temperature, pressure, etc. using analog circuits and components.

**Digital Component** – Digital computers work with discrete data and are based on binary numbers (0s and 1s). Digital components in a hybrid computer provide the computational power to perform complex calculations and control the overall operation of the system.

## Computer's classification based on Purpose

As per the capacity, a computer can be broadly classified as follows -

- Special Purpose
- General Purpose



#### **Special Purpose Computer**

A computer that is designed and optimized for a specific task or a set of tasks is called a special purpose computer (SPC). SPCs are designed to excel at a single or limited set of functions, frequently with a high degree of efficiency, speed, and accuracy.



Fig: Special Purpose Computer

Some of the following popular SPCs are:

- **Embedded Systems** These systems are integrated with devices to control specific functions. For example, a car's engine control unit and microwave ovens
- **Digital Signal Processors** These are commonly used in applications like audio processing, image compression, and telecommunications.
- **Automated Teller Machines** ATMs are special-purpose computers designed specifically for banking transactions and interactions with customers.
- **Medical Equipment** Machines like MRI and CT scanners are specialized computers used for capturing and processing medical images.
- **Spacecraft Computers** Computers used in spacecraft have to operate in extreme conditions and are optimized for the demands of space missions.

## **General Purpose Computer**

A computer that is designed to perform a wide range of tasks and functions is called a General Purpose Computer (GPC). A GPC is versatile and can be used for various purposes by running different software applications.



Fig: General Purpose Computer

Some of the following popular GPCs are as follows -

**Turing Completeness** – A GPC can simulate any algorithm or computation that can be explored algorithmically.

**Programmability** – GPCs can run different applications.



**General-Purpose Operating System** – GPCs can use different operating systems like Windows, macOS, or Linux that provide an interactive user interface and manage hardware resources, enabling the execution of various application programs.

**Input and Output Capabilities** — GPCs have input and output devices (keyboard, mouse, monitor, etc.) that permit users to interact with the system and receive feedback.

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