**What is Data?**

*Data is a raw and unorganized fact that is required to be processed to make it meaningful. It can be considered as facts and statistics collected together for reference or analysis.*

**Data and Its Types**

**1. 🔢 Numerical Data**

This includes only numbers. It can be used for mathematical operations like addition, subtraction, etc.

Examples:

* 45
* 3.14
* 2025
* -10

Used For:

* Calculations
* Statistics
* Measurements (like age, height, marks)

**2. 🔤 Alphabetic Data**

This includes only letters (A–Z or a–z), without any numbers or symbols.

Examples:

* John
* Pakistan
* abcXYZ

Used For:

* Names
* Countries
* Words or text input

**3. 🔡🔢 Alphanumeric Data**

This is a combination of letters and numbers. It may also include symbols (like @, #, etc., depending on context).

Examples:

* A1B2C3
* House22
* abc123
* Pass2025

Used For:

* Usernames
* IDs (like student ID: STU1001)
* Passwords
* Vehicle numbers

**📊 Summary Table:**

| **Type** | **Contains** | **Example** | **Common Use** |
| --- | --- | --- | --- |
| Numerical | Only numbers | 1234 | Calculations, marks |
| Alphabetic | Only letters | Fakhr | Names, countries |
| Alphanumeric | Letters + Numbers (+Symbols) | CS101 | IDs, passwords, codes |

**What is Data?**

*Data is a raw and unorganized fact that is required to be processed to make it meaningful. It can be considered as facts and statistics collected together for reference or analysis.*

[Data](https://www.geeksforgeeks.org/what-is-data/)are individual units of information. In analytical processes, data are represented by variables. Data is always interpreted, by a human or machine, to derive meaning. So, data is meaningless. Data contains numbers, statements, and characters in a raw form.

**Types of Data**

There are two types of Data:

1. **Quantitative:**Quantitative data refers to numerical informationlike weight, height, etc.
2. **Qualitative:**Qualitative data refers to non-numeric informationlike opinions, perceptions, etc.

**What is Information?**

*Information is defined as structured, organized, and processed data, presented within a context that makes it relevant and useful to the person who needs it. Data suggests that raw facts and figures regarding individuals, places, or the other issue, that is expressed within the type of numbers, letters or symbols.*

Information is the knowledge that is remodelled and classified into an intelligible type, which may be utilized in the method of deciding. In short, once knowledge ends up being purposeful when conversing, it’s referred to as info. It’s one thing that informs, in essence, it provides a solution to a specific question. It may be obtained from numerous sources like newspapers, the internet, television, people, books, etc.

**Difference between Information and Data**

| **S.NO** | **DATA** | **INFORMATION** |
| --- | --- | --- |
| **Definition** | Data is defined as unstructured information such as text, observations, images, symbols, and descriptions. In other words, data provides no specific function and has no meaning on its own. | Information refers to processed, organized, and structured data. It gives context for the facts and facilitates decision making. In other words, information is processed data that makes sense to us. |
| **Purpose** | Data are the variables that help to develop ideas/conclusions. | Information is meaningful data. |
| **Nature** | Data are text and numerical values. | Information is refined form of actual data. |
| **Dependence** | Data doesn’t rely on Information. | While Information relies on Data. |
| **Measurement** | Bits and Bytes are the measuring unit of data (in computer). A movie stored in computer in bits form has no meaning | Information is measured in meaningful units like time, quantity, etc. while a movie a screen have full impact. |
| **Structure** | As tabular data, graphs, and data trees can be easily structured. | Information can also be structured as language, ideas, and thoughts. |
| **Purposefulness** | Data does not have any specific purpose | Information carries a meaning that has been assigned by interpreting data. |
| **Knowledge Level** | It is low-level knowledge. | It is the second level of knowledge. |
| **Decision Making** | Data does not directly help in decision making. | Information directly helps in decision making. |
| **Meaning** | Data is a collection of facts, which itself has no meaning. | Information puts those facts into context. |
| **Example** | Example of data is student test scores. | Example of information is average score of class that is derived from given data. |

**Examples of Data vs. Information**

**Data Example**

* **Temperature Readings: Numbers representing temperature throughout the day, such as**“72°F”, “68°F”, “75°F”**.**
* **Student Grades**:A list of numerical scores obtained by students on a test, like “85”, “92”, “78”.
* **Stock Prices**: Daily closing prices of a company’s stock, such as “$50.25”, “$48.90”, “$52.10”.

**Information Example**

* **Weather Report:** Based on the temperature reading a weather report can be generated.
* **Grade Average:**Based on the student grades, the average grade of class can be derived.
* **Market Analysis:**The stock market showed a slight increase today derived from stock prices.

In each case, the raw data ( temperature readings, student grades, stock prices) becomes meaningful information after being processed, analyzed, and presented in a relevant context.

**What Is Data Processing?**

Data in its raw form is not useful to any organization. Data processing is the method of collecting raw data and translating it into usable information. It is usually performed in a step-by-step process by a team of [data scientists](https://www.simplilearn.com/a-day-in-the-life-of-a-data-scientist-article) and [data engineers](https://www.simplilearn.com/how-to-become-a-data-engineer-article) in an organization. The raw data is collected, filtered, sorted, processed, analyzed, stored, and then presented in a readable format.

Data processing is essential for organizations to create better business strategies and increase their competitive edge. By converting the data into readable formats like graphs, charts, and documents, employees throughout the organization can understand and use the data.

**🔄 Steps in Data Processing:**

1. **Collection**
Gathering raw data from various sources like sensors, surveys, files, or databases.
2. **Preparation (Cleaning)**
Removing errors, duplicates, or irrelevant data — making it usable.
3. **Input**
Converting the data into a format that can be processed by a system (e.g., entering it into a software or database).
4. **Processing**
Applying calculations, comparisons, sorting, classification, or other operations to transform data into meaningful form.
5. **Output**
The processed data is presented as information — reports, charts, summaries, etc.
6. **Storage**
Saving the processed data for future use or analysis (e.g., in databases or cloud storage).

**⚙️ Example:**

Imagine a school system collecting student test scores:

* **Raw Data**: Test results from different subjects.
* **Processing**: Calculate average marks, highest/lowest scores, and pass/fail status.
* **Output**: A student performance report.
* **Use**: Helps teachers and parents understand the student’s academic progress.

**What is Search Engine?**

A search engine is a program that locates and retrieves information from a database or the World Wide Web based on keywords entered by the user.

⚙️ How it works (in simple terms):

1. Crawling – Bots (called spiders) scan and collect data from websites across the internet.
2. Indexing – Collected data is stored and organized in a massive database (index).
3. Searching – When a user enters a query, the search engine matches it with the indexed data.
4. Ranking – Results are ranked using algorithms (based on relevance, popularity, content quality, etc.).
5. Results Display – The search engine shows the most relevant pages to the user.

🧠 Examples:

* Google
* Bing
* Yahoo
* DuckDuckGo
* Baidu

**📡 Means of Online Information Communication:**

**1. Email (Electronic Mail) ✉️**

A formal method to send messages, documents, and files.

Use Case:

* Official communication in schools or businesses
* Sending notices, assignments, reports

Examples:
Gmail, Outlook, Yahoo Mail

**2. Instant Messaging / Chat Apps 💬**

Real-time text communication between individuals or groups.

Use Case:

* Quick discussions
* Group chats among teachers or project members

Examples:
WhatsApp, Messenger, Telegram, Microsoft Teams

**3. Video Conferencing 🎥**

Live video and audio communication, often with screen sharing.

Use Case:

* Online classes
* Virtual meetings, parent-teacher conferences

Examples:
Zoom, Google Meet, Microsoft Teams, Skype

**4. Social Media Platforms 📱**

Interactive platforms for sharing content and updates.

Use Case:

* Promoting events
* Sharing academic content and news

Examples:
Facebook, Twitter (X), Instagram, LinkedIn

**5. Websites and Portals 🌍**

Used to publish and access structured content like articles, notices, forms, and media.

Use Case:

* Information portals like mcqsall.com
* School websites for announcements and results

Examples:
Educational websites, blogs, LMS (Learning Management Systems)

**6. Cloud Collaboration Tools ☁️**

Platforms that let multiple users work on the same documents or projects online.

Use Case:

* Shared notes, assignments, and schedules
* Project collaboration

Examples:
Google Drive, Microsoft OneDrive, Dropbox, Notion

**7. Forums and Discussion Boards 🧑‍🤝‍🧑**

Places for open discussions, asking questions, and sharing knowledge.

Use Case:

* Student Q&A
* Community support for software or courses

Examples:
Reddit, Quora, Stack Overflow, school or course-specific forums

**🧠 Summary Table:**

| **Communication Method** | **Primary Use** | **Example Apps/Sites** |
| --- | --- | --- |
| Email | Formal messages, attachments | Gmail, Outlook |
| Instant Messaging | Quick text communication | WhatsApp, Telegram |
| Video Conferencing | Live classes and meetings | Zoom, Google Meet |
| Social Media | Content sharing, engagement | Facebook, Instagram |
| **Websites/Portals** | **Public info and online services** | **mcqsall.com, school sites** |
| **Cloud Collaboration** | **Working on shared content** | **Google Drive, Notion** |
| **Forums/Discussion Boards** | **Peer learning, Q&A** | **Reddit, Stack Overflow** |

# What is a CPU?

The CPU, often referred to as the “brain” of a computer, is responsible for executing instructions from software programs. It performs essential tasks such as arithmetic operations, logical comparisons, data manipulation, and managing the flow of data within the system. The CPU interacts with other hardware components, such as memory and input and output devices, to ensure the seamless functioning of a computer.



# ALU, CU, and Register Memory

The CPU is divided into various components, each with a specific role. The Arithmetic Logic Unit (ALU) is the component responsible for carrying out arithmetic operations (addition, subtraction, multiplication, and division) and logical operations (AND, OR, NOT) on data. It performs calculations and generates results that are integral to various processes.

The Control Unit

(CU) serves as the manager of the CPU’s activities. It interprets and coordinates instructions from the computer’s memory, ensuring that each operation is executed in the correct sequence. The CU manages the flow of data between different components of the CPU and other hardware components, ensuring that the computer operates according to the program’s instructions.

Register Memory

Inside the CPU, register memory plays a crucial role in data storage and manipulation. Registers are small, high-speed storage locations that hold data temporarily during processing. They are used to store operands, intermediate results, and control information required by the ALU and CU. Registers allow the CPU to access and manipulate data quickly, contributing to the overall efficiency of the system

# Cache Memory on CPU

Cache memory is a specialized type of high-speed, volatile computer memory that provides faster data storage and access compared to main memory (RAM). The cache is positioned directly on the CPU chip or in close proximity to it. It stores frequently used instructions and data to reduce the time the CPU spends waiting for data from the slower main memory. Cache memory comes in different levels (L1, L2, and L3) based on proximity to the CPU and capacity. The use of cache memory significantly enhances CPU performance and responsiveness.

# CPU Speed

CPU speed, often measured in gigahertz (GHz), refers to the clock frequency at which a CPU can execute instructions. A higher clock speed generally indicates a faster CPU, as it can process more instructions per second. However, other factors like architectural design, number of cores, and cache size also influence overall performance. Over the years, advancements in technology have led to increased CPU speeds, allowing for faster computing and more complex tasks.

**Computer Network**

A computer network is a system where two or more computers (or devices) are connected together to share resources, such as files, internet connections, printers, and applications.
The main purpose of a network is to enable communication and data sharing between devices efficiently.

**Types of Computer Networks**

There are several types of computer networks, mainly classified based on their size, range, and purpose:

**1. Local Area Network (LAN)**

* **Definition: A network that connects computers within a small geographic area — like a home, office, or building.**
* **Features:**
	+ **High speed**
	+ **Covers short distances (up to a few kilometers)**
	+ **Private ownership**
* **Example: Computers connected inside a school or a company building.**

**2. Wide Area Network (WAN)**

* **Definition: A network that covers a large geographical area, often a country or continent.**
* **Features:**
	+ **Slower than LAN**
	+ **Uses public or leased communication lines (like telephone lines, satellites)**
	+ **Expensive to maintain**
* **Example: The Internet is the largest WAN.**

**3. Metropolitan Area Network (MAN)**

* **Definition: A network that covers a city or a large campus.**
* **Features:**
	+ **Larger than LAN but smaller than WAN**
	+ **Used by city governments, large universities, or companies with offices across a city**
* **Example: A city's public Wi-Fi network.**

**4. Virtual Private Network (VPN)**

* **Definition: A secure network created over the internet to connect remote users or offices.**
* **Features:**
	+ **Encrypts data**
	+ **Provides secure communication**
* **Example: Employees accessing company servers from home securely.**

**Summary Table**

| **Network Type** | **Area Covered** | **Example** |
| --- | --- | --- |
| **LAN** | **Small building or office** | **School computer lab** |
| **MAN** | **City-wide** | **City government network** |
| **WAN** | **Country or world-wide** | **Internet** |
| **VPN** | **Secure over internet** | **Remote working employees** |

**Explain different component of network?**

**1. Devices**

These are the hardware elements that form the network. Key devices include:

* **Router**: Connects different networks (like a home network to the internet) and directs data packets to their destinations.
* **Switch**: Connects multiple devices (like computers and printers) within the same network and manages data traffic efficiently.
* **Hub**: A basic device that connects several computers together but broadcasts data to all ports, making it less efficient than a switch.
* **Access Point (AP)**: Extends a wired network by adding Wi-Fi capability so wireless devices can connect.
* **Network Interface Card (NIC)**: A hardware component in a device (computer, printer, etc.) that allows it to connect to a network.
* **Modem**: Converts digital data from a computer to signals that can travel over telephone or cable lines and vice versa.
* **Firewall Device**: Provides a physical defense against external network threats by monitoring and controlling incoming and outgoing traffic.

**2. Links**

Links are the physical or logical connections between devices. These include:

* **Wired Links**:
	+ **Twisted Pair Cable**: Common in LANs; relatively cheap (e.g., Ethernet cables).
	+ **Coaxial Cable**: Used in cable internet and TV services.
	+ **Fiber Optic Cable**: Very high-speed data transmission over long distances.
* **Wireless Links**:
	+ **Wi-Fi**: Wireless local area networking using radio waves.
	+ **Bluetooth**: Short-range wireless communication between devices.
	+ **Satellite and Cellular Networks**: Used for wide-area networking without physical cables.

**3. Protocols**

Protocols are standardized rules that determine how data is transmitted across a network. Examples include:

* **TCP/IP (Transmission Control Protocol/Internet Protocol)**: The foundational protocol for the internet and most local networks.
* **HTTP/HTTPS (HyperText Transfer Protocol/Secure)**: Protocols for web communication (HTTPS includes encryption).
* **FTP (File Transfer Protocol)**: Used for transferring files between computers.
* **SMTP (Simple Mail Transfer Protocol)**: Used for sending emails.
* **DNS (Domain Name System)**: Resolves human-readable domain names (like google.com) into IP addresses.

Protocols ensure that devices from different manufacturers can communicate properly.

**4. Defense**

Defense mechanisms are strategies and technologies to protect a network from threats. Key aspects include:

* **Firewalls**: Hardware or software that blocks unauthorized access while permitting legitimate communication.
* **Encryption**: Scrambles data so it can only be read by someone with the correct decryption key (e.g., SSL/TLS in HTTPS).
* **Intrusion Detection and Prevention Systems (IDS/IPS)**: Monitor network traffic for suspicious activity and take action.
* **Antivirus and Anti-malware Software**: Protect individual devices by detecting and removing harmful software.
* **Authentication Mechanisms**: Ensure that only authorized users and devices can access the network (e.g., username/passwords, biometrics, two-factor authentication).
* **Virtual Private Network (VPN)**: Creates a secure, encrypted tunnel over the internet to protect private communications.

**Summary Table**

| **Component** | **Role** |
| --- | --- |
| Devices | Hardware that sends, receives, and directs data |
| Links | Physical or wireless paths for data transfer |
| Protocols | Rules for communication and data handling |
| Defense | Methods to protect the network and its data |

**How to Use the Internet and Email Applications**

**Using the Internet**

1. **Connect to the Internet**:
	* Make sure your device (computer, smartphone, or tablet) is connected to a Wi-Fi network or through a mobile network or cable.
2. **Open a Web Browser**:
	* Click on a browser icon like **Google Chrome**, **Mozilla Firefox**, **Microsoft Edge**, or **Safari**.
3. **Enter a Website Address (URL)**:
	* At the top of the browser, click inside the **address bar** and type a website address (e.g., www.google.com) and press **Enter**.
4. **Search for Information**:
	* If you don’t know the exact website, you can type keywords into a **search engine** like Google (e.g., "best smartphones 2025") and explore the results.
5. **Navigate Websites**:
	* Click on links, buttons, and menus to move around websites and find information, videos, images, or documents.
6. **Download Files (Optional)**:
	* Some websites allow you to download files like PDFs, images, or software — just click on the "Download" button, but always be careful and download from trusted websites.

**Using Email Applications**

You can access email through a **web browser** (like Gmail or Outlook.com) or an **email application** (like Microsoft Outlook, Mozilla Thunderbird, or the Mail app on phones).

**Steps to Send an Email (Web Version like Gmail)**

1. **Open your Email Website**:
	* Go to www.gmail.com (for Gmail), www.outlook.com (for Outlook), or any other service.
	* Login with your **email address** and **password**.
2. **Click on "Compose" or "New Email"**:
	* This opens a new email window.
3. **Fill in Email Details**:
	* **To**: Enter the recipient's email address (e.g., example@gmail.com).
	* **Subject**: Type a short title about your email (e.g., "Meeting Schedule").
	* **Message Body**: Type your main message.
4. **Attach Files (Optional)**:
	* Click on the **paperclip** icon to attach documents, images, or files.
5. **Send the Email**:
	* Click the **Send** button once you're ready.

**Steps to Check Emails**

1. Open your email inbox (on web or app).
2. New emails usually appear at the top.
3. Click on any email to open, read, and reply if needed.

**Summary Table**

| **Activity** | **Action** |
| --- | --- |
| Use Internet | Connect → Open Browser → Type URL or Search |
| Send Email | Open Email → Compose → Write → Send |
| Receive Email | Open Inbox → Read → Reply or Archive |

**Computer Virus**

A **computer virus** is a type of **malicious software (malware)** that is designed to **spread from one computer to another** and **interfere with normal computer operations**.
It can **replicate itself**, **corrupt or delete data**, **slow down performance**, or even cause complete system failure. Viruses usually spread through infected files, emails, downloads, or removable media like USB drives.

Just like a biological virus, a computer virus needs a "host" — typically a file or program — to attach itself to and activate.

**Types of Computer Viruses**

**1. File Infector Virus**

* **Description**: Attaches itself to executable files (like .exe or .com files).
* **Effect**: When the infected file is run, the virus gets activated and can spread.
* **Example**: The **CIH** virus (also known as Chernobyl virus).

**2. Boot Sector Virus**

* **Description**: Infects the **boot sector** of a hard drive or removable storage device.
* **Effect**: When the computer starts, the virus loads into memory before the operating system.
* **Example**: **Michelangelo** virus.

**3. Macro Virus**

* **Description**: Targets macros (small programs) within applications like Microsoft Word or Excel.
* **Effect**: Spreads through documents and emails by executing malicious macros.
* **Example**: **Melissa** virus.

**4. Polymorphic Virus**

* **Description**: Changes its code slightly every time it infects a system.
* **Effect**: Makes it hard for antivirus programs to detect and remove.
* **Example**: **Storm Worm**.

**5. Metamorphic Virus**

* **Description**: Completely rewrites its own code every time it infects a new system.
* **Effect**: Even harder to detect than polymorphic viruses.
* **Example**: **Simile** virus.

**6. Resident Virus**

* **Description**: Installs itself into a computer’s memory.
* **Effect**: Infects files and programs even after the original source is removed.
* **Example**: **CMOS** virus.

**7. Non-Resident Virus**

* **Description**: Does not stay in memory; it immediately looks for other targets after execution.
* **Effect**: Quickly spreads to other files but doesn’t persist in RAM.
* **Example**: **Cascade** virus.

**8. Multipartite Virus**

* **Description**: Infects both **boot sector** and **files**.
* **Effect**: Difficult to clean because it attacks from multiple angles.
* **Example**: **Tequila** virus.

# Summary Table

| **Type of Virus** | **Target/Behaviour** | **Example** |
| --- | --- | --- |
| File Infector Virus | Attaches to executable files | CIH (Chernobyl) |
| Boot Sector Virus | Infects boot sector of storage | Michelangelo |
| Macro Virus | Spreads through application macros | Melissa |
| Polymorphic Virus | Changes its code to avoid detection | Storm Worm |
| Metamorphic Virus | Rewrites its code completely | Simile |
| Resident Virus | Lives in system memory | CMOS |
| Non-Resident Virus | Spreads without memory residency | Cascade |
| Multipartite Virus | Attacks both boot sector and files | Tequila |