Ministry of Higher Education and Scientific Research
Al-zahrawi university college

Computer applications
First semester

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Lecture 1

Definition of a Computer:

A computer is an electronic device that processes data into useful information. It performs three main tasks: receiving data (Input), processing it (Processing), and displaying the results (Output). It can also store data for future use.

History of Computers

1. **First Generation (1940s-1950s):**
    - Early computers used vacuum tubes for processing.
    - They were large, slow, and consumed a lot of power.
    - Example: ENIAC.
2. **Second Generation (1950s-1960s):**
    - Transistors replaced vacuum tubes, making computers smaller and faster.
3. **Third Generation (1960s-1970s):**
    - Integrated Circuits (ICs) were introduced, improving performance and reducing size.
4. **Fourth Generation (1970s-Present):**
    - Microprocessors were developed, leading to personal computers (PCs).
5. **Fifth Generation (Present and Beyond):**
    - Focus on Artificial Intelligence (AI), robotics, and quantum computing.

Importance of a Computer:

1. **Saves Time and Effort:**
    - Performs tasks quickly and with great accuracy.
2. **Data Storage and Management:**
    - Stores large amounts of data and organizes it efficiently.
3. **Education and Learning:**
    - Provides access to educational materials like e-books, videos, and online courses.
4. **Communication:**
    - Enables email, video calls, and online chats.
5. **Business Applications:**
    - Used for calculations, planning, and data analysis in businesses.
6. **Healthcare:**
    - Helps in storing patient records and running medical devices.
7. **Entertainment:**
    - Used for watching movies, playing games, and listening to music.
8. **Scientific Research:**
    - Assists in conducting experiments and analyzing complex scientific data.

Main Functions of a Computer:

1. **Input:**
   Receiving data and instructions from input devices such as a keyboard, mouse, scanner, or microphone.
2. **Processing:**
   Performing operations on the input data to convert it into meaningful information. This is carried out by the **Central Processing Unit (CPU)**, often referred to as the "brain of the computer."
3. **Output:**
   Displaying the processed information through output devices such as a monitor, printer, or speakers.
4. **Storage:**
   Saving data and information for future use using storage devices like hard drives (HDD/SSD), USB drives, and cloud storage.
5. **Control:**
   Managing the overall operation of the computer, including coordinating input, processing, output, and storage processes.

Computer Components

A computer is made up of two main parts: **hardware** and **software**. Both are needed for the computer to work properly.

1. Hardware Components

Definition:
Hardware is the physical part of the computer that you can touch, like the keyboard or screen.

Main Parts of Hardware:

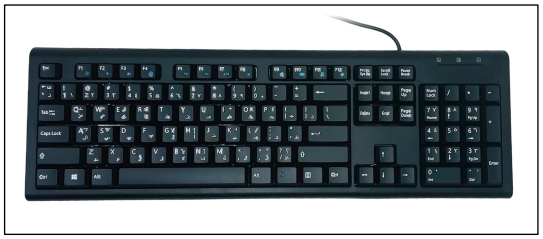
1. Input Devices
2.Output Devices
3.Processing Unit
4.Storage Devices
5.Motherboard
6. Power Supply

1. **Input Devices**

Input devices are hardware tools that allow us to send data, instructions, or commands to the computer. Without input devices, we would not be able to communicate with the computer or control its functions.

Examples of Input Devices:

1. **Keyboard**:
    - The keyboard is one of the most commonly used input devices.
    - It allows users to type letters, numbers, symbols, and commands.
    - Keyboards have different layouts, with the QWERTY layout being the most popular.
2. **Mouse**:
    - A pointing device used to control the cursor on the screen.
    - It helps us select, drag, and drop items or open files and programs.
    - Modern mice may have extra buttons for specific functions and can be wired or wireless.



3. **Scanner**:
    - A device used to digitize physical documents, photos, or objects.
    - It creates a digital copy that can be stored, edited, or shared using the computer.

4. **Microphone**:
    - Converts sound waves into digital signals for the computer.
    - Used for voice recording, online meetings, or giving voice commands through virtual assistants like Siri or Alexa.

5. **Webcam**:
    - A camera that captures video or images in real time.
    - Used in video calls, recording videos, or taking pictures directly on the computer.

6. **Touch Screen**:
    - Combines input and output functions, allowing users to interact directly with the screen by touching it.
    - Commonly found in smartphones, tablets, and some laptops.
7. **Game Controllers/Joysticks**:
    - Special devices designed for gaming.
    - Allow users to control movements and actions within video games.

2. **Output Devices**

Output devices are hardware components that display, project, or play the results of the computer's processing. These devices allow the computer to communicate its response to the user.

Examples of Output Devices:

1. **Monitor (Screen)**:
    - Displays images, text, videos, and the graphical user interface (GUI) of the computer.
    - Modern monitors use LED or LCD technology for clearer and brighter visuals.
    - Some monitors are touch-sensitive, functioning as both input and output devices.
2. **Printer**:
    - Produces a physical (paper) copy of digital documents, photos, or designs.
    - There are different types of printers:
        - **Inkjet printers** for high-quality color prints.
        - **Laser printers** for fast and cost-effective black-and-white printing.

3. **Speakers**:
    - Convert digital audio signals into sound waves that we can hear.
    - Used for listening to music, movies, or system notifications.
4. **Headphones**:
    - Similar to speakers but designed for private listening.
    - Often include microphones to enable two-way communication.
5. **Projector**:
    - Displays the computer's content onto a large surface, such as a wall or screen.
    - Commonly used for presentations, classrooms, or home theaters.



3. **Processing Unit:**

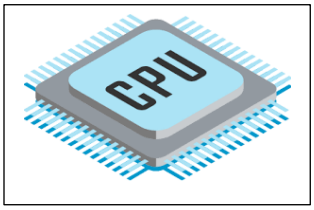
3.1 Central Processing Unit (CPU)

The **Central Processing Unit (CPU)** is the **brain of the computer**, responsible for executing instructions and processing data. It takes input from input devices, processes it, and sends the results to output devices. The CPU plays a key role in the overall performance of the computer.

It has two main parts:

- **ALU (Arithmetic Logic Unit):** This does all the math, like adding, subtracting, and comparing numbers.
- **CU (Control Unit):** This is the boss, telling the ALU what to do and making sure everything runs smoothly.

Think of it this way:



- You want to add 2 + 2. The CU tells the ALU to do it.
- The ALU calculates the answer (4).
- The CU sends the answer back to the computer.

The CPU also has:

- **Registers:** Tiny, super-fast memory slots to hold the numbers and instructions it's working on right now.
- **Cache:** A slightly bigger, fast memory to hold things the CPU uses a lot. This makes the computer faster overall.

3.2 The GPU (Graphics Processing Unit)

It is a part of the computer designed specifically to process images, videos, and graphics quickly. It is mainly used in gaming, graphic design, and data analysis.

4. Storage Devices

4.1 What are Storage Devices?

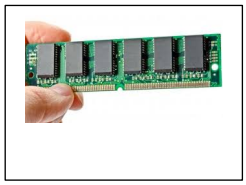
Storage devices are hardware components used to **store data and information** either temporarily or permanently. They play a crucial role in computers because they **save files, programs, and operating systems** even when the computer is turned off.

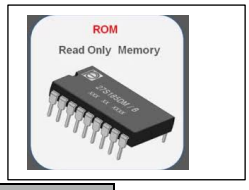
Storage devices can be categorized based on their **speed, capacity, portability, and purpose**.

4.2 Types of Storage Devices

A. Primary Storage

Primary storage is used for **immediate access to data** while the computer is operating.





- **RAM (Random Access Memory):**
  - Temporary storage.
  - Fast access to data.
  - Data is erased when the computer is turned off.
- **ROM (Read-Only Memory):**
  - Permanent storage for essential instructions.
  - Cannot be modified by normal users.
  - Stores the BIOS (Basic Input/Output System).

Feature	RAM	ROM
Volatility	Volatile (Data is lost when power is off)	Non-volatile (Data is permanent)
Data Storage	Temporary storage for active processes	Permanent storage for essential instructions
Speed	Very fast read/write speeds	Slower read speeds
Capacity	Moderate capacity (4GB, 8GB, 16GB)	Smaller capacity (e.g., BIOS chip)
Usage	Running applications and tasks	Storing firmware and boot instructions

B. Secondary Storage

Secondary storage retains data **even after the computer is powered off**.

1. Hard Disk Drive (HDD)

- Uses spinning magnetic disks to store data.
- High storage capacity (e.g., 500GB, 1TB, 2TB).
- Slower read/write speed compared to SSD.
- Affordable and reliable for long-term storage.

2. Solid-State Drive (SSD)

- Uses flash memory chips (no moving parts).
- Much faster read/write speed.
- More durable and energy-efficient.
- Higher cost per GB compared to HDD.

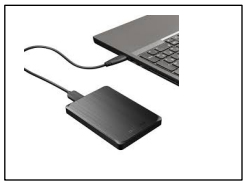
3. Flash Drives (USB Drives)

- Portable and small-sized.
- Easy to use and compatible with most devices.
- Suitable for transferring and sharing files.
- Storage capacity ranges from 4GB to 1TB.

4. Optical Storage Devices (CD, DVD, Blu-ray)

- Data is stored on optical disks using lasers.
- **CD (Compact Disc):** Up to 700MB.
- **DVD (Digital Versatile Disc):** Up to 4.7GB.
- **Blu-ray:** Up to 50GB.
- Less commonly used nowadays due to USB and cloud storage.

5. External Hard Drives



- Portable HDD or SSD connected via USB or Thunderbolt ports.
- Used for backup, large data storage, and file transfer.
- Available in large capacities, e.g., 1TB, 2TB, 4TB, etc.

C. Cloud Storage

- Data is stored online on remote servers.
- Accessible from any device with an internet connection.
- Examples: **Google Drive, Dropbox, Microsoft OneDrive.**
- Suitable for sharing and collaborating on documents.
- Subscription-based with free storage limits.

Comparison Between HDD and SSD

Feature	HDD	SSD
Speed	Slower	Faster
Durability	Less durable (moving parts)	More durable (no moving parts)
Power Consumption	Higher	Lower
Noise	Audible noise from spinning disks	Silent
Cost	Cheaper	More expensive
Best For	Large storage on a budget	Fast performance and efficiency

4.3 Storage Device Interfaces

Storage devices connect to computers using **different interfaces**:

- **SATA (Serial ATA):** Common for HDD and older SSDs.
- **NVMe (Non-Volatile Memory Express):** Modern SSD interface offering very high speed.
- **USB (Universal Serial Bus):** Used for flash drives and external hard drives.
- **Thunderbolt:** Very fast data transfer, mostly for Apple devices.

4.4 Importance of Storage Devices

1. **Data Storage:** Keep documents, media, and software safe.
2. **Backup:** Prevent data loss during hardware failure.
3. **File Transfer:** Move data between devices.
4. **Performance:** Faster storage (like SSD) improves system speed.
5. **Accessibility:** Cloud storage enables remote data access.

4.5 Tips for Choosing the Right Storage Device

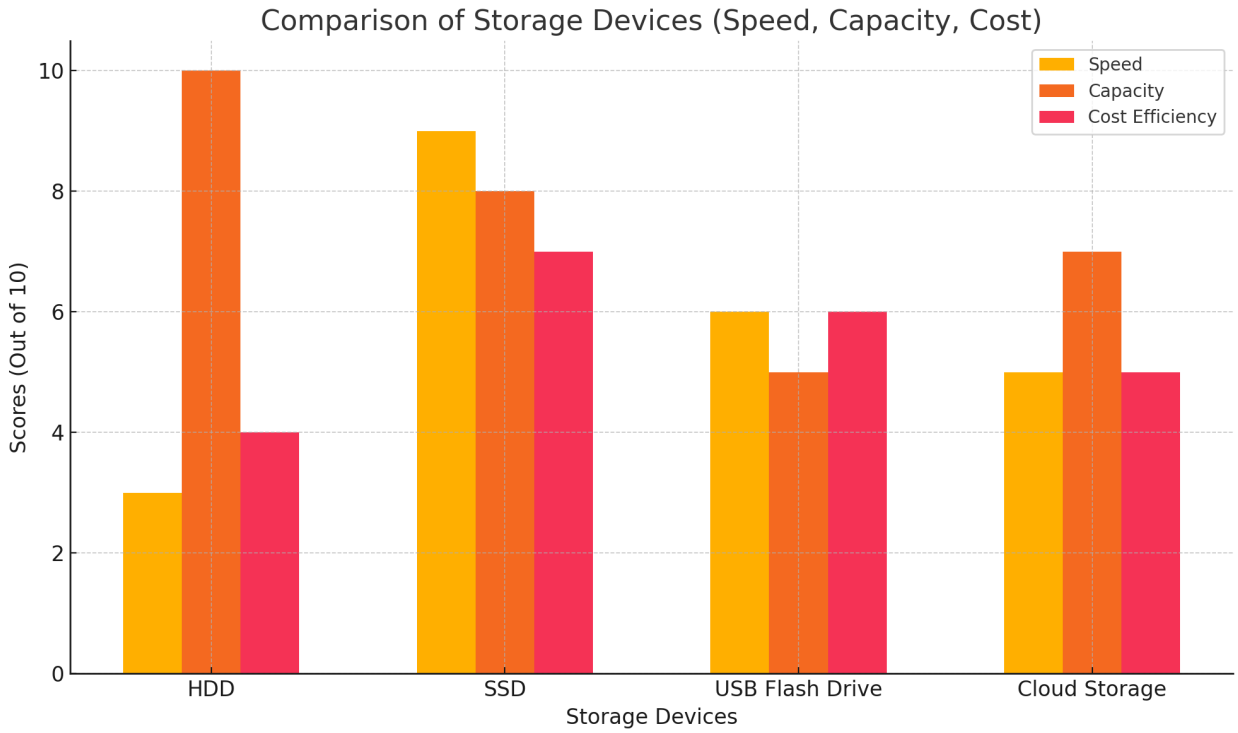
1. **For General Use:** HDD with large capacity (e.g., 1TB).
2. **For Speed and Performance:** SSD with at least 256GB.
3. **For Portability:** USB flash drive or external SSD.
4. **For Backup:** External hard drive or cloud storage.
5. **For Collaboration:** Cloud storage services (e.g., Google Drive).

4.6 Data Security in Storage Devices

- Use **password protection** and **encryption** for sensitive data.
- Regularly **backup your data** to avoid data loss.
- Use **antivirus software** to protect storage devices from malware.

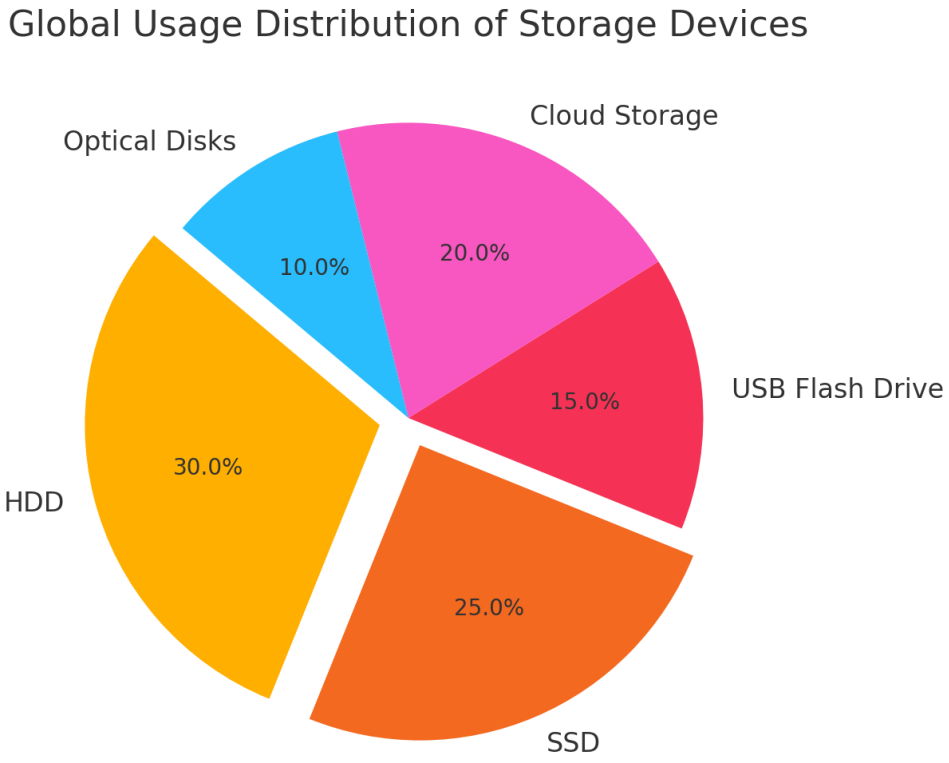
4 .7 Future of Storage Devices

- **Increased Cloud Adoption:** More reliance on online storage.
- **Larger Storage Capacities:** Terabyte-sized SSDs becoming common.
- **Faster Interfaces:** Improved NVMe and Thunderbolt technologies.
- **AI Integration:** Smarter data organization and management.



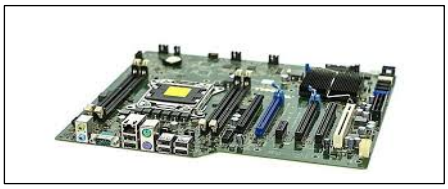
Comparison of Storage Devices (Speed, Capacity, Cost)

- **HDD:** Affordable with large capacity but slower speed.
- **SSD:** Faster speed, moderate capacity, and higher cost.
- **USB Flash Drive:** Portable, moderate speed, and flexible capacity.
- **Cloud Storage:** Accessible from anywhere, good balance between speed and cost.



5.**Motherboard**

The **motherboard** is the **main circuit board** of a computer. It acts as the **central hub**, connecting all internal components such as the **CPU (Processor)**, **RAM (Memory)**, **Storage Devices**, and **Expansion Cards**. Without it, these components cannot communicate or work together.



Functions of the Motherboard:

1. **Component Connection:** Links all hardware components together.
2. **Power Distribution:** Supplies power from the power supply to various parts.
3. **Data Transfer:** Ensures smooth communication between CPU, memory, and storage.
4. **Ports and Connectivity:** Provides USB, HDMI, Ethernet, and audio ports.
5. **System Performance:** Determines system capabilities and upgrade options.

6.**Power Supply**

The **Power Supply Unit (PSU)** is a critical hardware component in a computer that **converts electrical energy from an external source (e.g., a wall outlet)** into a **usable form for internal components**. It ensures the **right voltage, current, and power stability** for the motherboard, CPU, GPU, storage devices, and other peripherals.

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Lecture 2

2. Software Components in Computers

Software is one of the main components of a computer, and it works together with the hardware to perform the functions of the computer. Software consists of a set of commands and instructions that tell the hardware what to do .

2.1 What is Software?

Software refers to a collection of programs, instructions, and data that enable the hardware to perform specific tasks. Without software, a computer is just a collection of silent physical components.

2.2 Main Types of Software

A. System Software

- **Definition:** Software designed to manage and control computer hardware and provide a platform for other software.
- **Examples:**
  - **Operating Systems:** Windows, macOS, Linux
  - **Device Drivers**
  - **Utility Programs**
- **Functions:**
  - Manage hardware resources such as CPU and memory.
  - Provide a user interface to interact with the computer.
  - Ensure system stability and security.

B. Application Software

- **Definition:** Software designed to perform specific tasks for end-users.
- **Examples:**
  - **Microsoft Office Suite** (Word, Excel, PowerPoint)
  - **Web Browsers** (Google Chrome, Firefox)
  - **Photo and Video Editing Tools** (Photoshop)
- **Functions:**
  - Facilitate everyday tasks such as writing, calculations, and design.
  - Improve productivity and efficiency.

C. Programming Software

- **Definition:** Tools and programs used by developers to write, test, and debug software applications.
- **Examples:**
  - **Integrated Development Environments (IDEs):** Visual Studio, PyCharm
  - **Programming Languages:** Python, Java, C++
  - **Debugging Tools**
- **Functions:**
  - Assist in writing clean and efficient code.
  - Debug and test software applications.

2.3 Importance of Software in Computers

- Controls hardware functionality.
- Simplifies everyday tasks.
- Increases productivity and efficiency.
- Supports innovation and application development.
- Enables communication and integration with other systems.

2.4 Key Components of Software

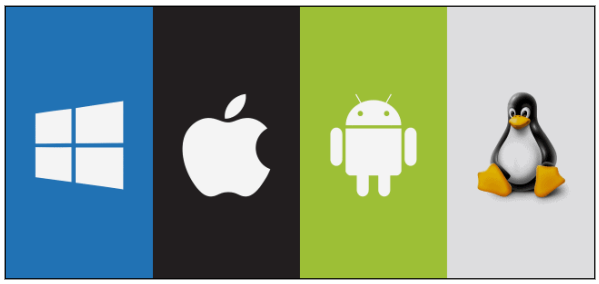
1. **User Interface (UI):** The interface that users interact with.
2. **Functions:** The specific tasks the software performs.
3. **Database:** Stores and manages data.
4. **Security:** Protects data from unauthorized access.

Operating Systems

Operating systems are essential software that manages computer resources and provides an interface between the user and the hardware. Simply put, an operating system (OS) acts as a bridge, enabling users to interact with the computer efficiently.

Functions of an Operating System:

1. **Resource Management**:
   - **CPU Management**: Organizes processes for the processor.
   - **Memory Management**: Allocates and frees memory for programs and data.
   - **Storage Management**: Manages reading and writing data on storage devices.
   - **Peripheral Management**: Handles input/output devices like printers, keyboards, and mice.
2. **User Interface**:
   - Provides a graphical (GUI) or command-line (CLI) interface.
   - Simplifies file access and program execution.
3. **Process Management**:
   - Manages running programs and allocates processor time.
   - Handles process priorities.
4. **Security and Protection**:
   - Protects the system from malware or unauthorized access.
   - Manages user permissions.
5. **Program Communication**:
   - Supports multitasking (running multiple programs at the same time).
   - Allows data exchange between programs.



The Most Common Operating Systems

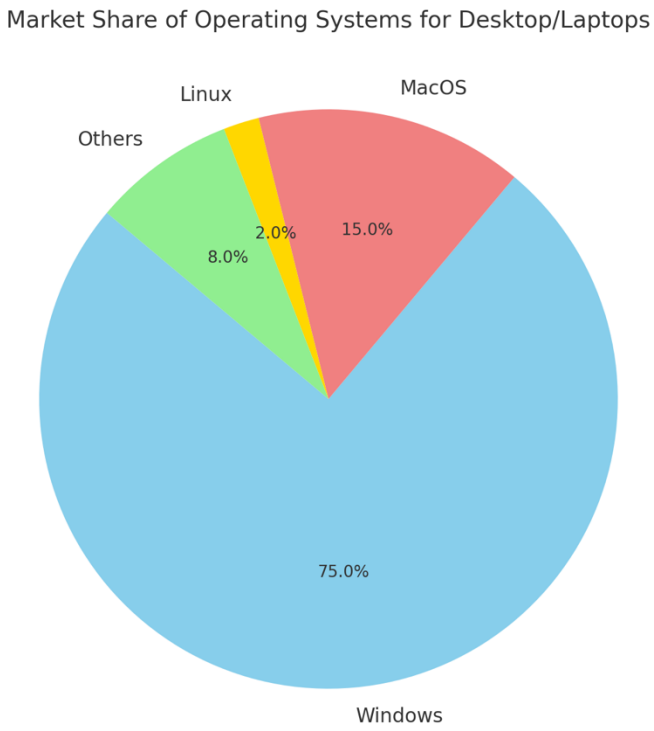
Here are the most popular operating systems categorized by their usage:

1. Desktop and Laptop Operating Systems:

- **Windows** (Most Common):
  - Examples: Windows 10, Windows 11.
  - Used by the majority of personal computers globally.
  - Popular for its user-friendly interface, wide compatibility with software and hardware, and extensive support for gaming and productivity tools.

- **macOS** (Exclusive to Apple Devices):
  - Examples: macOS Ventura, macOS Monterey.
  - Preferred by professionals in design, video editing, and media production.
  - Known for its stability, sleek interface, and strong integration with other Apple products.

- **Linux** (Open Source):
  - Examples: Ubuntu, Fedora, Debian.
  - Widely used by developers, IT professionals, and server administrators.
  - Highly secure and customizable but requires technical knowledge.



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2. Mobile Operating Systems:

- **Android** (Most Common Mobile OS):
  - Developed by Google.
  - Runs on the majority of smartphones and tablets globally.
  - Known for its flexibility, open-source nature, and wide range of apps.
- **iOS**:
  - Developed by Apple for iPhones and iPads.
  - Popular for its seamless performance, user-friendly design, and integration with the Apple ecosystem.

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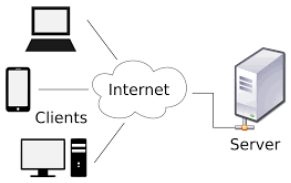
3. Server Operating Systems:

What is a Server?
A server is a powerful computer or software designed to **provide services or data** to other devices (called clients) over a network like the internet.

Simple Examples:

1. When you visit a website like Google, the server sends you the search page.
2. When you send an email, the server delivers your message.



- **Linux** (in Servers):
  - Examples: Red Hat, CentOS, Ubuntu Server.
  - Preferred for web hosting, cloud computing, and enterprise solutions due to its reliability, scalability, and cost-efficiency.
- **Windows Server**:
  - Developed by Microsoft for enterprise-level applications.
  - Common in organizations that use Microsoft software like SQL Server or Active Directory.

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4. Embedded Operating Systems:

- **Android (Customized)**:
  - Used in devices like smart TVs and wearables.
- **RTOS (Real-Time Operating Systems)**:
  - Found in embedded systems like medical devices and automotive systems.

Most Common in Numbers:

- **Windows** dominates desktop/laptop usage (around 75% market share).
- **Android** leads in mobile devices (about 70% market share).
- **Linux** is the king of servers (over 90% share).

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Lecture 3

Microsoft Excel is a spreadsheet program used for:

- **Creating tables** to organize data.
- **Doing calculations** with formulas.
- **Analyzing data** using sorting and filtering.
- **Making charts** to show data visually.
- **Automating tasks** with simple tools.

Excel Properties

- **Easy data entry** with a simple interface.
- **Fast data analysis** for quick results.
- **Multiple ways to display results** based on user needs.
- **Includes many functions** useful for various fields like engineering, business, and more.

Excel Function Definition

An **Excel function** is a built-in mathematical formula with a specific purpose. It takes certain inputs (data) from the user and provides specific results based on the entered data.

Types of Excel Functions

- **Logical functions**
- **Financial functions**
- **Text functions**
- **Statistical functions**

Rules for Writing Formulas in Excel

- **Start with an equal sign (=)** so Excel recognizes it as a formula, not just a number.
- **Write the function name** correctly.
- **Use parentheses ()** immediately after the function name.
- **Ensure logical and correct inputs** by following Excel's guidelines for accurate results.

Comparison Operators Table

Operator	Meaning
>	Greater than
<	Less than
=	Equal to
≠	Not equal to

Mathematical Operations Table

Operation	Symbol
Addition	+
Subtraction	-
Multiplication	*
Division	/
Exponentiation	^

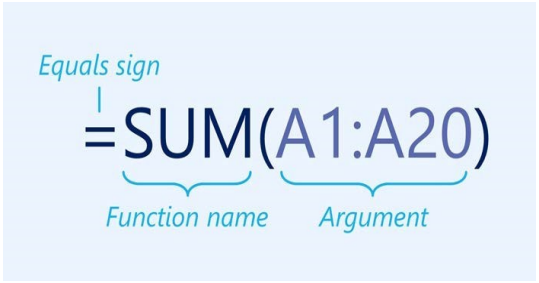
Common Excel Functions

• **SUM(range):** Calculates the total sum of values in a specific range.

• **AVERAGE(range):** Calculates the arithmetic mean of values in a given range.

• **MAX(range):** Finds the highest value in a specific range.

• **MIN(range):** Finds the lowest value in a specific range.



Example

If you have the following numbers in column **A**:

A
10
20
30
40
50

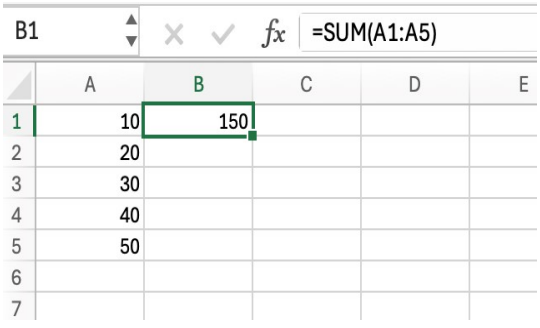
You can apply the following functions:

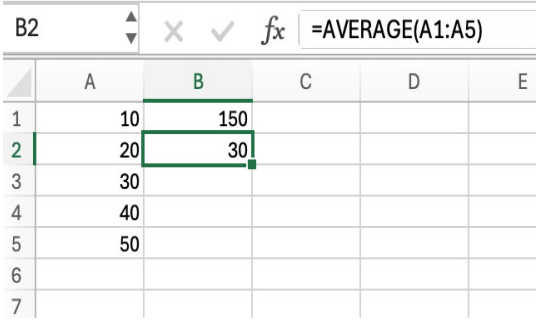
• =SUM(A1:A5) → **150** (Total sum)

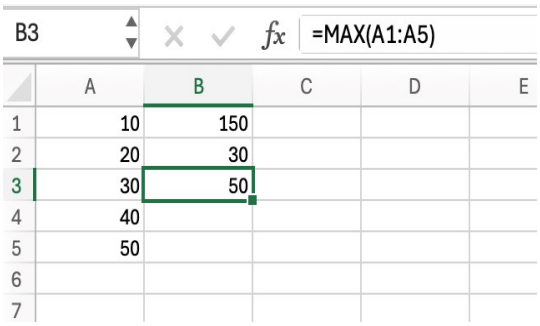
• =AVERAGE(A1:A5) → **30** (Average)

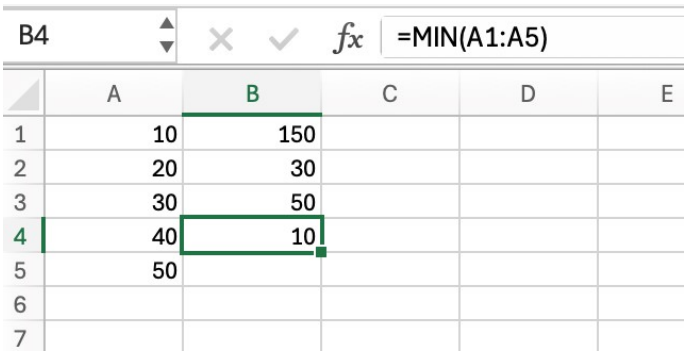
• =MAX(A1:A5) → **50** (Maximum value)

• =MIN(A1:A5) → **10** (Minimum value)









Explanation of IF, IF AND, and IF OR Functions in Excel with Examples

1. IF Function

The IF function is used to check a condition and return different values based on whether the condition is **TRUE** or **FALSE**.

Syntax:

```
IF(condition, value_if_true, value_if_false)
```

Example:

If the score in cell **A1** is 50 or more, display "Pass", otherwise display "Fail".

```
=IF(A1>=50, "Pass", "Fail")
```

A	B
60	Pass
45	Fail

2. IF AND Function

The IF AND function is used when **multiple conditions** must be **TRUE** for a specific result.

Syntax:

```
IF(AND(condition1, condition2), value_if_true, value_if_false)
```

Example:

If the score in **A1** is 50 or more **AND** attendance in **B1** is 75% or more, display "Pass", otherwise display "Fail".

```
=IF(AND(A1>=50, B1>=75), "Pass", "Fail")
```

A	B	C
60	80	Pass
50	70	Fail
40	90	Fail

3. IF OR Function

The IF OR function is used when **at least one** condition must be **TRUE** for a specific result.

Syntax:

```
IF(OR(condition1, condition2), value_if_true, value_if_false)
```

Example:

If **A1** is 50 or more **OR B1** is 75% or more, display "Pass", otherwise display "Fail".

```
=IF(OR(A1>=50, B1>=75), "Pass", "Fail")
```

A	B	C
40	80	Pass
50	70	Pass
30	60	Fail

COUNT, COUNTA, and COUNTIF Functions in Excel with Examples

1. COUNT Function

The COUNT function counts the number of numeric values in a range. It ignores text and empty cells.

Syntax:

```
COUNT(range)
```

Example:

If you have the following data in column **A**:

A
10
20
Hello
30
(empty)

The function:

```
=COUNT(A1:A5)
```

Result: 3 (Only numbers are counted: 10, 20, and 30)

2. COUNTA Function

The COUNTA function counts the number of **non-empty** cells, including numbers, text, and other values.

Syntax:

```
COUNTA(range)
```

Example:

Using the same data in column **A**, the function:

```
=COUNTA(A1:A5)
```

Result: 4 (Counts all non-empty cells: 10, 20, “Hello”, and 30)

3. COUNTIF Function

The COUNTIF function counts the number of cells that meet a **specific condition**.

Syntax:

```
COUNTIF(range, condition)
```

Example:

Count how many numbers in **A1:A5** are greater than 15:

```
=COUNTIF(A1:A5, ">15")
```

Result: 2 (Only 20 and 30 meet the condition)

Rounding Functions in Excel: ROUND, ROUNDUP, and ROUNDDOWN

1. ROUND Function (Standard Rounding)

This function rounds a number to a specified number of decimal places based on standard rounding rules (5 or greater rounds up, less than 5 rounds down).

Formula:

```typescript
=ROUND(number, num_digits)
```

Examples:

```pgsql
=ROUND(5.678, 2)   → 5.68
=ROUND(5.678, 1)   → 5.7
=ROUND(5.678, 0)   → 6
=ROUND(578, -2)    → 600
```

2. ROUNDUP Function (Always Rounds Up)

This function always rounds numbers up, regardless of the decimal value.

Formula:

```typescript
=ROUNDUP(number, num_digits)
```

Examples:

```
=ROUNDUP(5.221, 2) → 5.23
=ROUNDUP(5.221, 0) → 6
=ROUNDUP(583, -2)  → 600
```

3. ROUNDDOWN Function (Always Rounds Down)

This function always rounds numbers down, truncating the extra decimal places without rounding up.

Formula:

```typescript
=ROUNDDOWN(number, num_digits)
```

Examples:

```
=ROUNDDOWN(5.678, 2) → 5.67
=ROUNDDOWN(5.678, 0) → 5
=ROUNDDOWN(583, -2)  → 500
```

When to Use Each Function?

- **ROUND**: Use when you want to round based on standard rounding rules.
- **ROUNDUP**: Use when you always want to round numbers up.
- **ROUNDDOWN**: Use when you always want to round numbers down.