



The Public Authority for Applied Education and Training

**The higher Institute for Telecommunication
and Navigation**



Computer Department

CM-106 Introduction to Computers

Chapter 1

Introduction to the World of Computers

1.1 Computers in our life:

Computers appear almost everywhere in today's world, and most people need to use computers or computerized devices frequently on the job, at homes, at schools, at workplaces or while on the go. Computers have become integral part of our life. Knowing about and understanding computers and their uses is an essential skill today for everyone.

1.1.1 Computers in the Home

Using computers and using internet at home, we can do following:

- ☐ Looking up for information & news
- ☐ Exchanging of e-mail.
- ☐ Watching TV, Videos.
- ☐ Using Smart appliances to make smart home ..etc
- ☐ Downloading Music, Movies
- ☐ Shopping and paying bills.
- ☐ Managing bank accounts.
- ☐ Making vacation plans

1.1.2 Computers in Education

Using computers, network and internet at schools:

- ☐ Studying courses - Computer Aided Courses are available.
- ☐ Prepare papers and presentations.
- ☐ More usage of computers in schools or universities
- ☐ Libraries for research purposes.
- ☐ Students connect their PCs to Wireless network for communication or search info
- ☐ Enrollment process and all operations of schools
- ☐ Distance learning programs.

1.1.3 Computers in Workplace

Almost all companies use computers at workplaces to do all operations efficiently and accurately. Productivity gets increased by using computers.

- ☐ Checking inventories or order items.
- ☐ Using computer at work for different operations like
 - Accounts, ○ Sales, ○ Administration, ○ Stores,
 - Communications
- ☐ Doctors and nurses in hospitals ○ Checking patient's files ○ Examining X-rays
- ☐ Issuing tickets by policemen
- ☐ Attendance system, Pay roll
- ☐ Access control and Security

1.1.4 Computers on the GO

While you are on the Go you can use computers for:

- ☐ ATM machines transactions
- ☐ GPS System
- ☐ Using Kiosk (small self-service machines)
- ☐ Include touch screen to request information
- ☐ Purchase products
- ☐ Checking in for flight at Airports ☐ Point of Sale (POS) for selling.
- ☐ Wi-Fi access at Libraries, Airports and Cafes.

1.2 What is Computer and What Does it Do?

Computer: is a device that accepts data, performs operations on that data, presents the results as output and can store them for future need.

1.2.1 We can define Computer:

A programmable, electronic device that accepts data as input, performs processing operations on that data, and outputs the results and provides storage for data, programs and outputs.

Here are four operations computer will do:

- ☐ **Input:** The process of entering data into computer
- ☐ **Processing:** Performs operations on entered data and transfer it to information
- ☐ **Output:** The process of presenting the results of processing
- ☐ **Storage:** The operation of saving data for future use\

1.2.2 IPOS Cycle or Information Processing Cycle

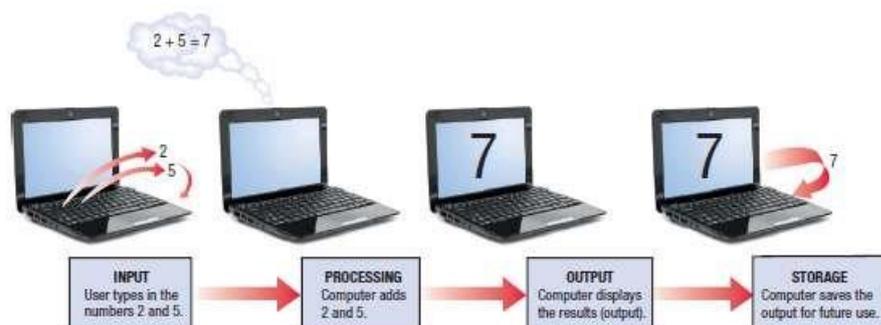
Four primary computer operations take place in sequence as shown below.



The progression of input, processing, output, and storage is known as IPOS cycle or the information processing cycle.

Example - Adding two numbers:

Assume you want the computer to perform addition of two number 2 and 5, the IPOS cycle will be as follow:



In addition to these four primary computer operations, today's computers also typically perform **communications** functions between these primary operations. **Communication** is often considered the **fifth primary computer operation** though it could be sending data as input or result as output.

☐ **Communications:** The transmission of data from one device to another.

1.2.3 Data vs. Information

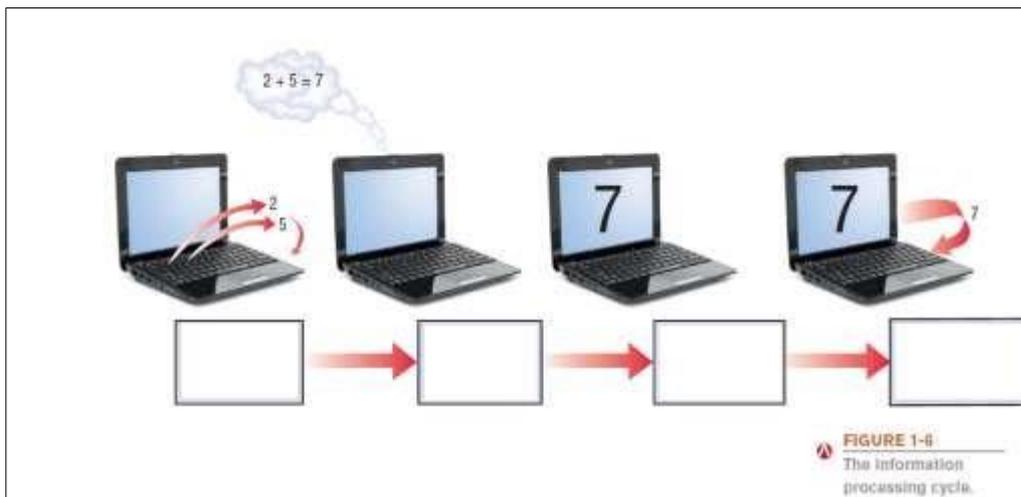
Inputs is Data and output processed data is Information. Let's clarify that

Data: Raw, unorganized facts

Information: Data that has been processed into meaningful form.

Data can be in many forms like number, text, graphics, audio, video etc..

Exercise: Information processing cycle



1.3 Hardware

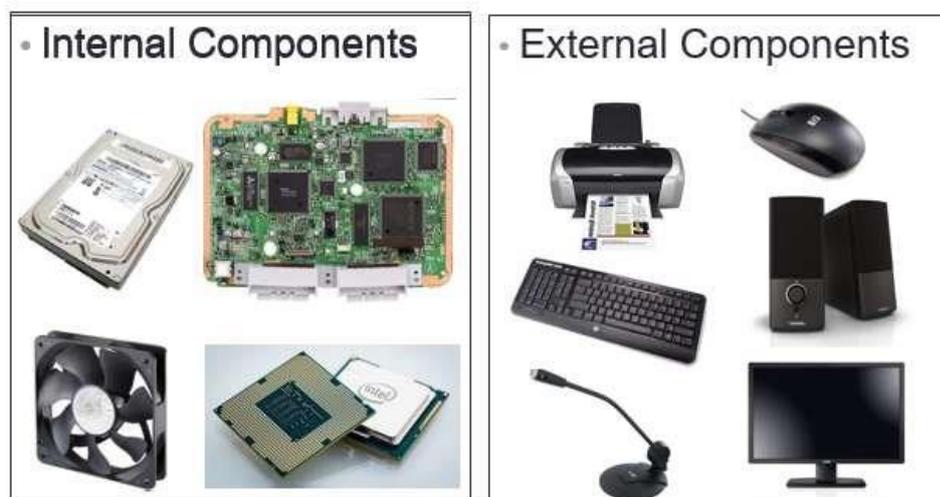
A computer is made up of **hardware** (the actual physical equipment that makes up the computer system) and **software** (the computer's programs). Hardware are tangible parts and Software are intangible parts of Computer system.

1.3.1 Define Hardware:

The physical parts of a computer system. These are the parts you can touch such as the keyboard, monitor, printer .. etc.

Hardware Components can be:

1. Internal
 - ▣ located inside the main box of the computer called system unit. Motherboard, Hard Disk, Processor, Fan ...etc.
2. External
 - ▣ located outside the main box of the computer (plugged into the computer ports)
Keyboard, Printer, Monitor, Mic, Mouse, Speaker ...etc.



Exercise: Identify Computer components



1.3.2 Input Devices:

- Keyboard
- Mouse
- Microphone
- Joy stick
- Scanner
- Fingerprint Reader
- Digital Pen
- Digital Camera
- Touch Screen



1.3.3 Processing Devices:

- CPU (Central Processing Unit) or Processor



1.3.4 Output Devices:

- ❑ Monitor / Display Screen
- ❑ Printer
- ❑ Speaker
- ❑ Headphone / Headset
- ❑ Projector



1.3.5 Storage Devices:

- ❑ Hard Disk
- ❑ Floppy Disk
- ❑ CD Drive
- ❑ DVD Drive
- ❑ Memory Cards
- ❑ Flash Memory



1.3.6 Communication Devices:

- ❑ Modem
- ❑ Router
- ❑ Switches



1.4 Software

Software is intangible part of computer, which can't be touched. These are programs to run computers and to run applications. Software is divided into:

1. **System software** used to run computer and develop computer applications. It includes Operating system.
2. **Application software** to run user applications.

1.4.1 Define Software

The instructions, also called computer programs that are used to tell a computer what it should do.

1.4.2 Systems Software

software used to operate computer system or help to create computer applications [application software] or to use system efficiently.

System Software consists of:

1. Operating Systems.
2. Translators [Compilers, Interpreters, Assemblers]
3. Utility Programs.

1.4.2.1 Operating System:

The main component of system software that enables a computer to operate, manage its activities and the resources under its control, run application programs, and interface with the user.

Example: Windows, Mac OS, Unix, Linux etc..

Without an Operating System, the computer cannot function **at all**

1.4.2.2 Boot:

Small program to start up a computer.

The operating system assists with the **boot** process, and then controls the operation of the computer, such as to allow users to run other types of software and to manage their files.

1.4.2.3 Windows desktop:

The background work area displayed on the screen for computers running Microsoft Windows.

Most software programs today use a variety of graphical objects that are selected to tell the computer what to do. The basic workspace for Windows' users is the **Windows desktop**.

Background work area displayed on the screen shows Windows, Icons, Menus, Toolbars, Taskbar, Hyperlinks, Sizing Buttons, Dialog Boxes...

1.4.3 Application software:

Programs that enable users to perform specific tasks on a computer, such as writing letters or playing games.

Application software consists of programs designed to allow people to perform specific tasks or applications, such as word processing, Web browsing, photo touch-up, and so on.

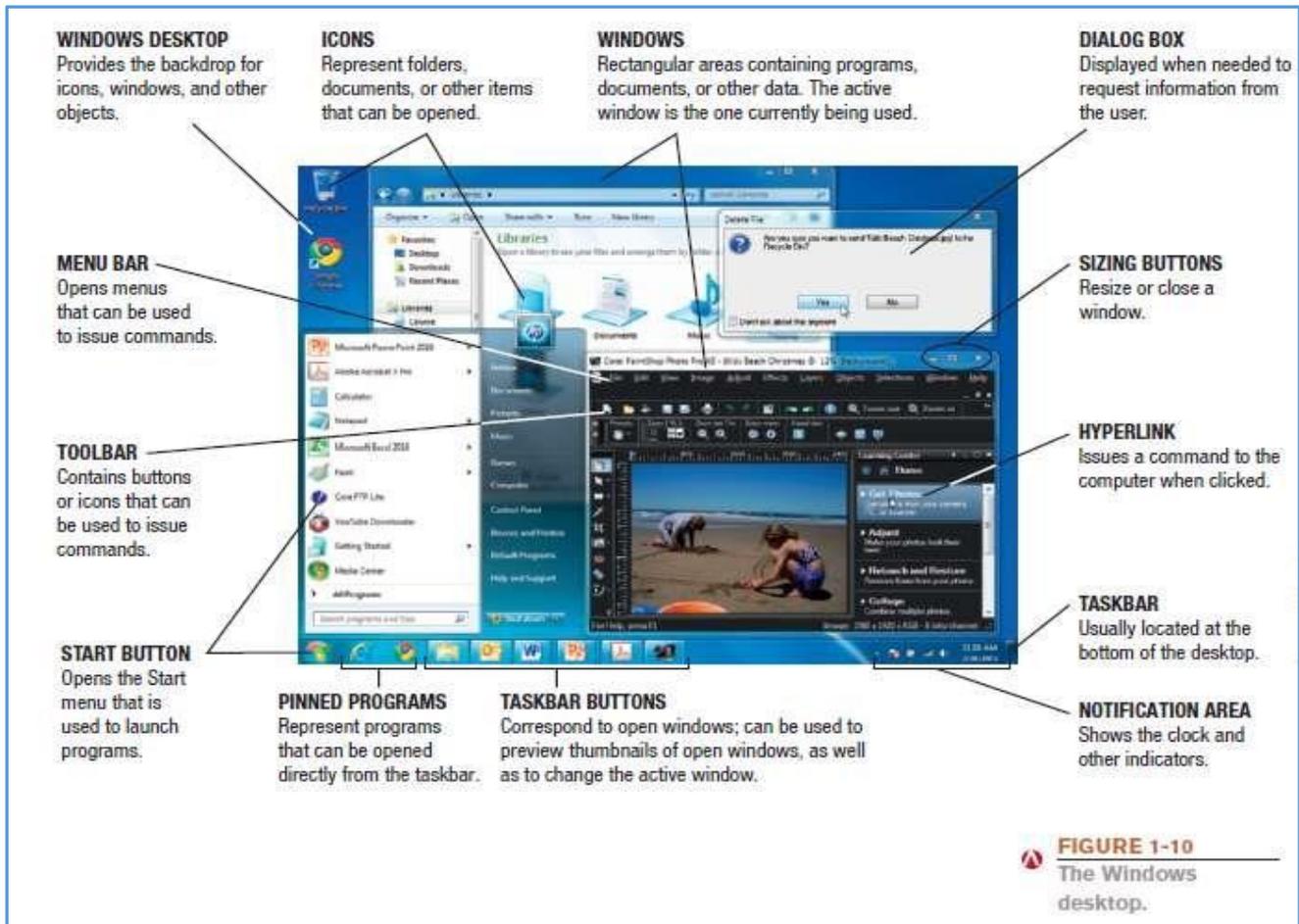
Software programs are written using a *programming language*. Programs are written by *programmers*; *computer users* are the people who use computers to perform tasks or obtain information.

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Examples of Application Software:

- ❑ MS Office
- ❑ Accounting
- ❑ Word Processor
- ❑ Spreadsheet
- ❑ File Manager
- ❑ Game
- ❑ Checkbook organizer
- ❑ Web Browser
- ❑ Reservation System

Exercise: Identify Desktop Components



- ❑ **Windows:** rectangular area which programs and documents are displayed
- ❑ **Icons:** a small graphical image that invokes some action when selected
- ❑ **Menu:** set of options used to issue a command to the computer
- ❑ **Toolbar:** a set of icons used to issue a command to the computer
- ❑ **Taskbar:** the bar located at the bottom of the windows desktop that contains the start button and clock
- ❑ **Hyperlink:** text or image that is linked to a webpage or other type of document
- ❑ **Sizing button:** small buttons located on the top-right corner of a window used to resize the window
- ❑ **Dialog box:** a window that requires the user to supply additional information.

1.5 Computer users & professionals

- ❑ **Computer User:** A person who uses a computer
- ❑ **Computer Professionals:** There are many types of professionals in computer field specializing with special skills like:
 - **Programmer** ○ **Systems analysts** ○ **Computer operators** ○ **Computer Technicians** ○ **Network Technicians** ○ **Security specialists etc..**
- ❑ **Programmer:** A person whose primary job is to write, maintain, and test computer program

1.6 Basic Computer Types

Computers are of different types depending on their sizes and uses. We will list six basic types.

1.6.1 Embeded Computers

Embeddd computer is a tiny computer embedded in a product and designed to perform specific tasks or functions for that product.



Example:

TV, Digital Watch, Washing Machine,

Microwave Oven .. etc.



1.6.2 Mobile Device

Mobile device. A very small communications device that has built-in computing or Internet capability.

Example:

Smartphone. A mobile device based on a mobile phone. It has built-in computing and Internet capability.



1.6.3 Microcomputer / Personal Computer

Small computers used by individuals at home or work are called **personal computers (PCs)** or **microcomputers**.

Example:

❑ **Desktop computers:**

A personal computer that is designed to fit on or next to a desk.

Portable computers called **notebook computers**, **laptop computers**, **tablet computers**, and **netbooks** and typically conform to either the *PC-compatible* or *Mac* standard.



☐ **Portable computer.**

A small personal computer, such as a notebook, tablet, or netbook that is designed to be carried around easily.



☐ **Laptop or Notebook computer:**

A fully functioning portable computer that opens to reveal a screen and keyboard.

☐ **Tablet computer:**

A portable computer about the size of a notebook that is designed to be used with a digital pen.



☐ **Netbook:**

A very small notebook computer. Tablet computers come in both *slate tablet* and *convertible tablet* formats.

☐ **Thin clients**

Thin clients are designed solely to access a network.

1.6.4 Midrange Servers



A computer used for medium size organizations that needs more capabilities than PC. Medium-sized computers, or **midrange servers**, are used in many businesses to host data and programs to be accessed via the company network.

A growing trend is **virtualization**— creating separate virtual environments on a single server that act as separate servers.

1.6.5 Mainframe Computer

Mainframe computer. A computer used in large organizations (such as hospitals, large businesses, and colleges) that need to manage large amounts of centralized data and run multiple programs simultaneously.



1.6.6 Supercomputer

Supercomputer. The fastest, most expensive, and most powerful type of computer.

These are very largest, most powerful computers, which typically run one application at a time are **supercomputers**.



1.6.6.1 Supercomputing Cluster

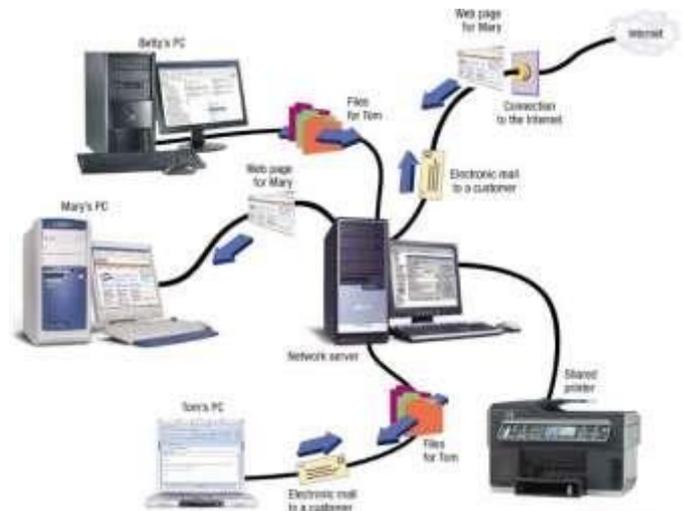
Supercomputing cluster. A group of numerous smaller computers connected together to act as a single supercomputer.

1.7 Computer networks and Internet

Today computers are connected in a network to share resources. Using Internet is also very common to have connectivity all around the world.

1.7.1 Computer Network

A collection of computers and other hardware devices that are connected together to share hardware, software, and data, as well as to communicate electronically with one another.



1.7.2 Internet & related Terms:

Internet is also a network. We will study Internet and its related terms.

Internet:

The largest and most well-known computer network, linking millions of computers all over the world.

The **Internet** is a worldwide collection of networks. Typically, individual users connect to the Internet by connecting to computers belonging to an Internet service provider (ISP).



☐ Internet service provider (ISP):

- Company that provides Internet access to others.
- The company charges a fee.

☐ World Wide Web (WWW):

- The collection of Web pages available through the Internet.
- An enormous collection of **Web pages** located on **Web servers**.

☐ **Web page:**

- A document, typically containing hyperlinks to other documents
- Web Page located on a Web server and
- These are available through the World Wide Web.
- The starting page for a Web site (a related group of Web pages) is called the **home page** for that site.
- Web pages are viewed with a **Web browser**
- To access a computer network, you need some type of **modem** or **network adapter**.

☐ **Web site:**

- A collection of related Web pages
- These belong to an organization or individual.

☐ **Web server:**

- A computer that is continually connected to the Internet
- It hosts Web pages that are accessible through the Internet.

☐ **Web browser:**

- A program used to view Web pages.

○ Examples:

- Microsoft Explorer, Microsoft Edge
- Firefox
- Chrome



☐ **Internet address:**

- An address that identifies a computer, person, or Web page on the Internet, such as
 - IP address,
 - domain name, or
 - e-mail address.

1.7.2.1 Internet Address:

An address that identifies a computer, person, or Web page on the Internet, such as an IP address, domain name, or e-mail address.

☐ **IP address:**

- A numeric Internet address used to uniquely identify a computer on the Internet.
 - IP is short for Internet Protocols
 - **Example:** 207.46.138.20

☐ **Domain name:**

- A text-based Internet address used to uniquely identify a computer on the Internet.
- Domain name corresponds to IP address
- **Example:** www.kfh.com , www.microsoft.com

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- Domain names typically reflect the name of the individual or organization associated with that Web site.
- Different parts of a domain name are separated by a period. ○ The far right part of the domain name (which begins with the rightmost period) is called the top-level domain (TLD) and traditionally identifies the type of organization or its location (such as .com for businesses, .edu for educational institutions, .jp for Web sites located in Japan, or .fr for Web sites located in France).

Here are some Top Level Domain (TLDs) used :

ORIGINAL TLDs	INTENDED USE
.com	Commercial businesses
.edu	Educational institutions
.gov	Government organizations
.int	International treaty organizations
.mil	Military organizations
.net	Network providers and ISPs
.org	Noncommercial organizations
NEWER TLDs	INTENDED USE
.aero	Aviation industry
.biz	Businesses
.fr	French businesses
.info	Resource sites
.jobs	Employment sites
.mobi	Sites optimized for mobile devices
.name	Individuals
.pro	Licensed professionals
.uk	United Kingdom businesses

□ Uniform Resource Locator (URL):

- An Internet address (usually beginning with http://) that uniquely identifies a Web page.
- **Example:**
 - <http://twitter.com/jobs/index.html>



Protocols

- **http:** Hypertext Transfer Protocol ○ used to display the web pages
- **ftp:** File Transfer Protocol ○ used to upload and download files
- **https:** Secure Hypertext Transfer Protocol ○ Display secure web pages
- **html:** Hypertext Markup Language ○ Language used to create Web pages

☐ E-mail address:

- An Internet address consisting of a username and computer domain name that uniquely identifies a person on the Internet.
- Used to contact people using the Internet.
- It consists of:
 - Username,
 - followed by @ symbol,
 - followed by domain name.
- Example: jsmith@google.com, ahmad@nbk.com

☐ Pronouncing Internet Addresses:

Because Internet addresses are frequently given verbally, it is important to know how to pronounce them. Some of the symbols are pronounced as below:

- @ → at
- (.) → dot
- (/) → slash

TYPE OF ADDRESS	SAMPLE ADDRESS	PRONUNCIATION
Domain name	berkeley.edu	berkeley dot e d u
URL	microsoft.com/windows/ie/default.asp	microsoft dot com slash windows slash i e slash default dot a s p
E-mail address	president@whitehouse.gov	president at white house dot gov

☐ Surfing the web:

- Web browser: Used to display Web pages
- Browser home page: The first page displayed when the browser is opened
- To load a Web page, you can:
 - Type a URL in the Address bar



- Click a hyperlink on a displayed Web page

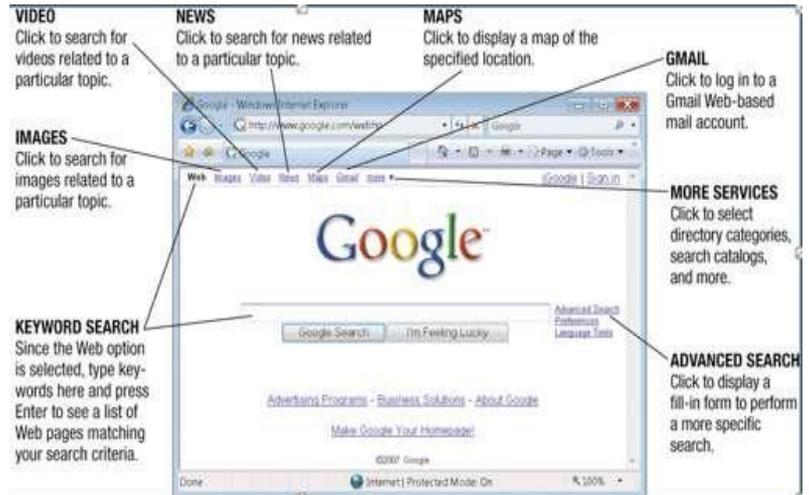


- Select a Favorite/Bookmark or page from the History list



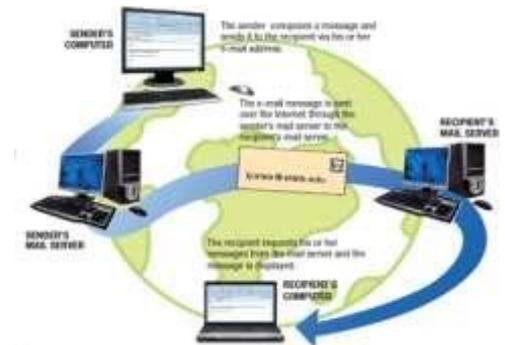
- **Searching the web:** ○ If you don't know the URL, you can search the information on web sites by typing keywords into search box at following sites

- Google
- Bing
- Yahoo
- Ask.com



□ **E-mail**

- E-mail : Stands for electronic mail
- It is the process of exchanging electronic messages between computers over the network
 - Sender PC → Sender Mail Server → Internet → Recipient's Mail Server → Recipient's PC
- It needs e-mail program such as:
 - Microsoft outlook or mailing sites like gmail.com or hotmail.com or yahoo.com



1.8 Computers and Society

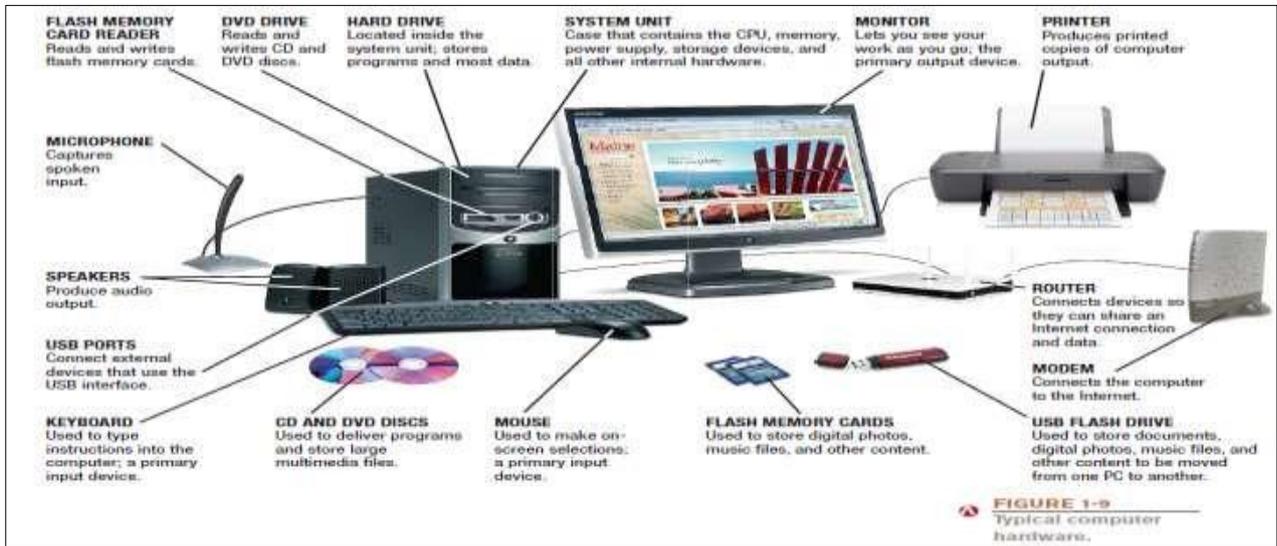
- The vast improvements in technology over the past decade have had a distinct impact on daily life, both at home and at work
- Many benefits of a computer-oriented society.
- Also **risks**
 - Computer viruses:
 - A malicious software program designed to change the way a computer operates
 - Identity theft and
 - Someone else uses your identity to purchase goods
 - Phishing
 - Identity thieves send fraudulent emails to people as business to obtain information
 - Privacy issues
 - Privacy of the individual or company is at risk.
- Differences in online communications
- The anonymity factor
- Information integrity (not all information on the Internet is accurate)

Exercises

1.9 Practical Exercises:

1.9.1 Exercise on Hardware

Identify the following hardware and classify them according computer main functions (IPOS & Communication)



NO	Component Name	Input	Output	Processing	Storage	Communication
1	Monitor					
2	Hard Drive					
3	DVD Drive					
4	Flash Memory Card Reader					
5	Microphone					
6	Speakers					
7	Keyboard					
8	Mouse					
9	USB Flash Drive					
10	Modem					
11	Router					
12	Printer					

1.9.2 Exercise on using Windows Desktop

Window Desktop has the following components:

Taskbar:

- ❑ The long horizontal bar at the bottom of your screen



- ❑ Taskbar is almost always visible It has three main sections:

1. The **Start Menu** button

- Search
- All programs
- Accessories
- Calculator
- WordPad etc...



2. The **middle section**, which shows you which programs and files you have open and allows you to quickly switch between them.



3. The notification area , which includes a clock and icons (small pictures) that communicate the status of certain programs and computer settings.

- **Exercise** Changing date & time



Desktop Icons

- Main desktop icons such as
 - Computer
 - User profile
 - Networks
 - Shortcuts to other programs



The Control Panel

- System and Security
- Network and Internet
- Hardware and Sound
- Programs
- User Accounts
- Appearance
- Clock, Language, Region
- Ease of Access



- Control Panel has following
 - ○ ○ ○ ○ ○ ○ ○

Exercise on Desktop background

- ☐ Changing desktop background ○ Changing screen resolution
 - Adding screen saver

- ☐ Information about your System (PC) ○ Operating System
 - Processor ○ Memory
 - Hard Disk

1.9.3 Exercise using Web Browser:

- ☐ Use one of 3 popular web browsers: ○ Microsoft Edge or Microsoft Internet Explorer
 - Google Chrome
 - Mozilla FireFox

- ☐ Surf to Website <http://www.arabtimesonline.com/news/> What is the main news on First page?

- ☐ Explain the above URL <http://www.arabtimesonline.com/news/>

- ☐ Click some of the hyperlinks on this site.

- ☐ Add the above URL in Bookmark on Chrome or Favorites in Internet Explorer.

- ☐ Set the home page of your browser to be <http://yahoo.com> on opening the browser.

- ☐ Search information on Windows 10

1.9.4 Exercise on Internet Addresses & Uniform Resource Locator (URLs)

Given the following Internet address:

<http://www.paaet.edu.kw/mysite/Default.aspx>

Answer the following questions:

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1. Protocol:

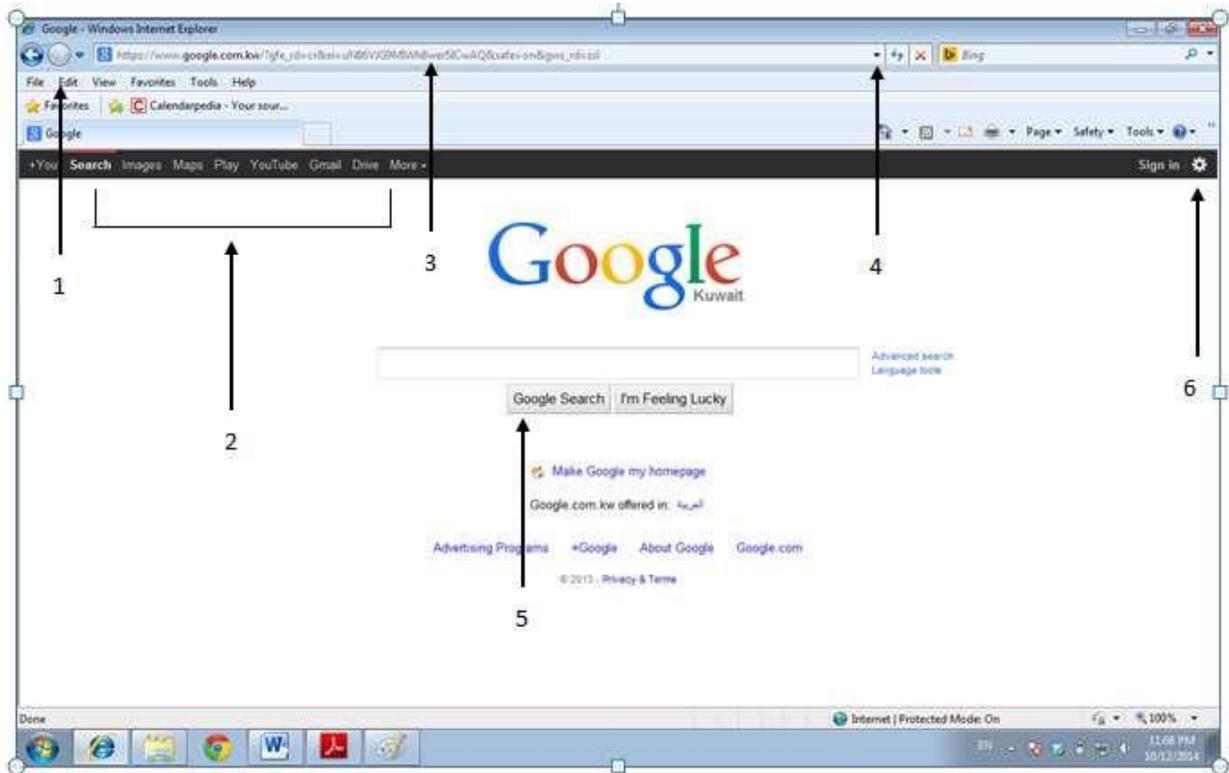
2. Original TLD: 3. Country TLD:

4. Web Server:

5. Folder Name:

6. Web Page Document:

1.9.5 Identify the following parts of Web Browser – Search Site?



1.
2.
3.
4.
5.

1.9.6 Exercise Creating file:

- ☐ For creating a file, one can use the following accessories programs of Windows ○
Wordpad ○ Notepad
- ☐ Open Wordpad program.
- ☐ Write down some information about your subject.
- ☐ Change the color to Blue.
- ☐ Save it in the filename “myfile”

1.9.7 Exercise using Calculator: ☐

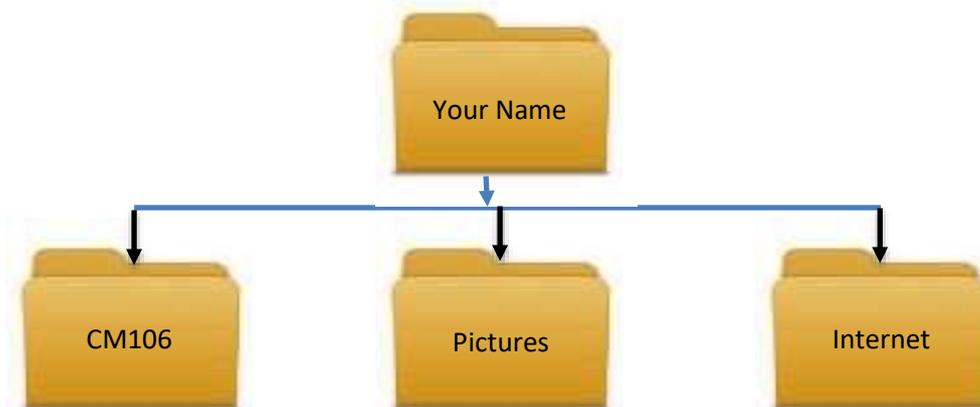
Execute Calculator program ☐

Add numbers.

- ☐ Subtract numbers.
- ☐ Multiply numbers.
- ☐ Divide numbers.

1.9.8 Exercise on Creating files and folders

- ☐ Create the following folders



- ☐ Open Wordpad program and write your name and group number and save it with the name “File1” inside “Your name” folder
- ☐ Copy any picture from the computer and save it inside “Pictures” folder
- ☐ Copy “File1” to folder CM106

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- ☐ Move folder “Pictures” to “CM106” folder
- ☐ Check the following information about your computer and the answer inside “File1” as follow:
 - Operating System:
 - Installed memory (RAM):
 - Processor:
 - Hard Disk capacity:
- ☐ Calculate the following
 - $2367 \times 8943 = \underline{\hspace{2cm}}$
 - $6767 / 20 = \underline{\hspace{2cm}}$
- ☐ Change the date to 20/1/2019. Change back to Today’s date
- ☐ Find the size of folder “CM106”
- ☐ Changing desktop background
- ☐ Adding screen saver

Chapter 2

System Unit: Processing and Memory

2.1 Data and Program Representation:

Most digital computers work in a two-state, or binary, fashion. It is convenient to think of these binary states in terms of 0s and 1s. Converting data to these 0s and 1s is called digital data representation.

Let's understand this.

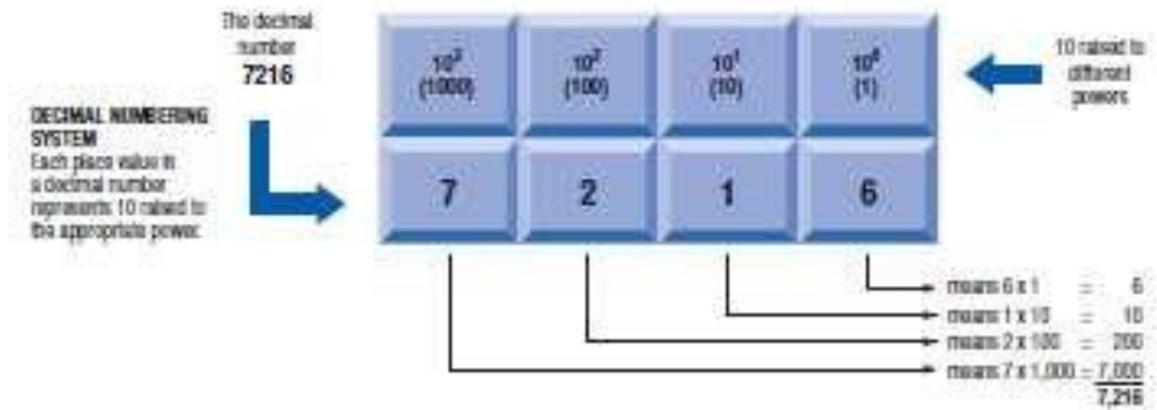
- ❑ Data in computer must be represented in **0** and **1**.
- ❑ The smallest unit of data that a digital computer can recognize is called “**bit**”
- ❑ Bits are grouped together to form letters, words, documents, programs and more ...
- ❑ A group of 8 bits is called “**Byte**”
- ❑ Approximately 1000 Bytes is known as **Kilobyte (KB)**. Actually **1KB=1024 Bytes**.

Unit- Abbreviation	Stands for	Approximate size
KB	Kilobyte	1,000 byte
MB	Megabyte	1 million byte
GB	Gigabyte	1 billion byte
TB	Terabyte	1 trillion byte
PB	Petabyte	1,000 terabyte
EB	Exabyte	1,000 petabyte
ZB	Zettabyte	1,000 exabyte
YB	Yottabyte	1,000 zettabyte

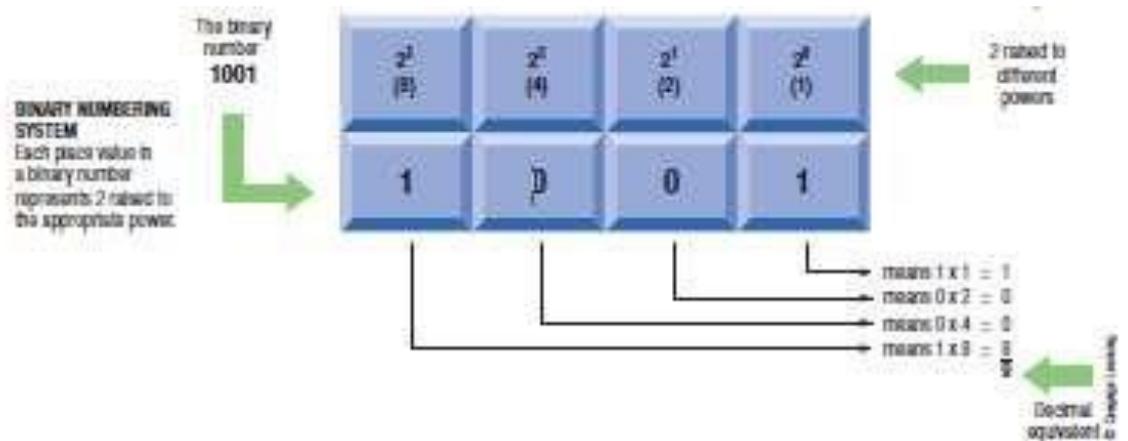
In this table also 1000 is approximately, exact is 1024. Means 1000 Terabyte is actually 1024 Terabytes.

2.2 Binary Number System

- ❑ Binary numbering system is the numbering system that represents all numbers just using two symbols (0 and 1)
- ❑ Decimal numbering system: Numbering system that uses 10 symbols (0,1,2,3,4,5,6,7,8,9) ❑ Example: 5 KB = 5000 Bytes approximately ; 10 MB = 10 Million Bytes approximately.
- ❑ Let's understand Decimal Number System that we usually use.



Now, let's understand Binary Number System that computer uses.



Base for decimal is 10 and for binary base is 2.

2.2.1 Converting from binary to decimal:

Base of Binary number is 2. The right most digit is 2^0 and then $2^1, 2^2, 2^3, 2^4$ instead of $10^0, 10^1, 10^2, 10^3, 10^4$ in decimal-base is 10.

Example-1: Convert binary 10010110_2 to decimal

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
1	0	0	1	0	1	1	0

$$10010110_2 = 128 + 16 + 4 + 2$$

$$= 150_{10}$$

Example – 2: Convert binary 11110000_2 to decimal

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
1	1	1	1	0	0	0	0

$$10010110_2 = 128 + 64 + 32 + 16$$

$$= 240_{10}$$

Example – 3: Convert binary 11010100₂ to decimal

2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
128	64	32	16	8	4	2	1
1	1	0	1	0	1	0	0

$$\begin{aligned} 10010110_2 &= 128 + 64 + 16 + 4 \\ &= 212_{10} \end{aligned}$$

2.2.2 Converting from decimal to binary (divide by two)

Example-1. Convert decimal 35₁₀ decimal to binary.

35/2 = 17	1		$(35)_{10} = (100011)_2$
17/2 = 8	1		
8/2 = 4	0		
4/2 = 2	0		
2/2 = 1	0		
1/2 = 0	1		

Example-2. Convert decimal 20₁₀ decimal to binary.

20/2 = 10	0		$(20)_{10} = (10100)_2$
10/2 = 5	0		
5/2 = 2	1		
2/2 = 1	0		
1/2 = 0	1		

2.2.3 Converting from decimal to binary

Example-3. Convert decimal 99₁₀ to binary.

2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
128	64	32	16	8	4	2	1
	1	1				1	1

99
- 64

35
- 32

3
- 2

1
- 1

0

0	1	1	0	0	0	1	1
---	---	---	---	---	---	---	---

Hence 99₁₀ = 01100011₂ = 1100011₂

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Example-4. Convert decimal 156_{10} to binary.

128	64	32	16	8	4	2	1
1			1	1	1		

	156
-	128

	28
-	16

	12
-	8

	4
-	4

	0

1	0	0	1	1	1	0	0
----------	----------	----------	----------	----------	----------	----------	----------

Hence $156_{10} = 10011100_2$

Example-5. Convert decimal 241₁₀ to binary.

128	64	32	16	8	4	2	1
1	1	1	1				1

	241
-	128

	113
-	64

	49
-	32

	17
-	16

	1
-	1

	0

1	1	1	1	0	0	0	1
----------	----------	----------	----------	----------	----------	----------	----------

Hence **241₁₀ = 11110001₂**

2.3 Coding System for Text-Based Data

While numeric data is represented by the binary numbering system, text-based data is represented by binary coding systems. ASCII, EBCDIC, and Unicode are codes that are used to represent all characters that can appear in text data—such as numbers (0 to 9), letters (a-z , A-Z) and special character like \$, @, #, % etc..

ASCII (American Standard Code for Information Interchange).

A fixed-length, binary coding system used to represent text-based data for computer processing on many types of computers. It is 8-bit code.

Example: The Letter (A) = (65)₁₀ → (01000001)₂
 The Letter (a) = (97)₁₀ → (01100001)₂

Unicode.

An international coding system that can be used to represent text-based data in any written language. It is 32-bit code.

Machine code or Machine language.

A binary-based language for representing computer programs that the computer can execute directly.

2.3.1 Coding System for Other Types of Data

Graphics Data

- ❑ Storing images in the form of **bitmap**
- ❑ Bitmap is a grid of hundreds of thousands dots called pixels (Picture Elements) ❑
Color of each pixel represented by combinations of 0s and 1s.
- ❑ Number of bits required to store the color of one pixel is called bit depth ❑ The more bits are used for the better quality of the image.

Audio Data

- ❑ Convert analog to digital by taking thousands Sample every second
- ❑ Sound files take up big storage space, Ex. 2-minutes sound = 32 MB
- ❑ When transmitting sound files over internet, they are compressed to shorten the download time

Video Data

- ❑ Displayed using collection of frames
- ❑ Each frame contain a still image
- ❑ Displaying the frames at rate of 30 frames per second will create the illusion of movie
- ❑ When transmitting over the Internet it will be compressed to reduce its size

2.4 Inside the System Unit

Personal computers typically contain a variety of hardware components located inside the **system unit**. Let us understand System unit and other Hardware components inside it.

❑ System unit.

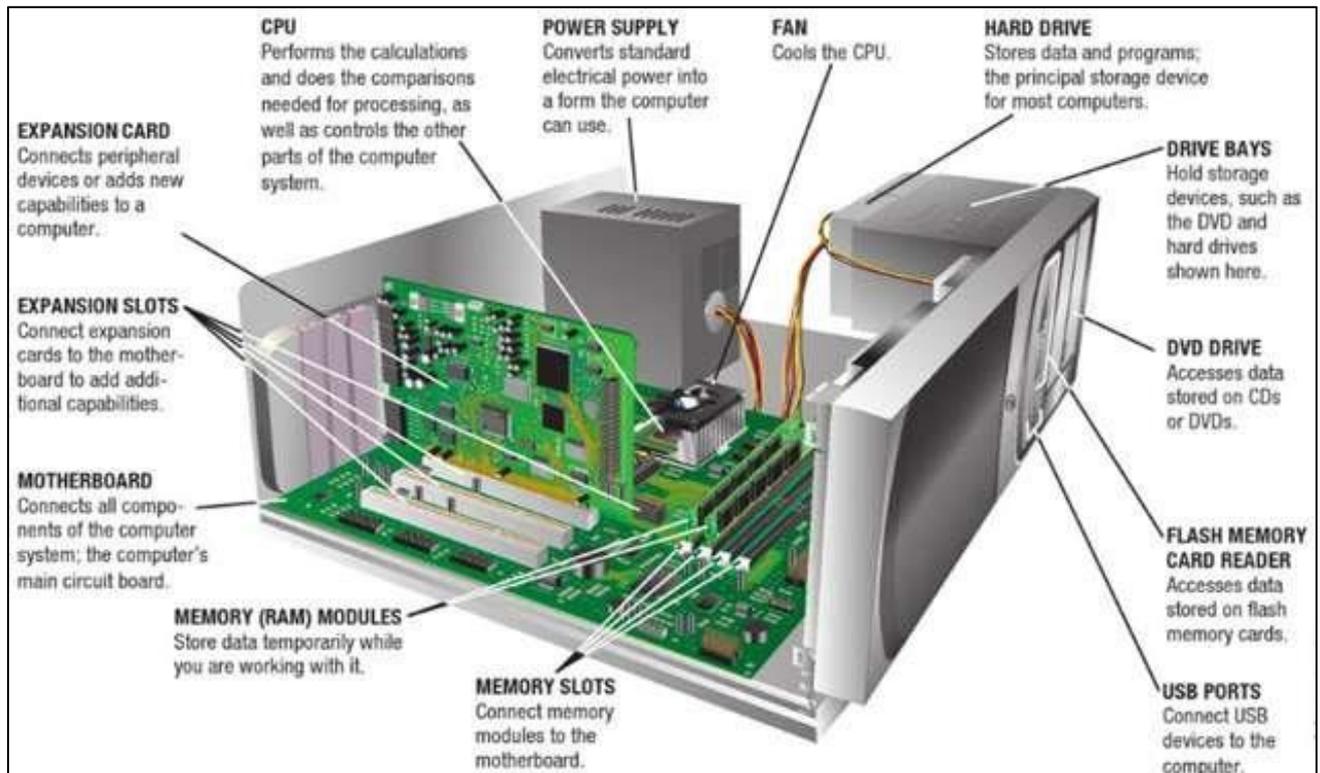
The main box of a computer that houses the CPU, motherboard, memory, and other devices.

It also has other circuitry such as:

- Power Supply
- Drive Bays

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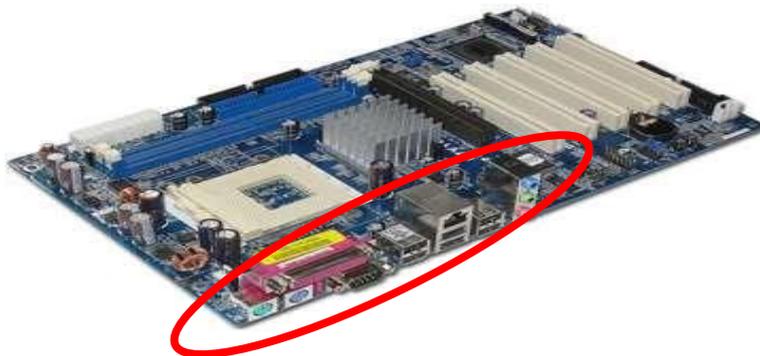
Here is a picture of System Unit and what exists in system unit:



Motherboard.

The main circuit board of a computer, located inside the system unit, to which all computer system components connect.

- All devices used with a computer need to be connected to the Motherboard.
 - External devices such as monitor, keyboard, mouse, connect to the motherboard by plugging into **Ports**
- ☐ The ports are built-in the motherboard



☐ Central processing unit (CPU).

The chip located on the motherboard of a computer that performs the processing for a computer. Also called the **processor**.

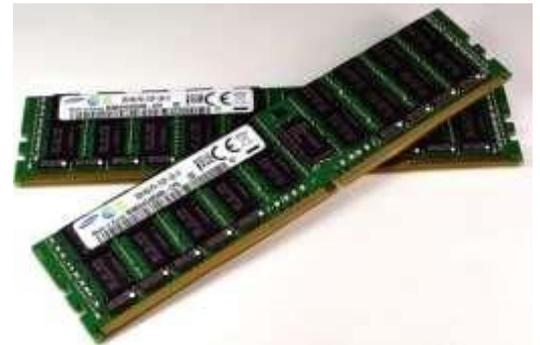
- It is called **Microprocessor** in a personal computer. It is also called **Processor**.



- Manufactured by companies such as Intel, Motorola and AMD.
- Microprocessors are designed for different Clock Speed and Word Size
 - Clock speed is related to CPU Speed and is measured in MHz and GHz. Higher CPU clock or speed means more instructions / second.
 - Word size is amount of data that can be manipulated at one time. Word size can be 32bit or 64-bit known as 32-bit Processor or 64-bit Processor.
- Multi-core processors such as dual-core (2 core), quad-core (4 cores) contains more processing units.
- **Cache Memory:** A group of fast memory circuitry located on or near the CPU to help speed up processing.
- It stores that data that may be needed soon.
- **Register:** High-speed memory built into the CPU that temporarily stores data during processing.

□ Memory.

- Chip-based storage.
- Amount of the computer's main memory which is located inside the system unit.
- It is called main memory and is volatile.
- Storage: amount of **long-term storage** available to a PC (Hard Drive). Non-Volatile
- **Volatile.**
A characteristic of memory or storage in which data is not retained when the power to the computer is turned off.
- **Nonvolatile.**
A characteristic of memory or storage in which data is retained even when the power to the computer is turned off.
- **RAM (Random Access Memory).**
 - Chips connected to the motherboard that provide a temporary location for the computer to hold data and program instructions while they are needed.
 - RAM is measured in Bytes
 - It is called main memory and is volatile.
- **ROM (Read-Only Memory).**
Nonvolatile chips located on the motherboard into which data or programs have been permanently stored.
 - You can't write over the data in ROM
 - You can't destroy the content in ROM when shut off



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- **Flash memory.**

Nonvolatile memory chips that can be used for storage by the computer or user; can be built into a computer or a storage medium.

- It can be erased and reprogrammed.

☐ Fans, Heat Sinks and other Cooling Components

- CPU operations will result into **Heat** because of all the amount of components in a small system unit and their processing activities.
- Heat can damage components
- Fans, Heat Sinks, and other cooling components are used to cool components so that chip runs faster without damage.

☐ Expansion Slots & Cards

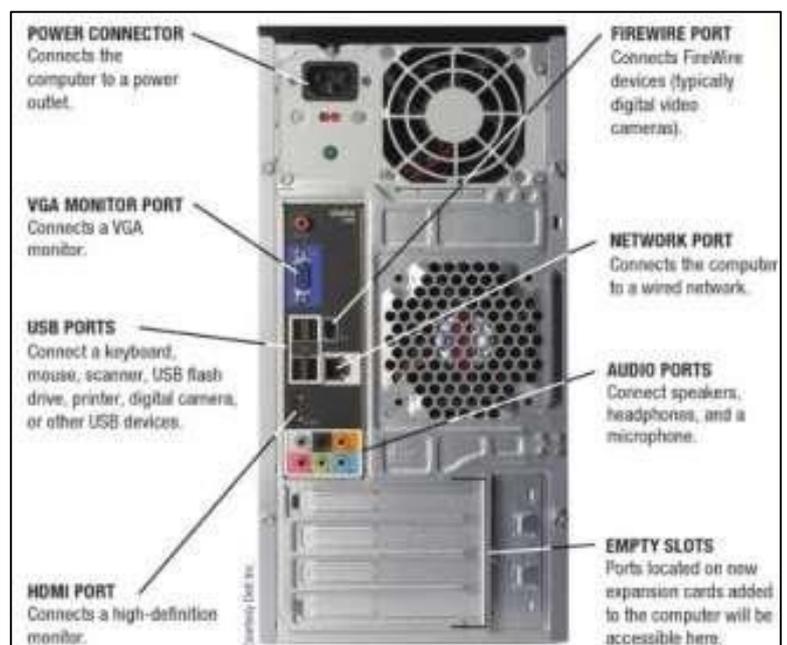
- Locations in the motherboard into which expansion cards are inserted
- Expansion cards are circuit boards (Add-on Cards, Interface Cards, Adapter Cards) are inserted in expansion slots like NIC-Network Interface Card, Sound Cards, Fax-Modem Card, SVGA Card etc.

☐ Buses:

- Buses: An electronic path within a computer over which data travels
- **System bus:** Bus that moves data back and forth between CPU and memory
- **Expansion bus:** Bus used to connect CPU to peripheral devices (I/O)
 - **PCI-e (PCI Express):** One of the buses used to connect peripheral devices.
 - **AGP Bus (Accelerated Graphic Bus):** Used for Video Cards and provides greater performance for Graphic Display.
 - **Universal Serial Bus (USB):** Universal bus used to connect 127 peripheral devices to a computer without requiring the use of additional expansion cards.
 - USB 2 is faster.
 - USB 3 the new one is faster than USB 2.

☐ Ports:

- **Ports:** A Connector on the exterior of a PC's system unit to which a device may be attached, Ports can be seen in the following picture:



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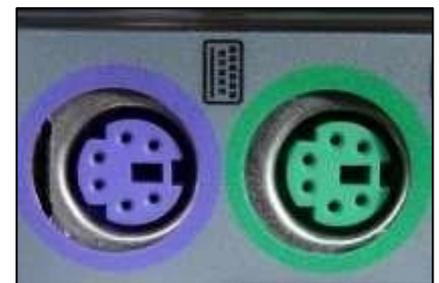
- **Serial Port:** Transmits data bit by bit, less expensive cables, can send data over long distances, can be used for keyboard and mouse
- **Parallel Port:** Transmits data byte by byte (8 bits at a time), more expensive, faster transfer than serial, can be used for printer.



- **Network Port:** Used to connect PC to a local area network, looks like a phone connector (RJ-45)



- **Keyboard Port + Mouse Port:** Use PS/2 connector and used to connect the keyboard or mouse to the system.



- **Monitor Port:** Used to connect the monitor to the PC



- **USB Ports:** Used to connect USB devices to the computer.



Chapter 3 Storage Systems

Storage device is a piece of computer equipment on which information can be stored. The work that we do needs to be preserved such as Program, Data & Results, for future use and should be stored on a more permanent medium and not RAM. Storage systems fill this role. In this chapter, we will see storage systems.

3.1 Storage System Characteristics:

All storage systems have specific characteristics, such as including both a storage medium and a storage device, how portable and volatile the system is, how data is accessed and represented, the type of storage technology used, and so on. These characteristics are discussed in the next few sections.

3.1.1 Two Parts of storage systems

❑ Storage device

- A piece of hardware, such as floppy drive or CD/DVD drive, into which a storage medium is inserted to be read from or written to.



❑ Storage medium

- The part of storage system where data is stored, such as floppy disk or CD disc.
- Inserted into the appropriate storage device



❑ Storage Devices can be:

- **Internal:** inside the system unit. Example: Hard Disk.
- **External:** plugged into an external port on the system unit. Example: External DVD Drive



❑ Letters and names are assigned to storage devices, so that devices can be identified.

❑ Examples:

- **A:** for floppy
- **C:** for 1st hard drive
- **F:** for removable flash drive

3.1.2 Storage medium volatility

❑ Nonvolatile Storage medium is the storage medium that retains its contents when the power is shut off.

❑ Volatile storage medium is the medium whose content is erased when the power is shut off.

3.1.3 Accessing data from storage

Accessing is required when computer system receives an instruction that requires data or program located in storage, it must go to the location on the storage medium and retrieve the requested data.

❑ Random Access (Direct Access)

- Data can be retrieved directly from any location on the storage medium, in any order such as (Hard disk, Floppy disk, CD/DVD).
- Also referred to as addressable media.

❑ Sequential access

- Data can only be retrieved in the order it is physically stored on the medium such as Tape drive.

3.1.4 Logical vs. Physical representation

❑ Logical representation

- Data stored on storage medium is referred to as a file, data files are also sometimes called documents.
- To keep files organized, related documents are stored in folders.



❑ Physical representation

- Data is stored on the storage media using its physical location.
- Physical location can be scattered across the hard drive.
- Users do not need to know the physical location.



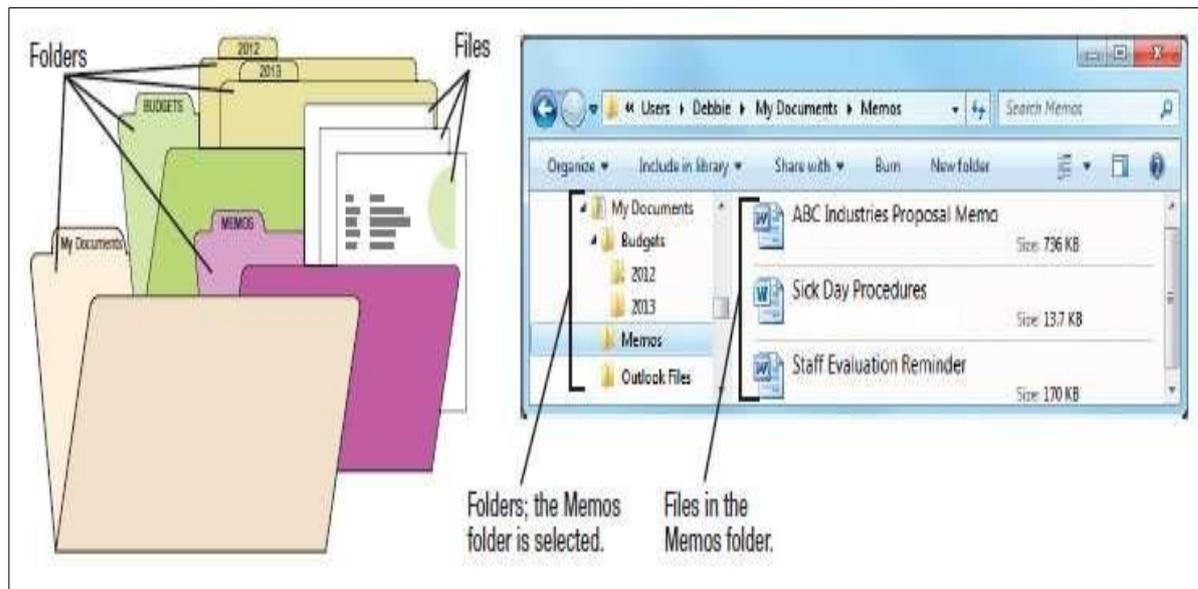
Logical representation can be understood as follows:

❑ **File**: something stored on a storage medium (program, document, photo)

❑ **Filename**: a name is given to a file by the user that is used to retrieve that file later.

❑ **Folders**: created to keep the files organized. Related documents are stored in folders located on the storage medium ❑ you can create subfolders within a folder.

□ **Example:** We can see here files stored in folders with their names.



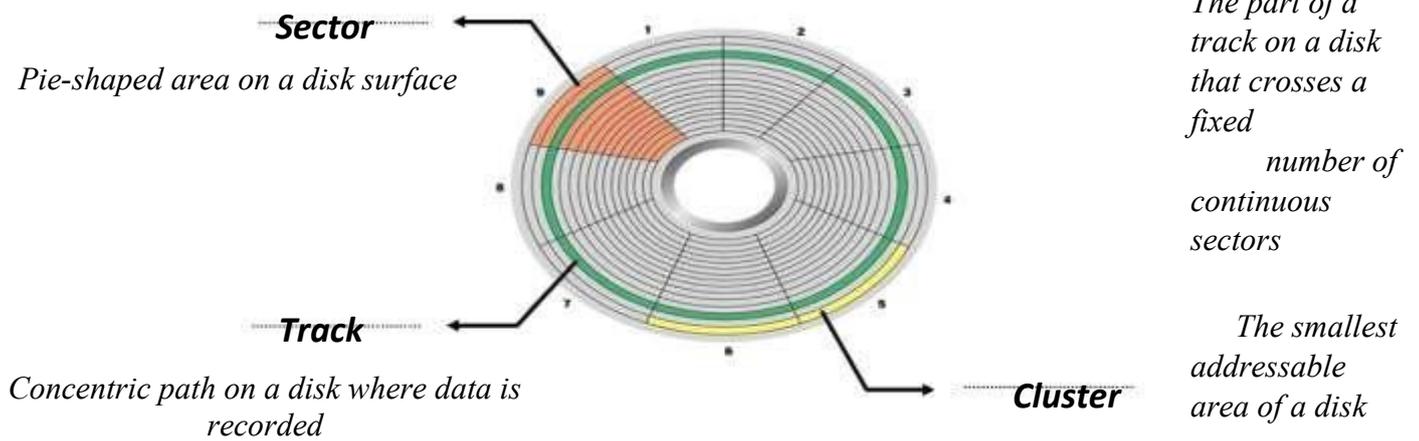
3.2 Magnetic Disk v/s Optical Disk

3.2.1 Magnetic Disk

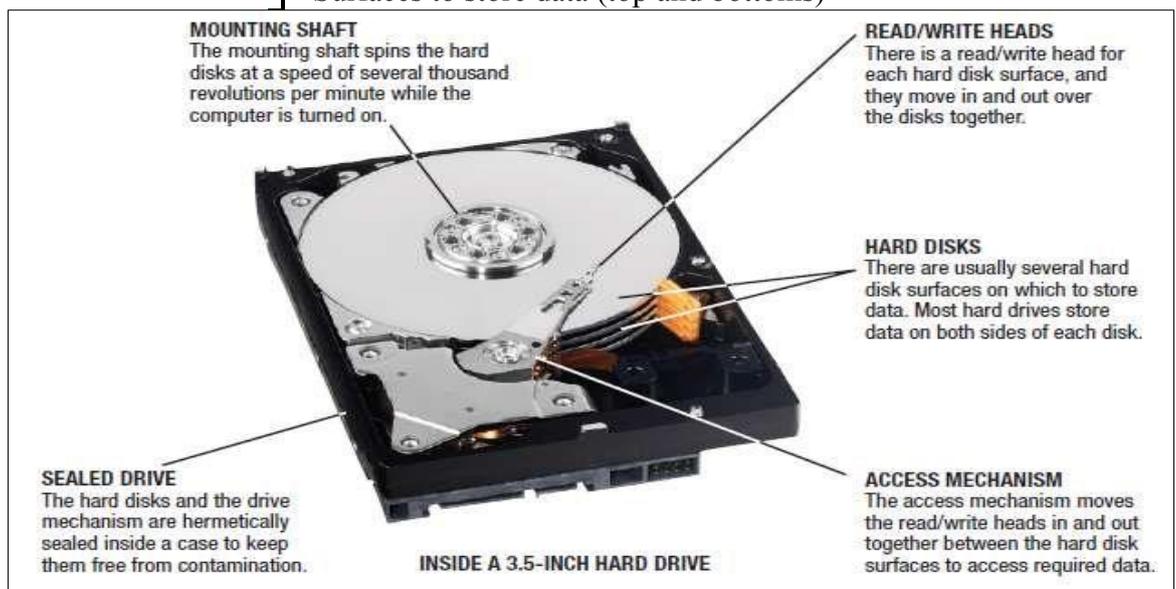
Magnetic Disk: Storage medium that records data using magnetic spots on disk made of flexible plastic or rigid metal

Example

- **Floppy Disk** is a Low capacity, removable magnetic disk made of flexible plastic permanently sealed inside a hard plastic cover (sometimes called diskette) ○ Floppy disk drive is a storage device that reads from and writes to floppy disks ○ Slow with small capacity
 - Floppy disks are organized into tracks, sectors, and clusters

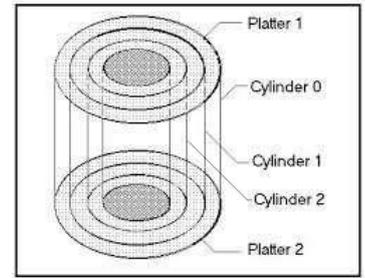


- **Hard Disk** : is a storage system consisting of one or more metal magnetic disks permanently sealed with an access mechanism inside its drive.
 - Hard Drives can be Internal hard drives and External hard drives
 - HD components
 - Hard disks (Platters)
 - └ Surfaces to store data (top and bottoms)



- Access mechanism
 - └ Move read/write head to access required data.
- Mounting shaft
- Spins the disks at the same time at speed of several thousands of revolutions per minutes.
 - Read/write heads
- Read/write head for each disk surface.

- Sealed drive
- Sealed to prevent hard disks and drive mechanism from contamination.
 - In addition to tracks, sectors, and clusters there is also **Cylinder** which is the collection of tracks located in the same location on a set of hard disk surfaces.



3.2.1.1 Hard drive speed and caching

- ☐ **Disk Access Time** (The time it takes to locate and read data from a storage medium)
 - **Seek time**
 - Time to move the read/write heads to the cylinder that contains the desired data.
 - **Rotational delay**
 - Time to rotate the disks into the proper position so that read/write heads are located over the part of the cylinder to be used.
 - **Data movement time**
 - Move the data from disk and transfer it to memory or transferring data from memory to store it on the disk.
- ☐ **Disk Cache**: Computer transfers additional data to dedicated RAM, known as disk cache, whenever disk content is retrieved. This helps to speed up access.

3.2.1.2 Partitioning and file system

- ☐ **Enables you to logically divide the physical capacity of single drive into separate areas called partitions.**
 - **C:** used for system
 - **D:** used for Data
 - **E:** Can be used for other operating systems
- ☐ **Each partition can have different file system**
 - FAT
 - FAT32
 - NTFS

3.2.2 Optical Disk

Optical Disk: A type of storage medium read from and written to using a laser beam such as CDs, DVDs and Blu-Ray Discs.

These discs can store data much more densely than magnetic disk

Optical Discs are available in a wide variety of sizes, shapes and capacities as mentioned below:

- 1) **Read-Only Discs**: Data can be read from but not written to such as CD-ROM & DVD-ROM Discs

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1. CD-ROM : Compact Disk Read-Only Memory
 - Hold about 650 MB
 2. DVD-ROM : Digital Versatile Disc Read-Only Memory
 - Hold 4.7 GB
- 2) **Recordable Discs:** Data can be written to but can't be erased and reused or rewritten such as CD-R, DVD-R, DVD+R, DVD+R DL.
3. CD-R : Compact discs recordable
 4. DVD-R / DVD+R : Recordable DVDs
 - Same but use different techniques for reading data
 5. DVD+R DL : a dual-layer recordable DVD
 - Hold 8.5 GB
- 3) **Rewritable Discs:** Data can be written to, erased and overwritten (or rewritten) just like magnetic disks.



These are CD-RW, DVD-RW, DVD+RW, DVD-RAM, Blue Laser Discs

6. CD-RW: Rewritable CD
7. DVD-RW/DVD+RW/DVD-RAM: Rewritable DVD

3.2.3 Flash Memory System Storage

Flash Memory is used in a variety of storage systems. It is in form of flash memory cards and USB flash drive. Its features are:

- No moving parts.
- Solid-state storage system.
- Require less power.

3.2.3.1 Flash Memory Card

- **Flash memory card:** a small, rectangular flash memory media, such as
 - 1) CompactFlash
 - 2) Secure Digital card (SD card)
 - 3) Multimedia Card (MMC) 4) XD
 - 5) Memory Stick.
- Flash cards are used in
 - 1) Digital camera
 - 2) Digital music player
 - 3) PCs
 - 4) Smart phones
- Can be inserted into reader in one direction to access data.



3.2.3.2 USB Flash Memory Drive

- **Flash memory drive**: a small drive that usually plugs into PCs USB port and contain flash memory media.



Chapter 4

Input and Output Devices

4.1 Input Devices

An **input device** is any hardware device that sends data to a computer, allowing you to interact with and control it.

Input devices used with computers to enter commands or data into the PC.

There are following input devices used these days:

- Keyboards
- Pointing Devices
- Scanners
- Digital Camera
- Audio Input

4.1.1 Keyboards

- ☐ One of the main sources of computer input is Keyboards.
- ☐ It is an input device containing numerous keys that can be used to input letters, numbers, and symbols.



- ☐ Include the standard alphanumeric keys plus a variety of other keys for special purpose
 - Function keys
 - Control and Alternate keys
 - Delete & backspace keys
 - Directional keys
 - Windows start menu key, control the speakers and launch e-mail.
- ☐ Notebook/ Laptop keyboards are smaller with fewer keys
- ☐ Notebook/ Laptop can connect conventional keyboard using USB port
- ☐ Types of keyboards
 - 1) Thumb pad → handheld PCs and mobile devices
 - 2) Portable keyboard/portable thumb pad → used in device that does not have builtin keyboard
 - 3) Pen input/touch input → device with don't support keyboard or thumb pad
 - 4) Wireless keyboard is available also

4.1.2 Pointing Devices

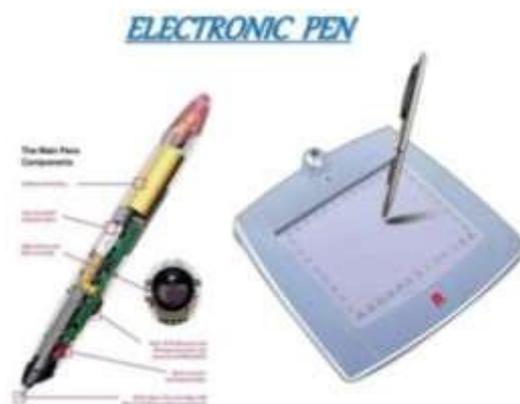
- ☐ It is an input device that moves an onscreen pointer, such as an arrow, to allow the user to select objects on the screen.

□ Example

- 1) Mouse is the most widely used pointing device.
 - An input device used to move a cursor around the screen.
 - A common pointing device that the user slides along a flat surface to move a pointer around the screen and clicks its button to make a selection.



- 2) Electronic pen (also called stylus)
 - An input device that is used to write electronically on the display screen.
 - Used with computers and digital writing system.
 - It has the ability of a device to identify handwritten character.



- 3) Hand Writing Recognition:



- 4) Touch screens
 - A Display device that is touched with the finger to issue commands or generate input to the connected PC.



- 5) Graphics tablet

- A flat, rectangular input device that is used with an electronic pen to transfer drawings or anything written on the device to a PC in graphic form



6) Signature capture devices

- A signature capture pad is a device that electronically captures a person's handwritten signature on an LCD touchpad using a pen-type stylus.



7) Joystick

- An input device that resembles a car's gear shift and often used for gaming



8) Trackball

- An input device, similar to an upside-down mouse that can be used to control an onscreen pointer and make selections.



9) Pointing stick:

- An input device shaped like a pencil eraser that is found in middle of many laptop keyboards



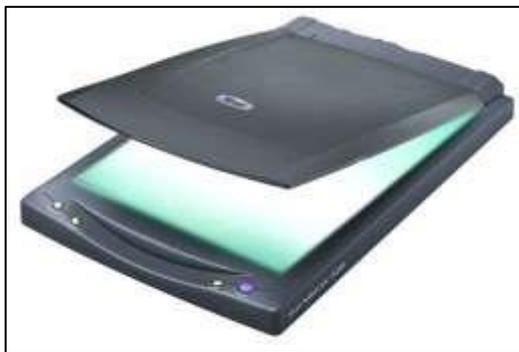
- 10) Touch pad ○ Small rectangular-shaped input device found in notebook computers that is touched with a finger to control an onscreen pointer to make selections



4.1.3 Scanners, Readers and Digital Cameras

4.1.3.1 Scanners

- Input device that reads printed text and graphics and transfers them to a computer digital form.
- Allow users to input data that exists in physical form such as
 1. Photographs.
 2. Drawings.
 3. Printed documents.
- Scanners types:
 - 1) Flat bed scanners.
 - 2) Sheet fed scanners.
 - 3) Handheld scanners.



4.1.3.2 Readers

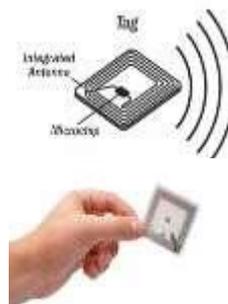
□ Barcode Readers

- Read barcodes which identifies products in retail stores.
- **Barcode:** Machine-readable code that represents data as a set of bars.

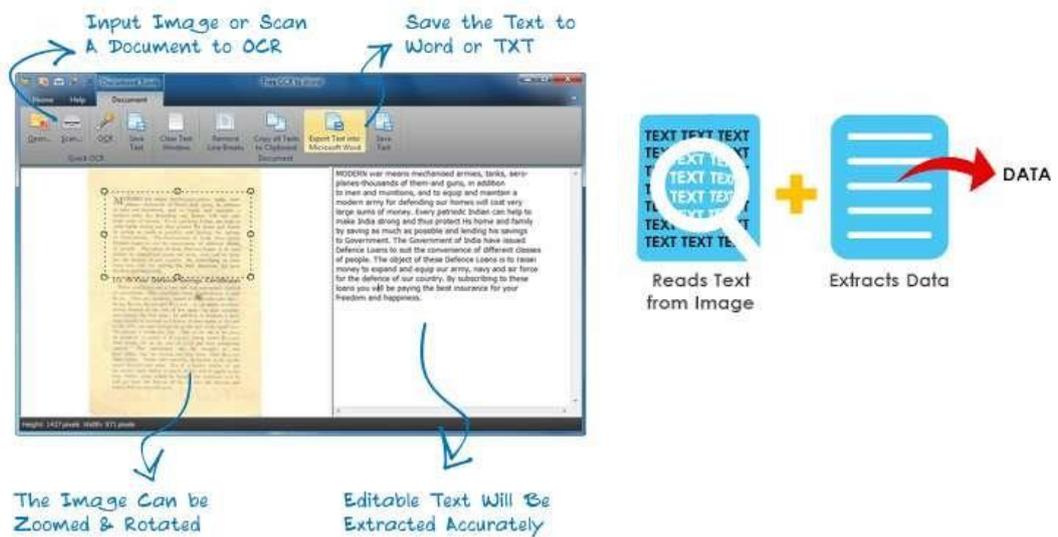


□ RFID Readers

- An input device that reads electronic tags attached with shipping labels, through radio waves.
- Radio frequency identification.
- Reads and store data in RFID tags, which contains tiny chips and antennas.



- ❑ Optical Mark readers (OMRs)
 - Used in testing forms or voting.
- ❑ Optical character recognition (OCR) devices
 - OCR device is the recognition of printed or written text characters by a computer.
 - Read printed optical characters.



- ❑ Magnetic Ink character recognition (MICR) readers
 - Used in banking industry to sort, process, and route checks to the proper banks.



- ❑ Biometric readers
 - It is used to identify individuals by their fingerprints, hand geometry, face or other biometric characteristics like iris of eyes.



4.1.3.3 Digital cameras

- ❑ It is an input device that takes pictures and records them as digital data images.
- ❑ **Digital still cameras**
 - Takes still photos
- ❑ **Digital video cameras**
 - It is used to capture videos
 - Example
 - Digital camcorders
 - PCs cams



4.1.4 Audio Input

- ❑ It is the process of entering audio data into the computer.
- ❑ Types of audio input:
 - Voice input: a system that enables a computer to recognize the human voice
 - Music Input: music input into a PC via CD or DVD
- ❑ Microphones are the devices..
- ❑ Voice input system enables computer to recognize spoken words.
- ❑ Used in medical and legal fields which saves time and effort.
- ❑ MIDI devices can be used to input original music compositions into PC (music also can be input via CD, DVD or web download)



4.2 Output Devices

An output device is any device used to send data from a computer to another device or user.

Most computer data output that is meant for humans is in the form of audio or video. Thus, most output devices used by humans are in these categories. Examples include monitors, projectors, speakers, headphones and printers.

4.2.1 Display Devices

- Also called monitors or display screens.
- The most common output device for computer.
- Also incorporated into other devices
- Available in different sizes
- They can be either Color or Monochrome
- 2D vs. 3D
- Digital and HDTV

Computer Monitor



Smart Phone



Navigation System



- Regardless of technology used, all displays are divided into small areas of dots called **pixels**.
- Monitors can be wired or wireless
- Monitors are Either
 - CRT monitors (Cathode-ray tube)
 - Flat-Panel displays
 - Liquid crystal displays (LCD)
 - Plasma displays
 - Both LCD and Plasma are almost replaced by organic light emitting diode (OLED) → they generate their own light and they don't need backlighting



LED



LCD



Plasma

- In addition to monitors, there are Data Projectors

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- A display device that projects all computer output to a wall or projection screen



4.2.2 Printers

- An output device that produces output on paper.
 - Produce hard copy through either impact or nonimpact technology
 - Quality of printers is measured by dots per inch (**dpi**)
 - Speed is measured by pages per minute (**ppm**)
 - Personal v/s Network printers
 - Color v/s black & white printers
 - The most common printer are:

- Laser printers

- An output device that uses toner powder and technology similar to photocopier to produce images on paper.
 - Faster.
 - Better Quality.



- Ink-jet printers

- An output device that sprays droplets of ink to produce images on paper.
 - Inexpensive.
 - Good for home use.



- Photo printers.

- An output device designed for printing digital photographs



- Barcode printers.

- An output device that prints bar coded documents



- Portable printers

- Small Printer that can be carried with you.



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- Plotters printers
 - The plotter is a computer printer for printing vector graphics. Plotters draw pictures on paper using a pen.



- Wide format printers
 - A printer that prints on large paper, which can range from two to more than 15 feet in width.



- Multifunction devices
 - A device that has multiple functions such as Printer, scanner, and fax machine



4.2.3 Audio Output

- Voice output systems.
- An output device that produces sound.
 - 1) Speakers
 - 2) Headphones and Headsets

