SECTION 1

TYPES AND COMPONENTS OF COMPUTER SYSTEMS

This Section you will learn about:
- **HARDWARE**
- **SOFTWARE**
- **THE MAIN COMPONENTS OF A COMPUTER SYSTEM**
- **OPERATING SYSTEMS:**
  - **GRAPHICAL USER INTERFACE (GUI)**
  - **COMMAND LINE INTERFACE (CLI)**
- **DIFFERENT TYPES OF COMPUTER SYSTEMS.**
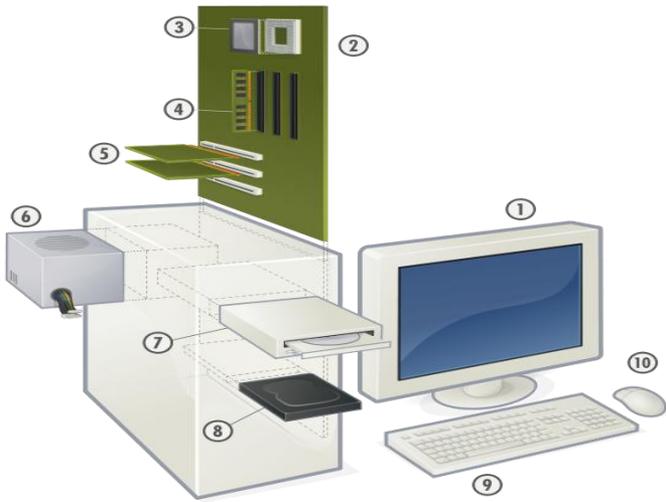
Hardware and Software

Computer hardware is the collection of physical elements that constitute a computer system. Computer hardware refers to the physical parts or components of a computer such as monitor, keyboard, Computer data storage, hard drive disk, mouse, system unit (graphic cards, sound cards, memory, motherboard and chips), etc. all of which are physical objects that you can actually touch.

Computer Hardware are broadly divided into four types

- **Input Devices :**
  Hardware used to input data into computer system like keyboard, mouse
- **Output Devices**
  Hardware used to output processed data from computer system like Monitor, printer
- **Storage Devices**
  Hardware used to store the data like hard disk ,Pen, Drive, CD
- **System Unit:** Hardware present in System Unit Like
  CPU , Motherboard, Graphics Card, Data Bus, System Cables, Ports etc

Label the hardware given below

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

9._____

10._____

Computer software is a set of *programs, procedures, code* and related data that provide the instructions for telling computer hardware what to do and how to do it
Software are broadly divided into two types

- **System Software:** System software is any computer software which manages and controls computer hardware so that application software can perform a task. **Operating systems**, such as Microsoft Windows, Mac OS X or Linux, are prominent examples of system software

- **Application Software** application software are programs that enable the end-user to perform specific, productive tasks, such as MS Word for word processing or Photoshop for image manipulation.

Hardware and Software have a symbiotic relationship, this means that without software hardware is very limited; and without hardware, software wouldn't be able to run at all. They need each other to fulfill their potential.

System Software Vs. Application Software

SYSTEM SOFTWARE		APPLICATION SOFTWARE
Enable the computer to function	Usage	Enable user to work effiently with documentation
COMPULSORY	Need	OPTIONAL-depends on usage and needs
Each computer need one system system software	Number Software	Each computer can have more than one application
Independent – can use without application software	Dependency	Dependent – application software cannot work without Application software
Provide environment in which the application run	Function	Provides the environment to enable user to accomplish specific task

Hardware Vs. Software

Software	Hardware
1. Software is a set of instructions that tells a computer exactly what to do.	1. Hardware is physical parts computer that cause processing of data.
2. Software cannot be executed without hardware.	2. Hardware cannot perform any task without software.
3. Software cannot be touched.	3. Hardware can be seen and touched.
4. Software is debugged in case of problem.	4. Hardware is repaired in case of problem.
5. Software is reinstalled if the problem is not solved.	5. Hardware is replaced if the problem is not solved.

Complete the blanks using words given below in box

A _____ is an electronic device that _____, retrieves, and processes data. It is made up of _____ and software. Hardware are the things you can _____ and pick up, for example the _____, mouse and _____. Software are the _____ and instructions which tell the computer what to do and how to _____.

KEYBOARD	STORES	OPERATE	TOUCH
HARDWARE	PROGRAMS	COMPUTER	MONITOR

MAIN COMPONENTS OF COMPUTER SYSTEMS

A **computer** is an electronic device, operating under the control of instructions stored in its own memory. At the most basic level, a computer is a device consisting of three pieces:

- A processor to interpret and execute programs
- A memory to store both data and programs
- A mechanism for transferring data to and from the outside world.

The Components of a Computer

|	
Input Device	• Allows you to enter data and instructions into a computer
Output Device	• Hardware component that conveys information to one or more people
System Unit	• Case that contains the electronic components of the computer that are used to process data
Storage Device	• Holds data, instructions, and information for future use
Communications Device	• Enables a computer to send and receive data, instructions, and information to and from one or more computers or mobile devices

In Section 2 & 3, We will learn more about Input System, Output System and External Storage Devices in detail . In this Section we focus more on System Unit which consist main Component of Computer – **Motherboard, CPU & Internal Memory** and mechanism how they work.

System Unit

The **system unit** is a case that contains electronic components of the computer used to process data .The inside of the system unit on a desktop personal computer includes:

- Drive bay(s)
- Power supply
- Sound card
- Video card
- Processor
- Memory
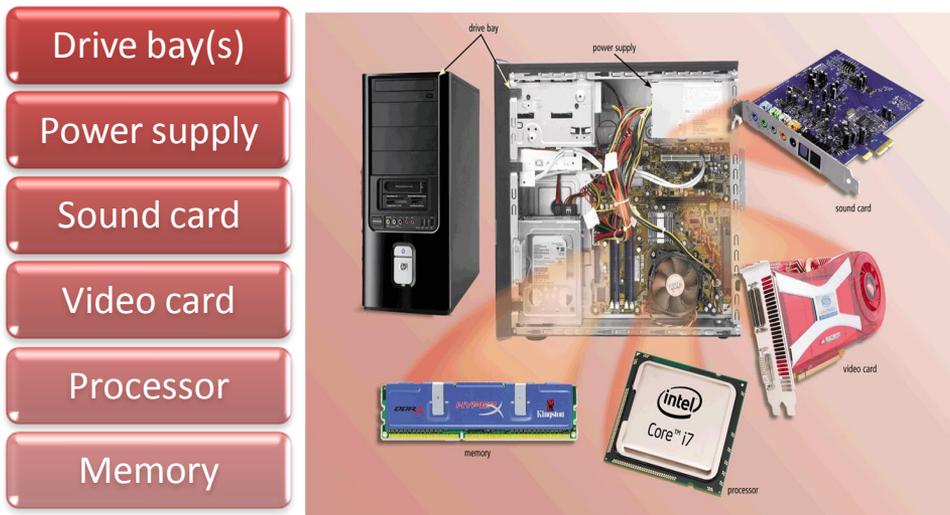
The motherboard is the main circuit board of the system unit
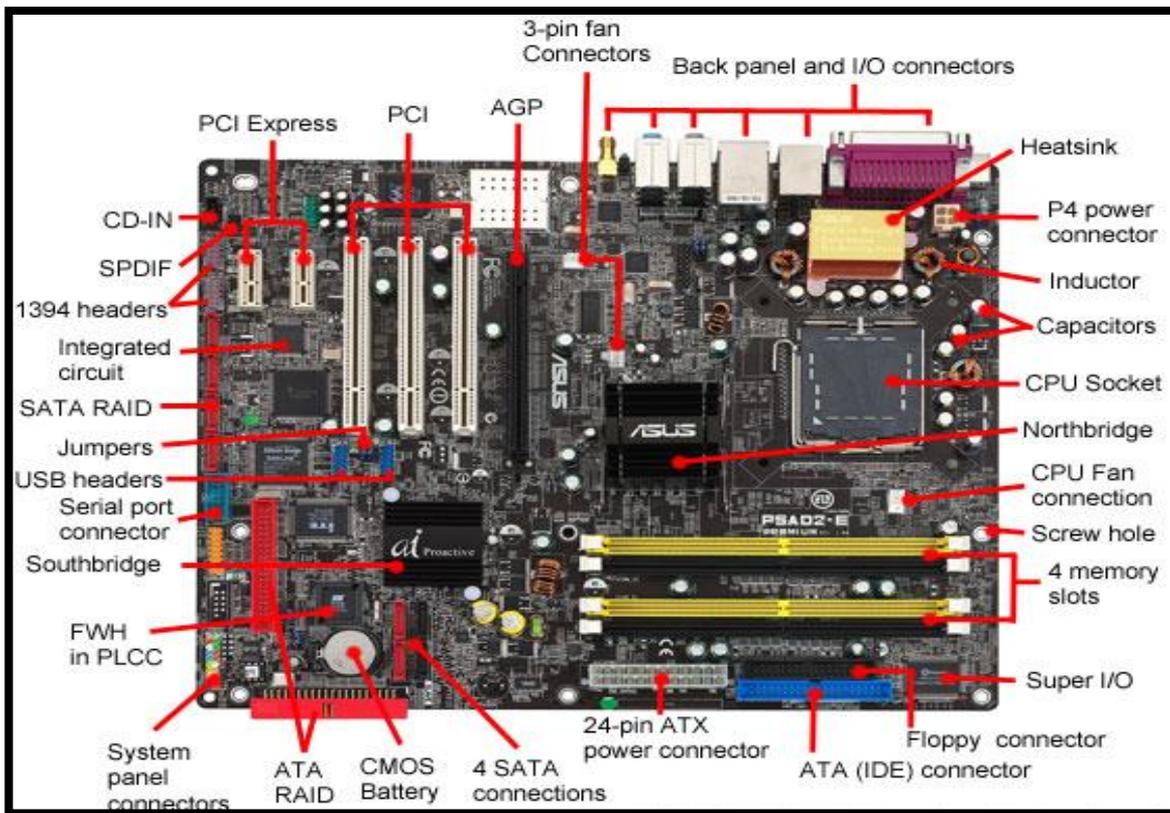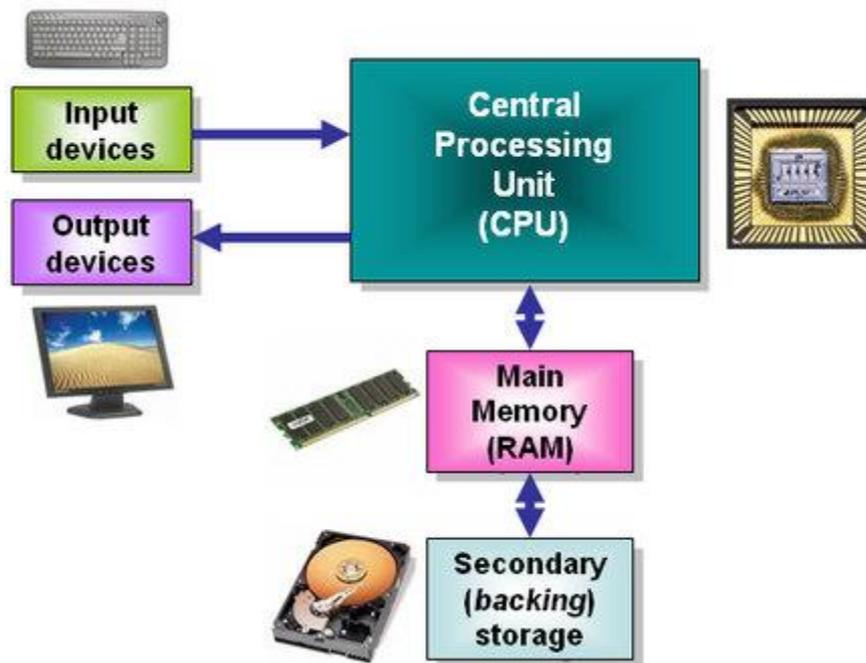

PROCESSOR (CPU)

The central processing unit (CPU) is the part of the computer which interprets and executes the commands from the computer hardware and software. CPUs used to be made up of discrete components and numerous small integrated circuits, which were combined together on one or more circuit board/s. However, due to modern manufacturing techniques, the term **microprocessor** is now used instead of CPU. This is a single integrated circuit (see Figure 1.2) which is at the heart of most PCs and is also found in many household devices and equipment where some control or monitoring is needed (e.g. the engine management system in a car).

CPU or Processor have Two Parts
1 Arithmetic Logical Unit(ALU): The **arithmetic logic unit** (ALU) performs arithmetic, comparison and other operations.
2. Control Unit: The **control unit** is the component of the processor that directs and coordinates most of the operations in the computer operations

Flow of CPU Working

For every instruction, a processor repeats a set of four basic operations, which comprise a machine cycle
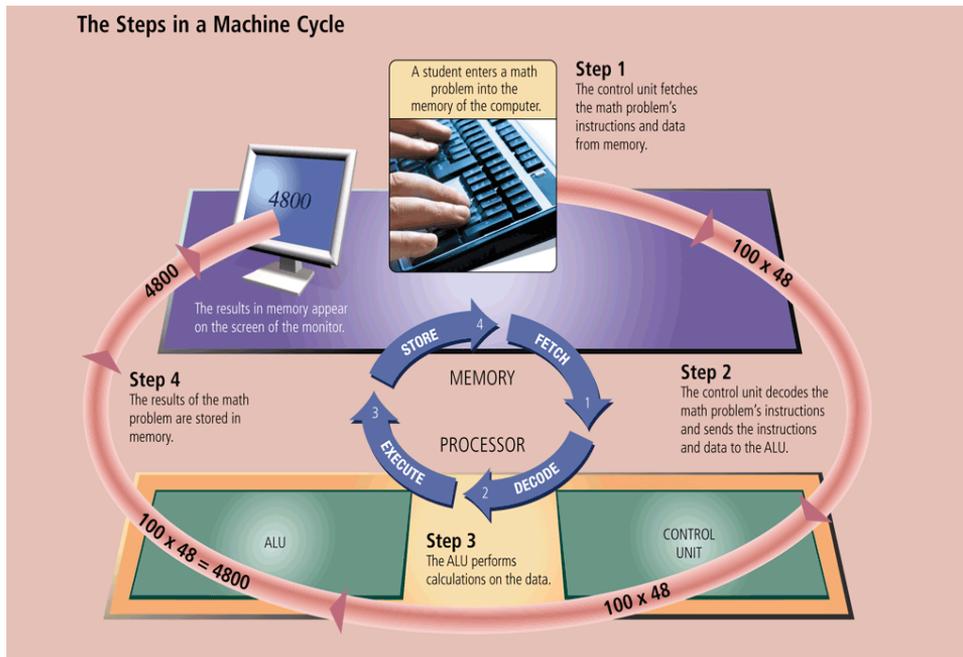
The processor contains registers, that temporarily hold data and instructions
The **system clock** controls the timing of all computer operations.The pace of the system clock is called the **clock speed**, and is measured in **gigahertz** (**GHz**)

Memory

Memory consists of electronic components that store instructions waiting to be executed by the processor, data needed by those instructions, and the results of processing the data.
Stores three basic categories of items:
- ✓ The operating system and other system software
- ✓ Application programs
- ✓ Data being processed and the resulting information

Memory Sizes				
Term	Abbreviation	Approximate Number of Bytes	Exact Number of Bytes	Approximate Number of Pages of Text
Kilobyte	KB or K	1 thousand	1,024	1/2
Megabyte	MB	1 million	1,048,576	500
Gigabyte	GB	1 billion	1,073,741,824	500,000
Terabyte	TB	1 trillion	1,099,511,627,776	500,000,000

Memory size is measured in **kilobytes** (**KB** or **K**), **megabytes** (**MB**), **gigabytes** (**GB**), or **terabytes** (**TB**)

The internal hard drive is the computer's main memory; this is where the **applications software**, disk **operating system** and **data files** are stored. The main advantage of these memories is the fast data transfer/access times and their large capacity to store data (this is discussed further in Chapter 3).

Main/Internal memory (including ROM and RAM)

This is the type of memory that can be read from and written to by the processor and other devices. Programs and data are loaded into RAM from storage devices such as a hard disk and remain in the RAM as long as the computer has continuous power.
The system unit contains two types of memory:

Random access memory (RAM) is an internal chip where data is temporarily stored when running applications. This memory can be written to and read from. Since its contents are lost when power to the computer is turned off, it is often referred to as a **'volatile' or 'temporary' memory**.
RAM chips usually reside on a **memory module** and are inserted into **memory slots**

memory chip

dual inline memory module

memory slot
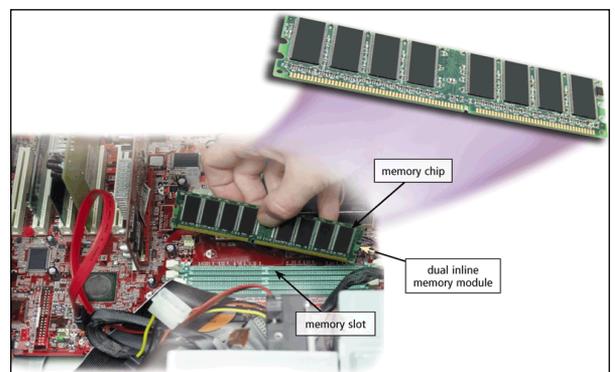
There are Two Basic types of RAM chips exist:
- **Static RAM (SRAM) :** SRAM retains its contents as long as the power is connected and is easy to interface to but uses six transistors per bit.
- **Dynamic RAM (DRAM)** Dynamic RAM is more complicated to interface to and control and needs regular refresh cycles to prevent its contents being lost. However, DRAM uses only one transistor and a capacitor per bit.

Cache Memory:
Cache memory is random access memory (RAM) that a computer microprocessor can access more quickly than it can access regular RAM. As the microprocessor processes data, it looks first in the cache memory and if it finds the data there (from a previous reading of data), it does not have to do the more time-consuming reading of data from larger memory. It is of two types- L1 cache is on the same chip as the microprocessor. L2 is usually a separate static RAM (SRAM) chip.

Read only memory (ROM) is a memory used to store information that needs to be permanent. It is often used to contain, for example, configuration data for a computer system. These chips cannot be altered and can only be read from (hence their name). One of the main advantages is that the information stored on the ROM chip is not lost even when power is turned off to the computer. They are often referred to as **'non-volatile' memories.**

Two Types of ROM
- **A PROM (programmable read-only memory) chip is a blank ROM chip that can be written to permanently**
- **EPROM which can be erased**

.**BIOS (basic input/output system)**.
ROM also contains some coding known as the boot file. When the computer is turned on, the BIOS carries out a hardware check to find out if all the devices are present and whether they are functional. Then it loads the operating system into the RAM. The BIOS stores the date, time and system configuration in a non-volatile chip called a **CMOS (complementary metal oxide semiconductor)**, which is usually battery powered.

Both types of memory are referred to as **Immediate Access Storage (IAS)** because the hardware can access the data so quickly compared to data in backing storage.

Comparing internal memory with backing storage:
- It is always **faster** to access data from **internal memory** than from backing storage.
- Data stored in internal memory is **lost** when the computer is turned off but data stored in backing storage is **retained**.
- Internal memory is **much smaller** than backing storage. It is far too small to hold **all** the data/programs that would be on the backing storage of a typical computer.

Give Three Difference Between RAM and ROM

RAM	ROM

OPERATING SYSTEM

An OS is a set of programs that controls how the hardware of a computer works… It is the means of communication between the user and the computer, deals with the loading and running of application programs and manages the transfer of data and files to and from the peripheral devices.

Functions of Operating System
- The OS acts like a bridge between the applications software and the computer hardware.
- Users need applications software to carry out tasks, the software needs the operating system in order to communicate with the hardware
- Accepts data from input devices and transfers it to the computer's memory.
- Makes sure any output is sent to the correct output device.
- Manages the transfer of data between the computer's memory and backing storage devices.
- Allocates memory space to programs and data.
- Loads applications software into memory and controls the running of them.
- Deals with any errors that occur when a program is being run and informs the user.
- Provides a human computer interface for the user
- Manages system security by restricting access to prevent unauthorised access to the system.
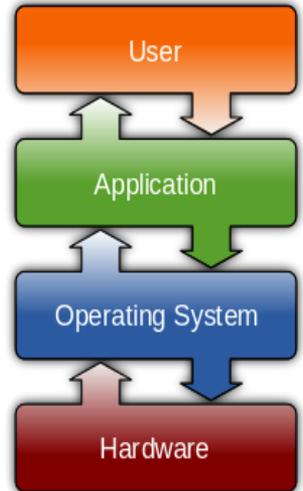
Types of Operating System:

- **Single User Systems:** Provides a platform for only one user at a time. They are popularly associated with Desk Top operating system which run on standalone systems where no user accounts are required. Example: **DOS, Windows 95, Windows7, Mac OS.**

- **Multi User Systems:** Provides regulated access for a number of users by maintaining a database of known users. Refers to computer systems that support two or more simultaneous users. Another term for multi-user is time sharing. Ex: All mainframes are multi-user systems. Example: **Unix**

- **Multi-tasking and Single-tasking Operating Systems:** When a single program is allowed to run at a time, the system is grouped under the single-tasking system category, while in case the operating system allows for execution of multiple tasks at a time, it is classified as a multi-tasking operating system.**Unix, Linux**
- **Distributed Operating System:** An operating system that manages a group of independent computers and makes them appear to be a single computer is known as a distributed operating system. Distributed computations are carried out on more than one machine. When computers in a group work in cooperation, they make a distributed system.
- An **embedded operating system** resides on a ROM chip on a mobile device or consumer electronic device

Utility Program is a type of system software that allows a user to perform maintenance-type tasks. Examples of Utility Programs : Windows Explorer (File/Folder Management), Compression Tool, Anti-Virus Utilities, Disk Defragmentation, Disk Clean, BackUp, WinZip, WinRAR etc…

USER INTERFACE

A **user interface** controls how you enter data and instructions and how information is displayed on the screen

There Are Two User interface provided by Operating System

Graphical User Interface (GUI): User interact the system through WIMP environment-Windows, Icon, Menus, and Pointers (WIMP). GUIs are small pictures that represent actions, and they can be selected by 'clicking' on them with the mouse. **Example of GUI interface Windows & Mac OS**
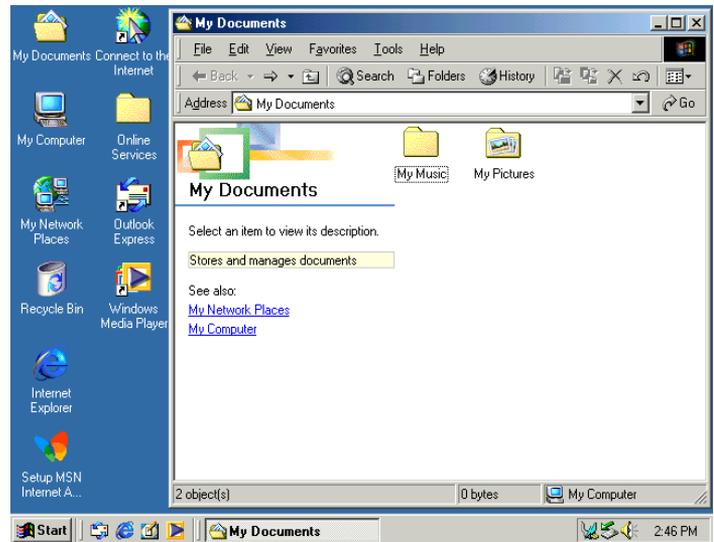
Command line interfaces(CLI)

CLIs require a user to type in instructions in order to choose options from menus, open software etc. There are often a number of commands that need to be typed in, for example, to save or load a file. The user therefore has to learn a number of commands just to carry out basic operations. It is also slow having to key in these commands every time an operation has to be carried out. However, the advantage of CLI is that the user is in direct communication with the computer and is not restricted to a number of pre-determined options. Example **DOS**

Types of computers

There are many types of computer systems in existence. This section summarizes some of the more common types currently available.

PC/desktop computers

PC/**desktop** usually refers to a general purpose computer which is made up of separate monitor, keyboard, mouse and processor unit (see Figure 1.1). The term PC (personal computer) usually refers to computer systems which are IBM- compatible, thus distinguishing them from, for example, Macintosh systems.
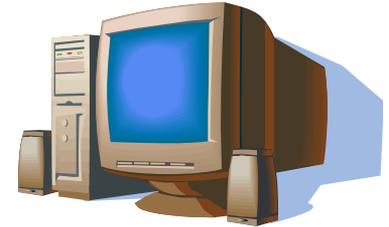
Advantages

- Spare parts and connections tend to be standardised, which usually results in low costs.
- Desktops tend to have a better specification (e.g. faster processor) for a given price(often due to size and construction constraints in laptops).
- The large casing allows good dissipation of any heat build-up.

Disadvantages

- Desktops are not particularly portable since they are made up of separate components.
- All the components need to be hooked up by wiring, which can be quite complex and clutters up the desk space.
- Because they are not particularly portable, it is necessary to copy files, etc. when you want to do some work elsewhere (e.g. at home).

Laptop computers

Laptop (or notebook) refers to a type of computer where the monitor, keyboard, pointing device and processor are all together in one single unit.
The key features you would expect to find in a laptop are:
- low weight (to aid portability)
- low power consumption (and also long battery life)
- a processor that does not generate too much heat (cooling is very important).

Advantages

They are very portable, since the monitor, pointing device, keyboard, processor and backing store units are all together in one single box.
- There are no trailing wires, etc. because everything is in one single unit.
- They can take full advantage of **WiFi** (see discussion in Chapter 4).
- Since they are portable, they can link into any multimedia system.

Disadvantages

- Since they are portable, they are easy to steal!
- They have limited battery life so the user may need to carry a heavy adaptor.
- The keyboards and pointing devices can sometimes be awkward to use.
- Heat dissipation is more difficult due to the structure of the laptop computers.

Netbooks

Netbook is a term used to describe a computer that can almost fit onto a hand and is a smaller version of a laptop. These used to be known as **palmtop** computers, but this term now generally applies to much smaller devices which use touch screens and often a stylus to key in data (see below).

Advantages

Netbook computers have many of the features of laptops and therefore have similar advantages and disadvantages.

Disadvantages

In addition to the disadvantages listed above for laptops:
- netbooks don't have optical drives
- the keyboards are only about 80 per cent the size of laptop keyboards
- they lack some of the features found in larger machines, principally due to the size constraints and to the fact that they are cheaper to purchase.

Personal digital assistants

Personal digital assistants (PDAs) are small handheld computers that usually come with a touch screen that is activated using a stylus. Data (e.g. text) is entered by using a keyboard that appears on the touch screen. Originally, these devices were used as personal organisers but their use has expanded somewhat to include new generation mobile phones, **data loggers**, satellite navigation systems, etc. Many PDAs now have basic database, **word-processing** and **spreadsheet** facilities.

Advantages

- They can be used anywhere because of their size.
- They are very lightweight and are more portable than laptop computers.

Disadvantages

- It is difficult to enter text quickly.
- They have very limited capabilities due to the software and the operating system used.

Mainframe computers

Mainframe computer is a term used for a large, very powerful, computer system. The name comes from the days when the individual components were housed in large (often room-sized) frames.

Uses

Their main purpose is to run commercial applications, such as banking and insurance, where huge amounts of data need to be processed each day.

The main features of main frame computers are as follows.

- They can have several CPUs.
- They have very fast processor speeds.
- They can support multiple operating systems.
- They have huge amounts of storage capacity.
- They have huge internal memories (e.g. several hundred Gbyte of RAM).
- They often operate using time sharing or batch processing (see Chapter 7).

Advantages

- Due to the features listed above, they can be used to do very large jobs which require large memories and very fast processor time.
- They are used in time-sharing systems to allow users to be given a time slice of the very powerful facilities afforded by a mainframe system.
- They are capable of very large number crunching, and so can deal with very complex mathematical functions (e.g. fractals) which would be very time consuming using, for example, a PC.

Disadvantages

- Mainframe computers need to be permanently housed in a large room, so cannot be moved around.
- They are very expensive to operate and maintain.

Give Three Difference Laptop and Desktop PC

Laptop	Desktop PC

TRY YOUR SELF

Arrange the types of computers listed below in the descending order of processing speed
Mainframe computer   PDA   Super computer   Laptop   PC

_____

Name 3 tasks performed by an Operating System.

1._____

2._____

3._____

Define the following and give <u>one</u> example of each:

Hardware_____

_____

Software_____

_____

Peripheral Device_____

_____

Operating System_____

_____

Name <u>two</u> applications where super computer will be most useful.

_____

_____

_____

Name <u>two</u> applications where mainframe computer will be most useful.

_____

_____

Name <u>two</u> ways PDA's can be connected to another computer.

_____

_____

Name the <u>two</u> components of a CPU.

1._____2_____

Complete each sentence below using <u>one</u> item from the list.

    Laptop   **Super Computer** **Mainframe**   **Palmtop**

a) A problem involving quantum mechanical physics or weather forecasting would need a

_____

b) A marketing executive will be making daily report while travelling would use a

_____

c) A stroke recognition software will be used to input data in a

_____

d) A sever in a very large computer network of a University would be a

_____

Fill in blanks by selecting correct options from the list given below:

operating system	multitasking	high level language	command-line
GUI	interpreted	application package	translator

a) User interface of an Operating System could be either

_____ or _____

b) A program written in high level programming language has to be either

_____ or _____

c) Ability of a computer to run more than two applications simultaneously is known as

_____

d) Word processors, spreadsheet software and graphics packages are example of

_____

e) System software consists of

_____ and _____

Name <u>two</u> utility packages installed in your computer at home.

1 _____2_____

Explain why laptop computers have increased in popularity over the last few years.

_____

_____

_____

_____

Explain why PDAs are so popular and identify three things that a PDA could be used

_____

_____

_____

_____

Explain what the term 'embedded computer' means

_____

_____

What is a 'Motherboard'? Name four devices which are attached to the Motherboard

_____

_____

_____

_____

Are the following statements true or false?

a. The CPU controls all other parts of the computer   ....

b. RAM is used for storing the start-up instructions on the computer   ....

c. Cache memory is faster to access than RAM   ....