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.
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System Software Vs. Application Software

<table>
<thead>
<tr>
<th>SYSTEM SOFTWARE</th>
<th>APPLICATION SOFTWARE</th>
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<tbody>
<tr>
<td>Enable the computer to function</td>
<td>Usage</td>
</tr>
<tr>
<td></td>
<td>Enable user to work efficiently with documentation</td>
</tr>
<tr>
<td>COMPULSORY</td>
<td>Need</td>
</tr>
<tr>
<td></td>
<td>OPTIONAL-depends on usage and needs</td>
</tr>
<tr>
<td>Each computer need one system system software</td>
<td>Number Software</td>
</tr>
<tr>
<td></td>
<td>Each computer can have more than one application</td>
</tr>
<tr>
<td>Independent – can use without application software</td>
<td>Dependency</td>
</tr>
<tr>
<td></td>
<td>Dependent – application software cannot work without Application software</td>
</tr>
<tr>
<td>Provide environment in which the application run</td>
<td>Function</td>
</tr>
<tr>
<td></td>
<td>Provides the environment to enable user to accomplish specific task</td>
</tr>
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Hardware Vs. Software

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

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 ______________.

<table>
<thead>
<tr>
<th>KEYBOARD</th>
<th>STORES</th>
<th>OPERATE</th>
<th>TOUCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARDWARE</td>
<td>PROGRAMS</td>
<td>COMPUTER</td>
<td>MONITOR</td>
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</table>
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 consists of main components 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.
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 size is measured in kilobytes (KB or K), megabytes (MB), gigabytes (GB), or terabytes (TB)

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Approximate Number of Bytes</th>
<th>Exact Number of Bytes</th>
<th>Approximate Number of Pages of Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilobyte</td>
<td>KB or K</td>
<td>1 thousand</td>
<td>1,024</td>
<td>1/2</td>
</tr>
<tr>
<td>Megabyte</td>
<td>MB</td>
<td>1 million</td>
<td>1,048,576</td>
<td>500</td>
</tr>
<tr>
<td>Gigabyte</td>
<td>GB</td>
<td>1 billion</td>
<td>1,073,741,824</td>
<td>500,000</td>
</tr>
<tr>
<td>Terabyte</td>
<td>TB</td>
<td>1 trillion</td>
<td>1,099,511,627,776</td>
<td>500,000,000</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>RAM</th>
<th>ROM</th>
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</table>
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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, Windows 7, 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**

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<tr>
<th>Laptop</th>
<th>Desktop PC</th>
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</table>
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 one example of each:

Hardware ______________________________________________________
_______________________________________________________________

Software ______________________________________________________
_______________________________________________________________

Peripheral Device ______________________________________________
_______________________________________________________________

Operating System ______________________________________________
_______________________________________________________________

Name two applications where super computer will be most useful.

________________________________________________________________________
________________________________________________________________________

Name two applications where mainframe computer will be most useful.

________________________________________________________________________
________________________________________________________________________
Name **two** ways PDA’s can be connected to another computer.


Name the **two** components of a CPU.
1. ___________________________ 2 ___________________________

Complete each sentence below using **one** 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 two 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 for.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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 ..............................