1. Computer is a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It has the ability to accept data, process it, and then produce outputs.

Computers can also store data for later uses in appropriate storage devices, and retrieve whenever it is necessary.

Modern computers are electronic devices used for a variety of purposes ranging from browsing the web, writing documents, editing videos, creating applications, playing video games etc.

They are designed to execute applications and provide a variety of solutions by combining integrated and software components.

Computer organization refers to the level of abstraction above the digital logical level, but below the operating system level.

Computer organization consists of following parts; -

1.CPU – central processing unit

2.Memory

3.Input devices

4.Output devices

CPU – central processing unit

It is alternatively referred to as the brain of the computer, processor, central processor, or microprocessor, the CPU was first developed at the intel with the help of Ted Hoff in the early 1970’s and is short for central processing unit. /The computer CPU is responsible for handling all instructions it receives from hardware and software running on the computer.

CPU is considered the brain od the computer. CPU performs all types of data processing operations. It stores data intermediate results and instructions. It controls the operation of all parts of computer.

CPU itself has following three components;

. ALU (Arithmetic Logic unit)

All arithmetic calculations and logical operation are performed using the Arithmetic /logical Unit or ALU.

Memory unit

A memory is just like a human brain. It is used to store data and instruction. Computer memory is use to stores information being processed by the CPU.

Control unit

Control unit help to perform operations of input, output unit, Memory unit and ALU in a sequence.

Memory

Computer memory is any physical device capable of storing information temporarily or permanently. for example, Random Access memory is a type of volatile memory that is stores information on an integrated circuit, and that is used by the operating system, software, hardware, or the user.

Input devices

A device that can be used to insert data into a computer system is called as input device. It allows people to supply information to computers. An input device is any hardware device that sends data to the computer, without any input devices, a computer would only be a display device and not allow users to interact with it, much like a TV.

Output devices

A device which is used to display from a computer is called as output device. It allows people to receive information from computers. An output device is any peripheral that receives or displays output from a computer.

(2). Classification of computer

The computer systems can be classified on the following basis;

1. On the basis of size
2. On the basis of functionality
3. On the basis of data handling

Classification on the basis of size

Super computer: The super computers are the highest performing system. A supercomputer is a computer with a high level of performance compared to a general – purpose computer. The actual Performance of a super computer is measured in FLOPS instead of MIPS. All of the world’s fastest 500 supercomputer run Linux- based operating system. Additional research is being conducted in China, the US, the EU, Taiwan and Japan to build even more technologically superior supercomputers. Supercomputers actually play role in the field of computation and are used for intensive computation and are used for intensive computation tasks in various fields, including quantum mechanics, weather forecasting, climate research, oil and gas exploitation.

1. Main frame computers – these are commonly called as big iron , they are usually used by big organization for big bulk data processing such as statistics , census data processing and are widely used as the server as these systems has a higher processing capability as compared to the other classes of computers , most of these mainframe architecture were established in 1960’s , the research and development worked continuously over the years and the main frame of the today are far more beeper than earlier ones , in size , capacity and efficiency .
2. Mini computers - these computers came into the market in mid 1960s and were sold at much cheaper price than the main frames, they were actually designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping, later they became very popular for personal uses with evolution.
3. Microcomputers: A microcomputer is a small, relatively inexpensive computer with a microprocessor, memory, and minimal I/O circuitry mounted on the single printed circuit board. The previous to these computers, mainframes and minicomputers, were comparatively much larger, hard to maintain and more expensive., they actually formed the foundation for present day microcomputers and smart gadget that we use in day-to-day life.

Classification on the basis of functionality:

* Server: Servers are nothing but dedicated computer which are set-up to offer some services to the clients.
* Workstation: Those are the computers designed to primarily to be used by single user at the time. They run multi-user operating systems.
* Information Appliances: They are ethe computing devices which are used in other machines to serve limited set of tasks like basic calculations, playing multimedia, browsing internet etc. They are generally referred as the mobile devices.
* Embedded computers: They are the computing devices which are used in other machines to serve limited set of requirements. they follow instructions from non-volatile memory and they are not required to execute reboot or rest.

Classification on the basis of data handling

1.Analog: An analog computer is a form of computer that uses the continuously changeable aspects of physical fact such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system of “0” and”1”, “computer capable of solving problems by processing information expressed in the discrete form.

Hybrid - A computer that process both analog and digital data, hybrid computer is a digital computer that accepts analog signal converts them to digital and processes them in digital form.

1. Random Access Memory is a type of computer memory that is used to temporarily store data that the computer is currently using or processing. RAM is volatile memory, which means that the data stored initially is lost when the power is turned off. RAM is typically used to store the operating system, application programs, and data that the computer is currently using.

Read only memory is a type of computer memory that is used to permanently store data that does not need to be modified. ROM is non – volatile memory, which means that the data stored in it is retained even when the power is turned off. ROM is typically used to store the computer’s BIOS, which contains the instructions for booting the computer, as well as firmware for other hardware devices.

Types of memory

Memory is the most essential element of a computing system because without its computer can’t perform simple tasks. Both types of memory are important for the computer, but they serve different purposes. RAM is used to store data that the computer needs to boot and operate. RAM is used to store data that the computer needs to boot and operate. RAM is faster than ROM, as it can be accessed and modifier in any order, while data can be stored in ROM can only be read.

Computer memory is of two basic types:

1. Primary memory (RAM and ROM)
2. Secondary memory (Hard drive, CD, etc.)

Random Access Memory (RAM)

* It is also called read-write memory or the main memory or primary memory.
* The programs and data that the CPU requires during the execution of a program are stored in this memory.
* It is a volatile memory as the data is lost when the power is turned off.

Types of Random Access Memory (RAM)

1.Static Ram: SRAM stands for the Static Read Only Memory. It is made up of Capacitors and has smaller life span than Static Ram.

2. Dynamic Ram: DRAM stands for the Dynamic Read Only Memory. It is made up of Capacitors and has smaller data life span than static RAM.

Read Only – Memory (ROM)

* Stores crucial information essential to operate the system, like the program essential to boot the computer.
* It is non-volatile.
* Always retains its data.
* Used in embedded systems or where the programming needs no change.
* Used in calculators and peripheral devices.
* ROM is further classified into four types – MROM, PROM, EPROM, and EPROM.

Types of ROM:

* PROM – It can be programmed by the user. Once programmed, the data and instructions in it cannot be changed.
* EPROM - it can be reprogrammed to erase data from it, expose it to ultraviolet light. To reprogram it, erase all the previous data.
* EEPROM – The data can be erased by applying an electric field, with no need for ultraviolet. We can erase only portions of the chip.
* MROM: Mask ROM is a kind of read only memory, that is masked off at the time of production.

1. Software testing can be stated as the process of verifying and validating whether a software or application is bug-free, meets the technical requirements as guided by its design and development, and meets the user requirements effectively and efficiently by handling all the exceptional and boundary cases.

The process of software testing aims not only at finding faults in the existing software but also at finding measure to improve the software in terms of efficiency, accuracy, and usability. It has mainly aimed at the measuring the specification, functionality, and performance of a software program or application.

Software testing can be divided into two steps;

* Verification – It refers to the set of tasks that ensure that the software correctly implements a specific function.
* Validation - It refers to a different set of tasks that ensure that the software that has been built in traceable to customer requirements.

Different types of Software testing;

Software Testing can be classified into two types;

* Manual Testing: Manual testing includes testing software manually. In this type, the tester takes over the role of an end-user and tests the software to identify any unexpected behavior or bug. These are different stages for manual testing such as unit testing, integrating testing, system testing, and user acceptance testing.

Testers use test plans, test cases, or test scenarios to test software to ensure the completeness of testing.

* Automation Testing: Automation testing, which is also known as Test Automation, is when the tester writes scripts and uses another software to test the product. This process involves the automation of a manual process. Automation Testing is used to re-run the test scenarios quickly and repeatedly, that were performed manually in manual testing.

Different types of Software Testing Techniques;

* . Black Box Testing: The technique of testing in which the tester doesn’t have the access to the source code of the software and is conducted at the software interface without any concern with the internal logical structure of the software.
* white-Box Testing: The technique of testing in which the tester is aware of the internal workings of the product, has access to its source code, and is conducted by making sure that all internal operations are performed according to the specifications.

Different levels of software testing;

* Unit Testing: A level of the software testing process where individual units are combined and tested as a group. The purpose of this level of testing is to expose faults in the interaction between integrated units.
* Integration Testing: A level of the software testing process where a complete, integrated system/software is tested. The purpose of this test is to evaluate the system’s compliance with the specified requirements.
* Acceptance Testing: A level of the software testing process where a system is tested for acceptability. the purpose of this test is to evaluate the system’s compliance with the business requirements and assess whether it is acceptable for delivery.

1. Operating System lies in the category of system software. It basically manages all the resources of the computer. An operating system acts as an interface between the software and different parts of the computer or the computer hardware. The operating system is designed in such a way that it can manage the overall resources and operations of the computer.

Operating System is a fully integrated set of specialized programs that handle all the operations of the computer. It controls and monitors the execution of all other programs that reside in the computer, which also includes application programs and other system software of the computer. Examples of Operating Systems are Windows, Linux, Mac OS, etc.

An Operating System (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is the most important type of system software in a computer system.

Why Use an Operating System?

The operating system helps in improving the computer software as well as hardware. Without OS, it became very difficult for any application to be user-friendly. Operating System provides a user with an interface that makes any application attractive and user-friendly. The operating System comes with a large number of device drivers that makes OS services reachable to the hardware environment. Each and every application present in the system requires the Operating System. The operating system works as a communication channel between system hardware and system software. The operating system helps interact an application with the hardware part without knowing about the actual hardware configuration. It is one of the most important parts of the system and hence it is present in every device, whether large or small device.

Functions of the Operating System

* Resource Management: The operating system manages and allocates memory, CPU time, and other hardware resources among the various programs and processes running on the computer.
* Process Management: The operating system is responsible for starting, stopping, and managing processes and programs. It also controls the scheduling of processes and allocates resources to them.
* Memory Management: The operating system manages the computer’s primary memory and provides mechanisms for optimizing memory usage.
* Security: The operating system provides a secure environment for the user, applications, and data by implementing security policies and mechanisms such as access controls and encryption.
* Job Accounting: It keeps track of time and resources used by various jobs or users.
* File Management: The operating system is responsible for organizing and managing the file system, including the creation, deletion, and manipulation of files and directories.
* Device Management: The operating system manages input/output devices such as printers, keyboards, mice, and displays. It provides the necessary drivers and interfaces to enable communication between the devices and the computer.
* Networking: The operating system provides networking capabilities such as establishing and managing network connections, handling network protocols, and sharing resources such as printers and files over a network.
* User Interface: The operating system provides a user interface that enables users to interact with the computer system. This can be a user interface, Command line interface.

Objectives of Operating System: -

* Convenient to use: One of the objectives is to make the computer system more convenient to use in an efficient manner.
* User Friendly: To make the computer system more interactive with a more convenient interface for the users.
* Easy Access: To provide easy access to users for using resources by acting as an intermediary between the hardware and its users.
* Management of Resources: For managing the resources of a computer in a better and faster way.
* Controls and Monitoring: By keeping track of who is using which resource, granting resource requests, and mediating conflicting requests from different programs and users.

Types of Operating System: -

* Batch Operating System: A Batch operating system is a type of operating system that does not interact with the computer directly. There is an operator who takes similar jobs having the same requirements and groups them into batches.

Time-sharing Operating System: Time sharing Operating System is a type of operating system that allows many users to share computer resources (maximum utilization of the resources).

* Distributed Operating System: Distributed Operating System is a type of operating system that manages a group of different computers and makes appear to be a single computer. These operating systems are designed to operate on a network of computers. They allow multiple users to access shared resources and communicate with each other over the network. Examples include Microsoft Windows Server and various distributions of Linux designed for servers.

Types of Operating System: -

* Network Operating System: Network Operating System is a type of operating system that runs on a server and provides the capability to manage data, users, groups, security, applications, and other networking functions.
* Real-time Operating System: is a type of operating system that serves a real-time system and the time interval required to process and respond to inputs is very small. These operating systems are designed to respond to events in real time. They are used in applications that require quick and deterministic responses, such as embedded systems, industrial control systems, and robotics.
* Multiprocessing Operating System: Multiprocessing are used in operating systems to boost the performance of multiple CPUs within a single computer system. Multiple CPUs are linked together so that a job can be divided and executed more quickly.
* Single-User Operating Systems: Single-User Operating Systems are designed to support a single user at a time. Examples include Microsoft Windows for personal computers and Apple macOS.
* Multi-User Operating Systems: Multi-User Operating System are designed to support multiple users simultaneously. Examples include Linux and Unix.
* Embedded Operating Systems: Embedded Operating System are designed to run on devices with limited resources, such as smartphones, wearable devices, and household appliances. Examples include Google’s Android and Apple’s iOS.
* Cluster Operating Systems: Cluster Operating Systems are designed to run on a group of computers, or a cluster, to work together as a single system. They are used for high-performance computing and for applications that require high availability and reliability. Examples include Rocks Cluster Distribution and Open MPI.

Examples of Operating System: -

* Windows (GUI-based, PC)
* GNU/Linux (Personal, Workstations, ISP, File, and print server, Three-tier client/Server)
* macOS (Macintosh), used for Apple’s personal computers and workstations (MacBook, iMac).
* Android (Google’s Operating System for smartphones/tablets/smartwatches)
* iOS (Apple’s OS for iPhone, iPad, and iPod Touch)

(6). OSI stands for **Open Systems Interconnection**. It has been developed by ISO – ‘**International Organization for Standardization** ‘, in the year 1984. It is a 7-layer architecture with each layer having specific functionality to perform. All these 7 layers work collaboratively to transmit the data from one person to another across the globe.

The OSI model is composed of seven ordered layers;

* Layer 1- The Physical Layer
* Layer 2- The Data Link Layer
* Layer 3- The Network Layer
* Layer 4- The Transport Layer
* Layer 5- The Session Layer
* Layer 6- The Presentation Layer
* Layer 7- The Application Layer

Layers of OSI model

* Physical Layer – This layer manages the functions required to carry a bit stream over a physical medium. It deals with the electrical and mechanical specifications of the interface and transmission medium. It defines the procedures and functions that physical devices and interface have to perform for transmission to occur.
* Data Link Layer - This layer transforms the physical layer, a raw transmission facility, to a reliable link. It makes the physical layer appear error- free to upper layer. It is also responsible for other functions such as framing, error control, flow control, physical addressing and access control mechanism.
* Network Layer - This layer is responsible for the source- to-destinations delivery of a packet, possibly across multiple networks. The Data Link layer overseas the delivery of the packet between two system on the same network. The network layer ensures that each packet gets from its point of origin to its final destination. If two systems are attached to the same link, there is no need for the network layer. However, if the two systems are attached to different networks with connecting devices between the networks. there is often a need for the network layer to accomplish source to destination delivery. Other responsibilities of the Network layer include logical addressing, and routing

* Transport Layer – This layer is accountable for process-to-process delivery of the entire message. A process is an application program running on the host. The Network layer overseas the source to destination delivery of individual packets. It does not recognize the relationship between those packets. It treats each packet independently, as though each piece belonged to a separate message, whether or not it does, the transport layer, also ensures that the whole message arrives intact and in order, overseeing both error and flow control at the source to destination level.
* Session Layer – This layer acts as the network dialog controller. It establishes, maintains and synchronizes the interaction among communicating systems.
* Presentation Layer – This layer is anxious with the syntax and semantics of the information exchanged between two systems. The specific responsibilities of this layer include translation, Encryption and Compression.
* Application Layer – This layer enables the user, whether human or software to access the network. It provides user interface and support for services such as electronic mail, remote file access and transfer, shared database management, and other types of distributed information services. Specific service offered by the Application layer include: Provision of Network Virtual terminals, File transfer, access and management, mail services, and directory services.

Data transmission in OSI Model: -

The sending process has some data it wants to send to the receiving process. It gives the data to the application layer, which then attaches the application header. AH, to the front of it and gives the resulting to the presentation layer.

The presentation layer may transform this item in various ways, where they are actually transmitted to the receiving machine. On the machine various headers are stripped off one by one as the message propagates up the layer until it finally arrives at the receiving process.

The key data idea throughout is although actual data transmission is vertical, each layer is programmed though it were really horizontal.

Network models: -

Computer networks are created by different entities. Standard are needed so that these heterogeneous networks can communicate with one other. The two best known standards are the OSI model and the Internet model. The OSI model defines a seven -layer network; the internet model defines a five-layer network.

Need of layers in the OSI model:

* The approach of establishing a link between two devices for communicating and sharing information is complex. Generating profitable communication takes many tasks. A network architecture needs to be developed to perform all these functions.
* In network architecture, various tasks and functions are classified into related and manageable sets called LAYERS. Network architecture can be defined as a set of protocols that describe how each layer functions. Protocols are hidden in the OSI model and are easily changed as technology changes.
* Intermediate systems require only a few layers and not all layers. Protocol layering enables us to design the system or device to which the consecutive layers are placed. It also allows services to be distinct from implementation.