JK EXAM CRACKER

COMPUTER AWARENESS

FOR JKSSB EXAMS

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CONTENTS

FUNDAMENTALS OF COMPUTER

C – Commonly

O - Oriented

M - Machine

P - Particularly

U - Used

T - for Trade

E - Education

R - and Research

The word **computer** is derived from the word **compute**.

Compute means to calculate. The computer was originally defined as a super fast calculator.

Today's world is an information-rich world and it has become a necessity for everyone to know about computers. **A computer is an electronic data processing device, which accepts and stores data input, processes the data input, and generates the output in a required format.**

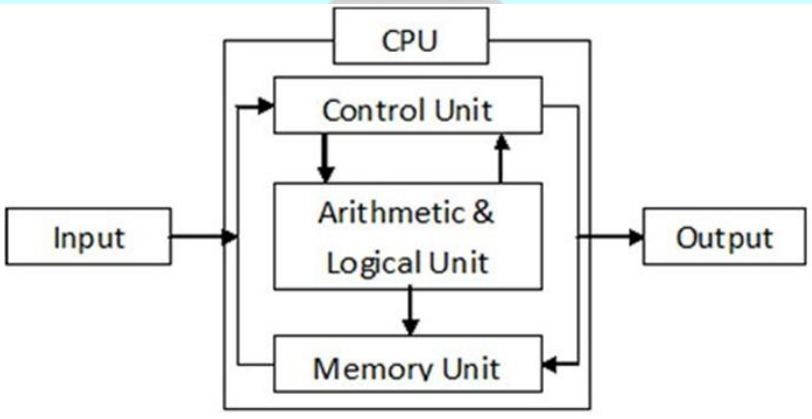


Fig. Block Diagram of Computer

FUNDAMENTALS OF COMPUTER

To know about the working of a computer, first need to understand various terms such as Data, Processing and Information. First of all, lets start with basic terms:-

1. Data : Data is a collection of basic facts and figure without any sequence. This data is also called as raw data. When the data is collected as facts and figures, there is no meaning to it, at that time, for example, name of people, names of employees etc.

2. **Processing** : Processing is the set of instructions given by the user to the related data that was collected earlier to output meaningful information. The computer does the required processing by making the necessary calculations, comparisons and decisions.

3. **Information** : Information is the end point or the final output of any processed work. This meaningful output data is called information.

4. **Program**: The set of instructions given to the computer to perform various operations is called as the computer program.

FUNDAMENTALS OF COMPUTER

COMPONANTS OF COMPUTER

All types of computers follow the same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

Sr. No.	Operation	Description
1	Take Input	The process of entering data and instructions into the computer system.
2	Store Data	Saving data and instructions so that they are available for processing as and when required.
3	Processing Data	Performing arithmetic, and logical operations on data in order to convert them into useful information.
4	Output Information	The process of producing useful information or results for the user, such as a printed report or visual display.
5	Control the workflow	Directs the manner and sequence in which all of the above operations are performed.

Input Unit- This unit contains devices with the help of which we enter data into the computer. This unit creates a link between the user and the computer. The input devices translate the information into a form understandable by the computer.

CPU (Central Processing Unit)- CPU is considered as the brain of the computer. CPU performs all types of data processing operations. It stores data, intermediate results, and instructions (program). It controls the operation of all parts of the computer.

CPU itself has the following three components:

- **ALU (Arithmetic Logic Unit)-** This unit consists of two subsections namely,

1. Arithmetic Section
2. Logic Section

Arithmetic Section- Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division. All complex operations are done by making repetitive use of the above operations.

Logic Section- Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

- **Memory Unit-** This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed. It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM). Its size affects speed, power, and capability. Primary memory and secondary memory are two types of memories in the computer. Functions of the memory unit are –

- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores the final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through the main memory.

- **Control Unit-** This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations.

Functions of this unit are –

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

Output Unit- The output unit consists of devices with the help of which we get the information from the computer. This unit is a link between the computer and the users. Output devices translate the computer's output into a form understandable by the users.

Advantages of Computers

1. High Speed

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the Pico second.
- It can perform millions of calculations in a few seconds as compared to man who will spend many months to perform the same task.

2. Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are 100% error free.
- Computers perform all jobs with 100% accuracy provided that the

input is correct. Storage Capability

3. Memory is a very important characteristic of computers.

- A computer has much more storage capacity than human beings.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio, etc.

4. Diligence

- Unlike human beings, a computer is free from monotony, tiredness, and lack of concentration.
- It can work continuously without any error and boredom.
- It can perform repeated tasks with the same speed and accuracy.

5. Versatility

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.
- This machine can be used to solve the problems related to various fields.
- At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

6. Reliability

- A computer is a reliable machine.
- Modern electronic components have long lives.
- Computers are designed to make maintenance easy.

7. Automation

- Computer is an automatic machine.
- Automation is the ability to perform a given task automatically. Once the computer receives a program i.e., the program is stored in the computer memory, then the program and instruction can control the program execution without human interaction.

8. Reduction in Paper Work and Cost

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up the process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.

Computer Applications.

1. **Banking and Financial company** : Computers are used in bank for electronic money transfer, voucher, ledger, bank sheet, etc. different systems are used in Financial Company such as ATM (Automatic Teller Machine), EFTS (Electronic Fund Transfer System) etc which is computer based systems for customer services provided by banks.
2. **Education** : The computer helps in providing a lot of facilities in the education system. The computer provides a tool in the education system known as CBE (Computer Based Education). CBE involves control, delivery, and evaluation of learning. Computer education is rapidly increasing the graph of number of computer students. It is used to prepare a database about performance of a student and analysis is carried out on this basis.

3. **Healthcare** : Computers have become an important part in hospitals, labs, and dispensaries. They are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, ultrasounds and CT scans, etc. are also done by computerized machines.
4. **Military** : Computers are largely used in defence. Modern tanks, missiles, weapons, etc. Military also employs computerized control systems. Some military areas where a computer has been used are:

- Missile Control
- Military Communication
- Military Operation and Planning
- Smart Weapons

5. **Communication** : Communication is a way to convey a message, an idea, a picture, or speech that is received and understood clearly and correctly by the person for whom it is meant. Some main areas in this category are:

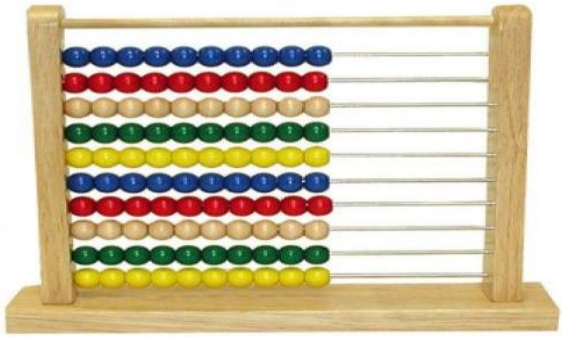
- E-mail
- Chatting
- Usenet
- FTP
- Telnet
- Video-conferencing

6. **Government** : Computers play an important role in government services. Some major fields in this category are:

- Budgets
- Sales tax department
- Income tax department
- Computation of male/female ratio
- Computerization of voters lists
- Computerization of PAN card
- Weather forecasting

EVOLUTION OF COMPUTER

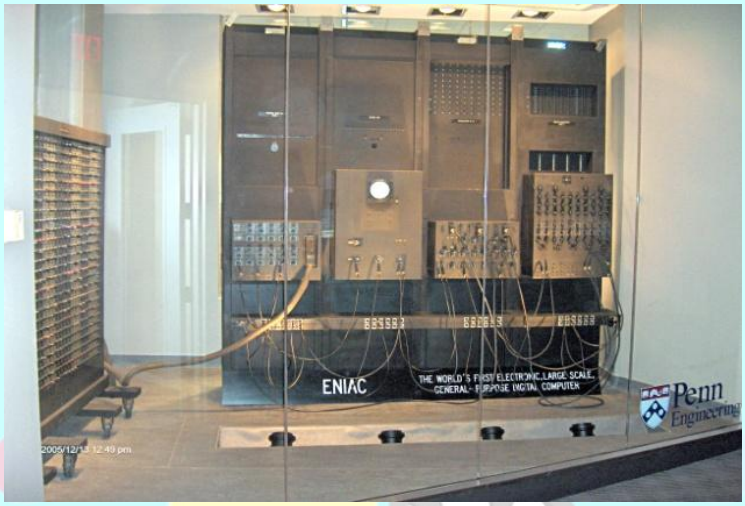
ABACUS- The abacus is one of the earliest known computation devices. It is a tool that helped in calculating answers of arithmetic problems. It is simply a wooden rack holding parallel wires on which beads are strung. Calculations are done by manipulating the beads. The abacus was developed in China about 5000 years ago. The abacus was so successful that its use spread from China to many other countries.



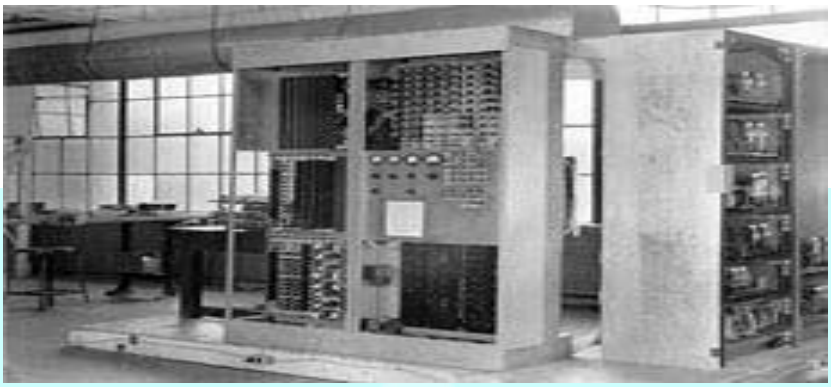
Pascal's calculator called 'Pascaline'- In the year 1642, Blaise Pascal a French scientist invented an adding machine called Pascal's calculator. Though these machines were early forerunners to computer engineering, the calculator failed to be a great commercial success.

Analytical engine or difference engine- Charles Babbage a British mathematician at Cambridge University invented the first analytical engine or difference engine. This machine could be programmed by instructions coded on punch cards and had mechanical memory to store the results. For his contributions in this field Charles Babbage is known as 'the father of modern digital computer.

ENIAC (Electronic Numeric Integrator and Calculator) –In 1944 John Mauchley and J. Presper proposed an electronic digital computer called ENIAC, and completed it in 1946 which is regarded as first successful general digital computer.

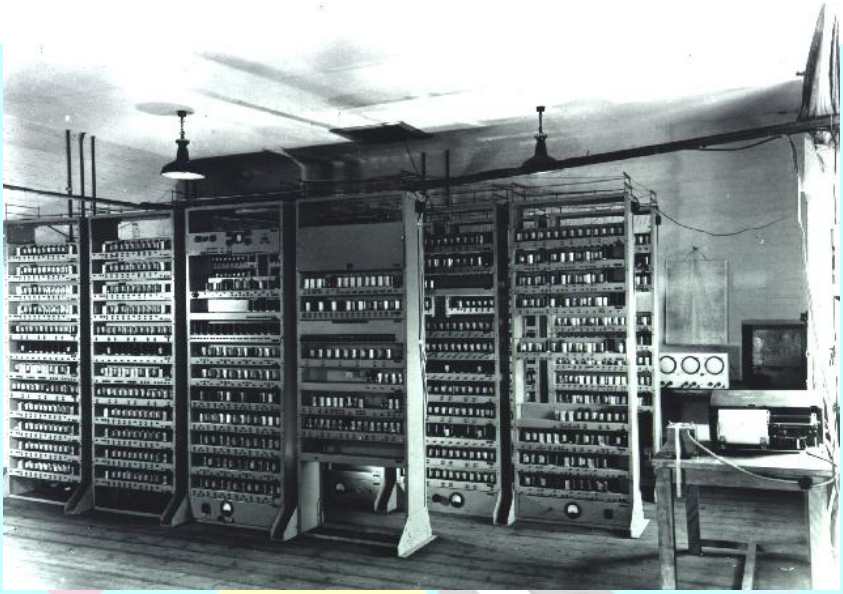


EDVAC(Electronic Discrete Variable Automatic Computer) – In the mid 1940's Dr. John von Neumann designed the Electronic Discrete Variable Automatic Computer with a memory to store both program and data. This was the first machine which used the stored program concept. It had five distinct units - arithmetic, central control, memory, input and output. The key element was the central control. All the functions of the computer were co-ordinate through this single source, the central control. The programming of the computers was done in machine language.



UNIVAC 1 – Remington Rand designed this computer specifically for business data processing applications. The Universal Automatic Computer was the first general purpose commercially available computer.

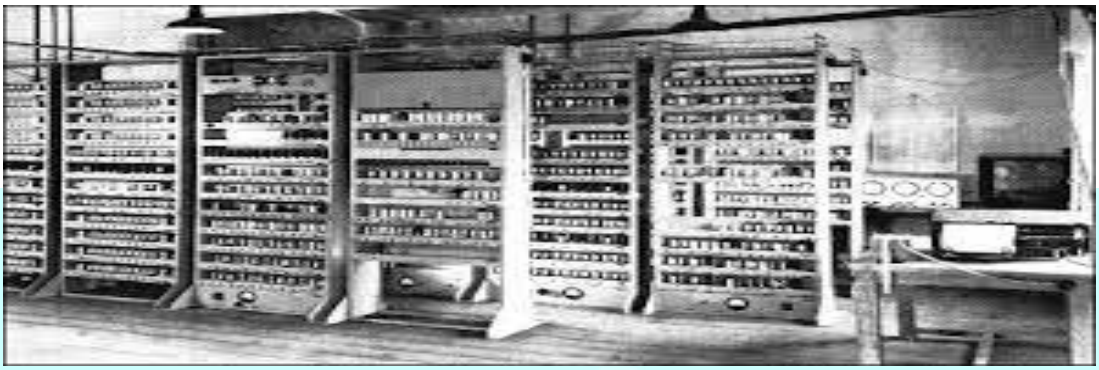
EDSAC(Electronic delay storage automatic computer)- Ist computer capable of storing instructions and data in memory.



GENERATION OF COMPUTER

First Generation Computers - The period of first generation was from 1946-1959. The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit). These tubes, like electric bulbs, produced a lot of heat and the installations used to fuse frequently. Therefore, they were very expensive and only large organizations were able to afford it.

In this generation, mainly batch processing operating system was used. Punch cards, paper tape, and magnetic tape was used as input and output devices. The computers in this generation used machine code as the programming language.



The main features of the first generation are:

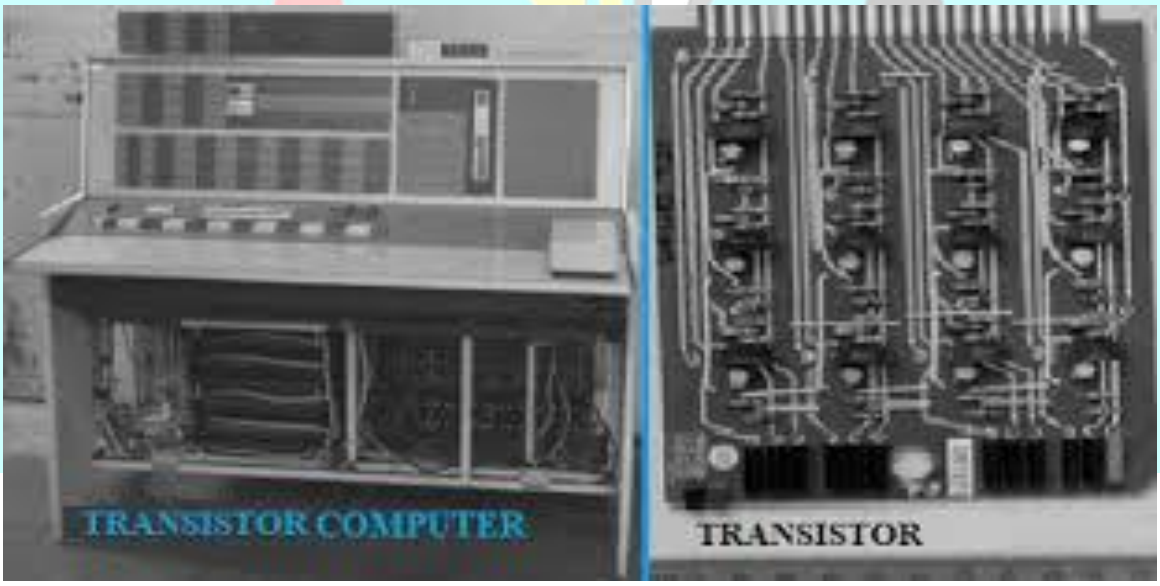
- Vacuum tube technology
- Unreliable
- Supported machine language only
- Very costly
- Generated a lot of heat
- Slow input and output devices
- Huge size
- Need of AC
- Non-portable
- Consumed a lot of electricity

Some computers of this generation were:

- ENIAC

- EDVAC
- UNIVAC
- IBM-701
- IBM-650

Second Generation Computers - The period of second generation was from 1959-1965. In this generation, transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes. In this generation, magnetic cores were used as the primary memory and magnetic tape and magnetic disks as secondary storage devices. In this generation, assembly language and high-level programming languages like FORTRAN, COBOL were used. The computers used batch processing and multiprogramming operating system.



The main features of second generation are:

- Use of transistors
- Reliable in comparison to first generation computers
- Smaller size as compared to first generation computers
- Generated less heat as compared to first generation computers
- Consumed less electricity as compared to first generation computers
- Faster than first generation computers
- Still very costly
- AC required
- Supported machine and assembly languages

Some computers of this generation were:

- IBM 1620
- IBM 7094
- CDC 1604
- CDC 3600
- UNIVAC 1108

Third Generation Computers - The period of third generation was from 1965-1971. The computers of third generation used Integrated Circuits (ICs) in place of transistors. A single IC has many transistors, resistors, and capacitors along with the associated circuitry. The IC was invented by Jack Kilby. This development made computers smaller in size, reliable, and efficient. In this generation remote processing, time-sharing, multi-programming operating system were used. High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation.

The main features of third generation are:

- IC used
- More reliable in comparison to previous two generations
- Smaller size
- Generated less heat
- Faster
- Lesser maintenance

- Costly
- AC required
- Consumed lesser electricity
- Supported high-level language

Some computers of this generation were:

- IBM-360 series
- Honeywell-6000 series
- PDP (Personal Data Processor)
- IBM-370/168
- TDC-316

Fourth Generation Computers

The period of fourth generation was from 1971-1980. Computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements with their associated circuits on a single chip made it possible to have microcomputers of fourth generation.

Fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to Personal Computer (PC) revolution. In this generation, time sharing, real time networks, distributed operating system were used. All the high-level languages like C, C++, DBASE etc., were used in this generation.

The main features of fourth generation are:

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PCs
- Very small size
- Pipeline processing
- No AC required
- Concept of internet was introduced
- Great developments in the fields of networks
- Computers became easily available

Some computers of this generation were:

- DEC 10
- STAR 1000
- PDP 11
- CRAY-1(Super Computer)
- CRAY-X-MP(Super Computer)

Fifth Generation Computers

The period of fifth generation is 1980-till date. In the fifth generation, VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence)software. AI is an emerging branch in computer science, which interprets the means and method of making computers think like human beings. All the high-level languages like C and C++, Java, .Net etc., are used in this generation.

AI includes:

- Robotics

- Neural Networks
- Game Playing
- Development of expert systems to make decisions in real-life situations
- Natural language understanding and generation

The main features of fifth generation are:

- ULSI technology
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology
- More user-friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates

Some computer types of this generation are:

- Desktop
- Laptop
- NoteBook
- UltraBook
- ChromeBook

FUNDAMENTALS OF COMPUTER

TYPES OF COMPUTER

There are three major categories based on which computers can be classified. These are:

1. Based on Size
2. Based on Purpose
3. Based on Types

Types of Computer-Based on Types

The three types of computers along with their functions are given below:

- **Analog Computer** – An analog computer one that uses the continuously changeable aspects of physical phenomena to model the problem being solved. These phenomena may be such as electrical, mechanical, or hydraulic quantities and they are extremely complex to be used. Such computers are mostly used for scientific and industrial applications. Examples of Analog computers include Thermometer, Operational Amplifiers, Electric Integrators, etc.

- **Digital Computer** – Such computers are capable of solving problems in discrete format. It only operates on data entered in binary language and can perform the dynamic function of managing large amounts of data and regulating the operations of the machine, Examples of Digital computers are Desktop, Laptop, Mobile Phones, etc.

- **Hybrid Computer** – Computers that exhibit features of both Analog and Digital computers are called Hybrid Computers. The logical operations are solved by the digital aspects and the differential equations

are solved using the analog features. Few important examples of Hybrid Computers include Space Flights, Food processing Plants, etc.

Types of Computers – Based on Size

Described below are the four types of Computers based on their sizes along with their functions:

- **Micro Computers** – A relatively inexpensive and small computer comprising a microprocessor and a Central Processing Unit (CPU) is called a Microcomputer. Such computers are made with minimal circuitry mounting over a single circuit board. Examples include Desktop, Laptop, etc.

- **Mini Computer** – Developed in the mid-1960s, Mini computers are comparatively smaller than mainframe computers. They were developed keeping in consideration human interaction, control instrumentation and were cost-effective. For example Smartphones, iPads, etc.

- **Mainframe Computer** – Computers used by large Organisations to manage bulk data are called Mainframe computers. Main functions of such type include managing customer statistics, census and other heavy data in a single device. For example, the system used at Trading companies.

- **Super Computer** – Supercomputers are the biggest and fastest computers. They are designed to process huge amount of data. A supercomputer can process trillions of instructions in a second. It has thousands of interconnected processors.

Supercomputers are particularly used in scientific and engineering applications such as weather forecasting, scientific simulations, Quantum Mechanics, Climate research and nuclear energy research.

- **Param Shivay**, the India's first supercomputer assembled indigenously, was installed in IIT (BHU), followed by Param Shakti and Param Brahma at IIT-Kharagpur and IISER, Pune, respectively. **Bhatkar** is best known as the architect of India's national initiative in supercomputing where he led the development of Param supercomputers. He developed the first Indian supercomputer, the PARAM 8000, in 1991 and later the PARAM 10000 in 1998.

- **Vijay Pandurang Bhatkar**, a technocrat is considered the father of the Indian Supercomputer.

- **The CDC 6600, released in 1964, is generally considered the first supercomputer, designed by Seymour Cray who is considered the father of Super Computer.**
- **Arm-powered Fugaku, in Kobe, Japan, is the the world's fastest supercomputer as of November 2020.**

Types of Computer – By Purpose

On the basis of purpose, there are just two variety of computers. Those two varieties have been discussed in detail below:

- **General Purpose** – Based on General Purpose, there are these following functions which a device is expected to perform:

1. Basic Input/Output functions
2. Calculations
3. Data Saving on a smaller scale
4. General performing activities

These may include basic calculators, laptops, desktop computers, mobile phones, etc., which can help people with their basic necessary functions are included in the General Purpose computer type.

- **Special Purpose** – When a computer is designed specifically to perform a certain function, such type of computers are known as Special Purpose computer. These types may include:

1. Thermometers to test temperature
2. Generators to manage electricity
3. Devices used for analysing Climate Change
4. Large computers for IT Companies
5. Machines used at Manufacturing Units and the list goes on and on

COMPUTER HARDWARE

COMPUTER HARDWARE

Abbreviated as HW, hardware is best described as any physical component of a computer system that contains a circuit board, ICs, or other electronics. A perfect example of hardware is the screen on which you are viewing this page. Whether it be a monitor, tablet, or Smartphone, it is hardware.

External hardware

Below is a list of external hardware or hardware found outside a computer.

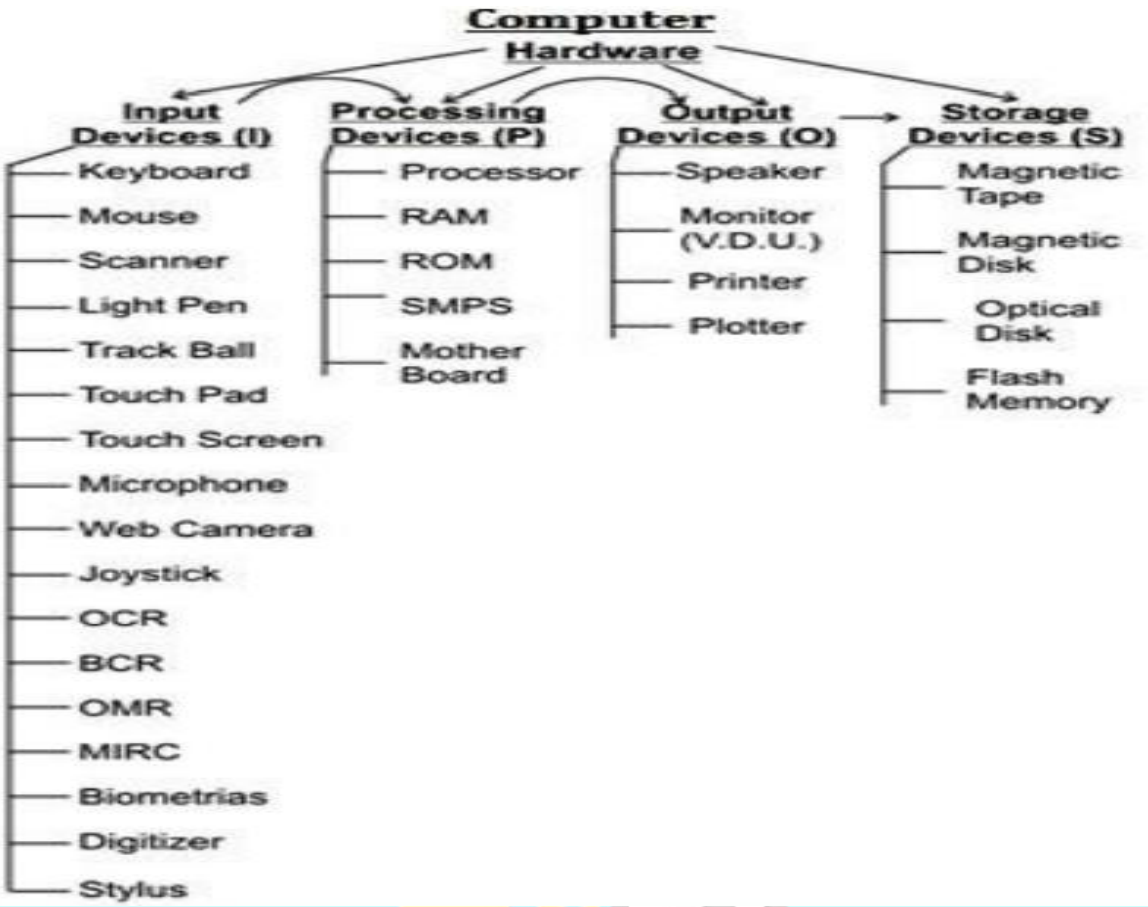
- Flat-panel, monitor, and LCD
- Gamepad
- Joystick
- Keyboard
- Microphone
- Mouse
- Printer
- Projector
- Scanner
- Speakers
- USB thumb drive

Internal hardware

Below is a list of internal hardware or hardware found inside a computer.

1. CPU (central processing unit).
2. Drive (e.g., Blu-ray, CD-ROM, DVD, floppy drive, hard drive, and SSD).
3. Fan (heat sink)
4. Modem
5. Motherboard
6. Network card
7. Power supply
8. RAM
9. Sound card
10. Video card

COMPUTER HARDWARE



INPUT DEVICES- An input device is a piece of hardware used to provide data to a computer used for interaction and control. It allows input of raw data to the computer for processing.

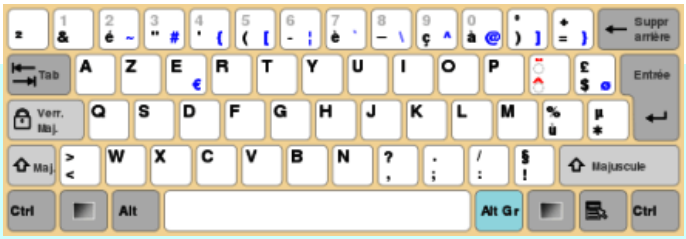
Here's a list of some input devices used in computers and other computing devices:

KEYBOARD- A keyboard is a typewriter-style device, which uses an arrangement of buttons or keys, to act as mechanical levers or electronic switches. Most of the commonly available personal computers have a keyboard, popularly known as Qwerty. Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

Types of keyboards: There can be different types of keyboards based on the region and language used. Some of the common types of keyboards are as follows:

i) QWERTY Keyboard: It is the most commonly used keyboard with computers in modern times. It is named after the first six letters of the top row of buttons and is even popular in countries that do not use Latin-based alphabet. It is so popular that some people think that it is the only type of keyboard to use with computers as an input device.

ii) AZERTY Keyboard: It is considered the standard French keyboard. It is developed in France as an alternative layout to the QWERTY layout and is mainly used in France and other European countries. Some countries have manufactured their own versions of AZERTY.



iii) DVORAK Keyboard: This type of keyboard layout was developed to increase the typing speed by reducing the finger movement while typing. The most frequently used letters are kept in a home row to improve typing.

TYPES OF KEYS ON KEYBOARD

Typing (alphanumeric) keys- These keys include the same letter, number, punctuation, and symbol keys found on a traditional typewriter.i.e; A-Z.0-9.

Modifier / Combination keys-A Modifier key is a special key (or combination) on a computer keyboard that temporarily modifies the normal action of another key when pressed together. By themselves, modifier keys usually do nothing; that is, pressing any of the Shift, Alt, or Ctrl keys alone does not (generally) trigger any action from the computer.

Function keys- The function keys are used to perform specific tasks. They are labeled as F1, F2, F3, and so on, up to F12. The functionality of these keys differs from program to program.

COMPUTER HARDWARE

Key	Function	Description
F1	Help	Displays field level help messages
F2	List	Lists the Codes to be used in a particular field
F3	Quit / Exit	Takes the user to where he started. This can be used to abandon incorrect data before accepting it and also to go back to the previous menu
F4	Accept	
F5	Background Menu	
F6	Next Block (Next Page)	To go to next page / next block depending upon the screen
F8	Copy record	It copied record of one field to another same type of field for faster work
F9	View Signatures	To access specimen signatures (Alt+F4 to close)
F10	Commit	To conclude transactions and once this key is pressed, related data is written into the database
F11	Validates	It checks the data & takes the user to Next Field
F12	Previous Block / Page	To come back to previous page / block depending on the screen

Toggle keys- 'Caps lock' and 'Num lock' keys are called as Toggle Keys because when pressed, they change their status from one state to another

Control keys- These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).

Special Purpose Keys- Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

- **Windows** key is a four pane key that helps you open any program and applications
- **ESC Key** is used to interrupt or cancel the current process
- **F1 through F12** Keys are the function keys that has various uses
- **Tab Key** helps to begin a line of text
- **Caps Lock** Key enables or disables the letter in uppercase
- **Shift Key** helps a user to type a single uppercase letter
- **Ctrl Key** is used in keyboard shortcut key
- **Fn Key** is used for performing special functions like brightness, contrast, switching
- **Spacebar key** is used for creating empty space to separate words
- **Arrows Key** with up, down, left and right buttons
- **Backspace key** is similar to delete key for removing texts in a word
- **Delete key** is used to remove text, file or other objects from system
- **Enter key** is used to send the cursor to next line
- **Insert key** toggles how text is inserted
- **Break key** enables the user to break a computer from pause or other halted state
- **Prt Sc** key helps you to take screenshot on your monitor
- **Home key** returns to beginning of line, document, page or screen

- **Page up key** helps to move up one page which is currently viewed
- **Page down key** helps you move down the currently viewed page
- **End key** moves the cursor to end of line, document or screen
- **Num lock** key enables and disables the numeric keypad.

Pointing Devices:

An input device used to control a pointer on the screen is called a pointing device. A pointer is a small symbol that appears on the screen in a graphical user interface. Different shapes of a pointer are available.

1. **Mouse** : Mouse is a cursor-control device . It is a pointing and drop device. It's size is good enough to fit the palm. It has a palm size box with a round ball at its base .It senses the movement of mouse and sends corresponding signals to CPU on pressing of the buttons. There are two buttons that provide the left click and the right click. A scroll bar is present in the mid .Mouse is only used to control the position of cursor on screen. The first computer mouse was invented by DouglasEngelbart.

Different types of a mouse are as follows:

Mechanical mouse- Mechanical mouse encloses a rubber or metal ball in it. The movement of the cursor depends on the movement of the ball. This mouse is normally used on a mouse pad. A mouse pad is a small pad made of rubber or foam to provide easy movement for the mouse. It also protects the mouse from dust and dirt.

Optical Mouse-Optical mouse contains no ball inside it. It uses a device that emits light to detect the mouse movement. Optical sensor or laser is used in these types of mouse. Furthermore, It is more costly than a mechanical mouse.

Wireless Mouse-A wireless or cordless mouse is a type of mouse that does not require a wire to work. It transmits data using wireless technology like radio waves or infrared light waves.

COMPUTER HARDWARE

The five action that you can perform with a mouse are the

- **POINTING- To locate any object on screen.**
- **CLICKING- To select an item on screen.**
- **DOUBLE CLICKING- To open a program or document.**
- **RIGHT CLICKING- Displays list of commands on screen.**
- **DRAGGING- To move an item on the screen.**

2. **Trackball-** A trackball can also be used as an alternative to a mouse. This device also has buttons similar to those on a mouse. It holds a large moving ball on the top. The body of the trackball is not moved. The ball is rolled with fingers. The position of the cursor on the screen is controlled by rotating the ball.

The main benefit of the trackball over a mouse is that it takes less space to move. The trackball is often included in laptop computers. The standard desktop computer also uses a trackball operated as a separate input device. It is used in CAD, CAM, workstations, Large trackballs are sometimes seen on computerized special-purpose workstations, such as the radar consoles in an air traffic control room, or sonar equipment on a ship or submarine.

3. Touchpad/ Trackpad- A touchpad is a small, plane surface over which the user moves his finger. The user controls the movement of the cursor on the screen by moving his fingers on the touchpad. It is also known as a trackpad.
A touchpad also has one or more buttons near it. These button work like mouse buttons. Touchpads are commonly used with notebook computers.

4. **Graphics Tablet-** A graphics tablet consists of a flat pad on which the user draws with a special pen called a stylus. The image is created on the screen as the user draws on the pad. A designer can produce very accurate drawings using a graphics tablet. It is also called a digitizer.

5. **Touch screen**- The touch screen is a video display screen that receives input from the touch of a finger. The screen is covered with a plastic layer. There are undetectable beams of infrared light at the back of the screen. In order to enter data, the user touches icons or menus on the screen. Most touch screen computer use sensors to detect the touch of a finger.

6. **Light Pen**- A light pen is a hand-held pen-like device. It is light- sensitive stylus. Light pen is connected by a wire to the computer. It has a device at the tip that emits light. The pen sends information to the computer when a user touches the pen on certain areas of a specially designed screen. A light pen I usually used by engineers, graphics designers and illustrators.

A light pen detects changes in brightness of nearby screen pixels when scanned by cathode-ray tube electron beam and communicates the timing of this event to the computer. Since a CRT scans the entire screen one pixel at a time, the computer can keep track of the expected time of scanning various locations on screen by the beam and infer the pen's position from the latest timestamp.

7. **Joystick**- A joystick consists of a base and a stick. The stick can be moved in several directions to shift an object anywhere on the computer screen. A joystick can perform a similar function to a mouse or trackball. It is often considered less comfortable and efficient. The most common use of a joystick is for playing computer games.

A joystick, also known as the control column, is the principal control device in the cockpit of many civilian and military aircraft, either as a centre stick or side-stick. It often has supplementary switches to control various aspects of the aircraft's flight.

Joysticks are often used to control video games, and usually have one or more push-buttons whose state can also be read by the computer. A popular variation of the joystick used on modern video game consoles is the analog stick. Joysticks are also used for controlling machines such as cranes, trucks, underwater unmanned vehicles, wheelchairs, surveillance cameras, and zero turning radius lawn mowers. Miniature finger-operated joysticks have been adopted as input devices for smaller electronic equipment such as mobile phones.

8. **Stylus**- The stylus is similar to a ballpoint pen. It uses pressure to write text and draw lines. It was also called a pen. A stylus is used in graphical applications. Architects, artists, and designers use it to create drawings and sketches.

Scanner: Scanner is an input device, which works on a similar principle of a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation.

Scanner captures images from the source which are then converted into the digital form that can be stored on the disc. These images can be edited before they are printed.

The most common types of scanners are-

1. Hand-held Scanners - They are very small which can be held in a hand. These are less expensive and less wide. Hence, in order to scan a single page image, multiple passes are required. But their handiness is a major advantage of handheld scanner.

2. Flatbed Scanners- They are large and more expensive scanners that creates higher quality images. These scanners have a flat surface on which the printed image to be scanned, is placed. (Similar to the way a page is placed on a photocopier). Flatbed scanners can scan a page in a single pass.

3. Drum Scanners- They are are medium-size scanners with a rolling drum. The sheet is fed through the scanners so that the drum rolls over the entire sheer to be scanned (Just as the sheets are fed in a fax machine).

Magnetic Ink Card Reader (MICR) : We see in banks, libraries etc using MICR as an input device . As large number of cheques are processed everyday MICR serves a very useful purpose. A special type of ink that contains particles of magnetic material that is machine readable, is used to read the code number and cheque number that are printed on the cheques in banks. This reading process is called Magnetic Ink Character Recognition (MICR). The main advantage of MICR is that it is highly accurate and fast in reading.

MICR reads the characters by examining their shapes in a matrix form and the information is then passed `on to the computer.

OMR (Optical Mark Recognition): Optical mark recognition (also called optical mark reading and OMR) is the process of capturing human-marked data from document forms such as surveys and test. It uses a beam of light that is reflected on the paper with marks, to capture presence and absence of marks. They are used to read questionnaires, multiple choice examination paper in the form of lines or shaded areas.

Optical Character Reader (OCR) : OCR is an input device that is used to read a printed text. The role of OCR is to scan the text optically character by character by converting them into a machine readable code and store the text on the system. The OCR is used for the preparation of electricity bills, insurance premium, telephone bills.

It is used to scan the document containing text. It is the mechanical or electronic conversion of scanned or photographed images of typewritten or printed text into machine encoded/computer-readable text.

COMPUTER HARDWARE

SCR (Smart Card Readers): A small electronic device about the size of a credit card that contains electronic memory, and possibly an embedded integrated circuit (IC). Smart cards containing an IC are sometimes called Integrated Circuit Cards (ICCs).

Smart cards are used for a variety of purposes, including:

– Storing a patient's medical records

– Storing digital cash

– Generating network IDs (similar to a token)

To use a smart card, either to pull information from it or add data to it, you need a smart card reader, a small device into which you insert the smart card.

Bar Code Readers : Bar Code Reader is a device used for reading bar coded data (data in form of light and dark lines). Bar coded data is generally used in labeling goods, numbering the books, etc .Bar Code Reader scans a bar code image by converting it into an alphanumeric values . This value is then fed to the computer to which bar code reader is connected.

- **A QR code (abbreviated from Quick Response code)** is a type of matrix barcode (or two-dimensional barcode) first designed in 1994 for the automotive industry in Japan. A barcode is a machine-readable optical label that contains information about the item to which it is attached. In practice, QR codes often contain data for a locator, identifier, or tracker that points to a website or application. A QR code uses four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to store data efficiently; extensions may also be used.

COMPUTER HARDWARE

Biometrics- A biometric device is a security identification and authentication device. Such devices use automated methods of verifying or recognizing the identity of a living person based on a physiological or behavioral characteristic. These characteristics include fingerprints, facial images, and iris and voice recognition.

Microphone : A microphone, is an acoustic-to-electric transducer or sensor that converts sound in air into an electrical signal. Microphones are used in many applications such as telephones, hearing aids, public address systems for concert halls and public events, motion picture production, live and recorded audio engineering, two-way radios, megaphones, radio and television broadcasting, and in computers for recording voice, speech recognition, VoIP, and for non-acoustic purposes such as ultrasonic checking or knock sensors.

Webcam : A webcam is a video camera that feeds or streams its image in real time to or through a computer to computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and email as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

COMPUTER HARDWARE

OUTPUT DEVICES

An output device is any piece of computer hardware equipment which converts information into human-readable form. It can be text, graphics, tactile, audio, and video.

Following are some of the important output devices used in a computer.

- Monitors
- Graphic Plotter
- Printer
- Speaker.

Monitors

Monitors, commonly called as **Visual Display Unit** (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

It can either be a monochrome display or a color display. The number of pixels displayed on a screen is known as **Resolution.**

Dot pitch (sometimes called line pitch, stripe pitch, or phosphor pitch) is a specification for a computer display, computer printer, image scanner, or other pixel-based device that describes the distance, for example, between dots (sub-pixels) on a display screen. In the case of an RGB color display, the derived unit of pixel pitch is a measure of the size of a triad plus the distance between triads.

The refresh rate (or "vertical refresh rate", "vertical scan rate", terminology originating with the cathode ray tubes) is the the frequency with which the image on a computer monitor or similar electronic display screen is refreshed, usually expressed in hertz. This is independent from frame rate, which describes how many images are stored or generated every second by the device driving the display.

On cathode ray tube (CRT) displays, higher refresh rates produce less flickering, thereby reducing eye strain. In other technologies such as liquid-crystal displays, the refresh rate affects only how often the image can potentially be updated.

RESOLUTION- The number of pixels arranged horizontally by the number of pixels arranged vertically is the resolution of the display. This means that the number of pixels inside the display, the better will be the picture quality and the clearer the picture displayed would be.

Some of the common display resolutions found on the displays are as follows-

- **2560 x 1440 (1440p)**
- **1920 x 1080 (FHD or Full HD or 1080p)**
- **1600 x 900**
- **1024 x 768**
- **1280 x 720 (HD or 720p)**

COMPUTER HARDWARE

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

➢ **CRT** is the technology used in traditional computer monitors and televisions. The image on a CRT display is created by firing electrons from the back of the tube to phosphors . (the screen is covered with a fine line of phosphoric elements called phosphors) located towards the front of the display. Once the electrons hit the phosphors, they light up and are projected on the screen. The color you see on the screen is produced by a blend of red, blue, and green light, often referred to as RGB

The CRT display is made up of small picture elements called **pixels**. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character.

There are some disadvantages of CRT –

- **Large in Size**
- **High power consumption**

'VDT (video display terminal) and VDU (video display unit) are alternative names for monitors.'

➢ **Flat-Panel Display Monitor** : These flat panel displays overcome the disadvantages of CRT as they have reduced volume, weight and power requirement compared to the CRT. They come in different shapes and size. You can hang them on walls or wear them on your wrists. They are used in all modern day calculators, video games, monitors, laptop computer, graphics display etc as displays.

The flat-panel display are of two main types :

Non-Emissive Displays : The Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Example is LCD (Liquid-Crystal Device)

- **Liquid Crystal Devices (LCD) monitors**– It is a flat panel display that uses the light- modulating properties of liquid crystals. It is used in LCD televisions, aircraft cockpit displays, etc. It is thin, light-weight screen made up of any number of colour or monochrome pixels arranged in front of a light source.

It is more energy-efficient, as it does not use phosphorous and can be disposed of more safely than the CRT monitors.

A thin-film-transistor liquid-crystal display (TFT LCD) is a variant of a liquid-crystal display (LCD) that uses thin-film-transistor (TFT) technology to improve image qualities such as addressability and contrast. A TFT LCD is an active matrix LCD, in contrast to passive matrix LCDs or simple, direct-driven[clarification needed] LCDs with a few segments.

Emissive Displays : The emissive displays convert electrical energy into light. Example are plasma panel and LED (Light-Emitting Diodes).

- **Light Emitting Diode (LED) monitors** - It is an improved version of the LCD monitor. The technology used in both the monitors is the same except the backlighting.
  The LED monitors are lighter, thinner, and less expensive. These monitors are more reliable as they have a more broad dimming range.
- **Plasma monitors**- It is a monitor in which each pixel on the screen is illuminated by a tiny bit of charges gas or plasma similar to a tiny neon light. These monitors are thinner than Cathode ray tube monitors and brighter than liquid crystal display monitors.

Printers : Printer is among the most common output device, which is used to print information on paper. The printed form of output is referred as Hard Copy. The form of output displayed on the screen is referred as Soft Copy.

- **The speed of the printer is measured in Pages per Minute (PPM), Characters per second (CPS), Lines per minute (LPM). The faster the printing, the more expensive the printer.**
- **Printer Resolution is easured in dots Per inch (DPI).**

On the basis of technology, printers are categorized into

Impact and Non- Impact Printers.

Impact printers create an image by using some mechanism to physically press an inked ribbon against the page, causing the ink to be deposited on the page in the shape desired.

I) Dot matrix :- They are the most popular printers because of their ease of printing features. They come at a low cost. The dot-matrix printer uses print heads containing from 9 to 24 pins. These pins produce

patterns of dots on the paper to form the individual characters. Each character is printed in the form of pattern of Dot's and head

II)**Daisy wheel Printer** :- These are known as daisy wheel printers as the head lies on the wheel and Pins correspond to characters like petals of Daisy flower. A hammer strikes a "petal" containing a character against the ribbon, and the character prints on the paper. Its speed is slow typically 25-55 characters per second. These printers are used for word-processing in offices and offer very nice quality representation.

Advantages

- More reliable than DMP
- Better quality
- Fonts of character can be easily changed

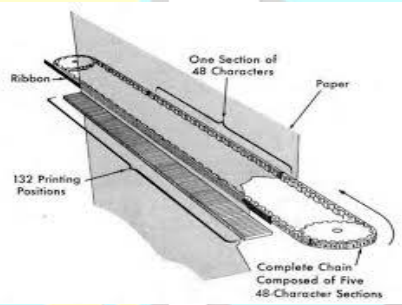
Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

III) Line printer:-Line printers, or line-at-a-time printers, use special mechanism that can print a whole line at once; they can typically print the range of 1,200 to 6,000 lines per minute. Speed of line printers is limited by the speed of cartridge used.

IV) Drum printer:- A drum printer consists of a solid, cylindrical drum that has raised characters in bands on its surface. The number of print positions across the drum equals the number available on the page. This printer looks like a drum in shape that's why it is called a drum printer. The Drum surface has a number of tracks. Total tracks are equal to size of paper, i.e., for a paper width of 132 characters, Drum will have 132 tracks. A character set is embossed on track. The different character sets available in market are 48 character set, 64 and 96 characters set. One rotation of drum leads to printing of one line. These printers print between 300 to 2000 lines per minute. Hence they have a very high speed.

V) Chain printer:- A chain printer uses a chain of print characters wrapped around two pulleys. In this printer because chain of character sets are used hence they are called as Chain Printers. A standard character set may have 48, 64, 96 characters.



Non – Impact Printers do not touch the paper when creating an image.

I) Ink-jet printers:- Ink-jet printers are new technology non-impact character printers. They print characters via spraying small drops of ink onto paper. Ink-jet printers produce very high quality output with presentable features. They are noiseless printers and have many styles of printing modes available. These are also called as the coloured printers. Models of Ink-jet printers can produce multiple copies of printing also. One or more nozzles in the print head emit a steady stream of ink drops. Droplets of ink are electrically charged after leaving the nozzle. The droplets are then guided to the paper by electrically charged deflecting plates.

Advantages

- High quality printing
- More reliable

Disadvantages

- Expensive as the cost per page is high
- Slow as compared to laser printer

II) Laser printers:- They use laser lights to produce the dots needed to form the characters to be printed on a page. When a whole page is loaded, it will be printed.

Advantages

- Very high speed
- Very high quality output
- Good graphics quality
- Supports many fonts and different character size

Disadvantages

- Expensive
- Cannot be used to produce multiple copies of a document in a single printing

III)Thermal printer:- is a digital printing process which produces a printed image by selectively heating coated thermo chromic paper, or thermal paper as it is commonly known, when the paper passes over the thermal print head.

Thermal printers are used most commonly to create labels, safety signs, wayfinding markers, barcodes, shipping labels, and other heavily-used items.

Plotters- A plotter is a computer hardware device much like a printer that is used for printing vector graphics. Instead of toner, plotters use a pen, pencil, marker, or another writing tool to draw multiple, continuous lines onto paper rather than a series of dots like a traditional printer. Though once widely used for computer-aided design, these devices have more or less been phased out by wide-format printers. Plotters produce a hard copy of schematics and other similar applications.

Advantages of plotters

- Plotters can work on very large sheets of paper while maintaining high resolution.
- They can print on a wide variety of flat materials including plywood, aluminum, sheet steel, cardboard, and plastic.
- Plotters allow the same pattern to be drawn thousands of times without any image degradation.

Disadvantages of plotters

- Plotters are quite large compared to a traditional printer.
- Plotters are also much more expensive than a traditional printer.

The first plotter was invented in 1953 by Remington-Rand. It was used in conjunction with the UNIVAC computer to created technical drawings.

Speaker : A hardware device connected to a computer's sound card that outputs sounds generated by the computer. It needs a sound card connected to a CPU, that generates sound via a card. These are used for listening music, for being audible in seminars etc.

Projector : A projector is an output device that can take images generated by a computer and reproduce them on a large, flat (usually lightly colored) surface. For example, projectors are used in meetings to help ensure that all participants can view the information being presented.

COMPUTER PROCESSING DEVICES

Processing is the core function of any computer. When a computer receives data from an input device, this data must first go through an intermediate stage before it is sent to an output device. Processing is the intermediate stage where raw data is transformed into information so that it can be outputted meaningfully for the user. An example of a processing device is the central processing unit (CPU), which is a set of electronic circuitry that processes and executes instructions.

- **CPU (CENTRAL PRECESSING UNIT)**
  Think of a computer as a human body with the CPU being the brain, controlling everything the computer does. The CPU is the part of a computer responsible for receiving and carrying out computer instructions. It does this by making use of millions (or even billions) of transistors,

which can each be switched on or off individually. The computer system 's principal and the most critical computing device is the central processing unit.

'It is also called the computer's heart and brain because it carries out a computer program 's instructions, as well as all computer functions.'

A computer can't perform any of the operations without a CPU. A CPU is fabricated as a single integrated chip as is also known as **Microprocessor.**

- **The speed of a CPU is measured in gigahertz (GHz), which shows how many instructions can be performed in one second. One GHz is equal to a 100 million hertz.(Gigahertz refers to the CPU frequency , As a general guideline; the higher the frequency, the better the CPU.)**
- **Number of cores: As with the processor speed, generally more cores are better.**
- **The CPU was first developed during the 1970s at Intel, with the first processor, the 4004 processor, released.**

The microprocessor is subdivided into three important units, which work together in order to accomplish its function. The units are:

- **The control unit:** It manages and supervises the operations of the processor and other components that are crucial in data manipulation.
- **Arithmetic and logic unit:** The ALU is responsible for all arithmetic and logic operations like addition, multiplication, subtraction, division, and comparison logic operations.
- **Memory Unit:** These are storage locations inside the processor that respond to the instructions of the control unit by moving relevant data around during processing.

Instruction cycle

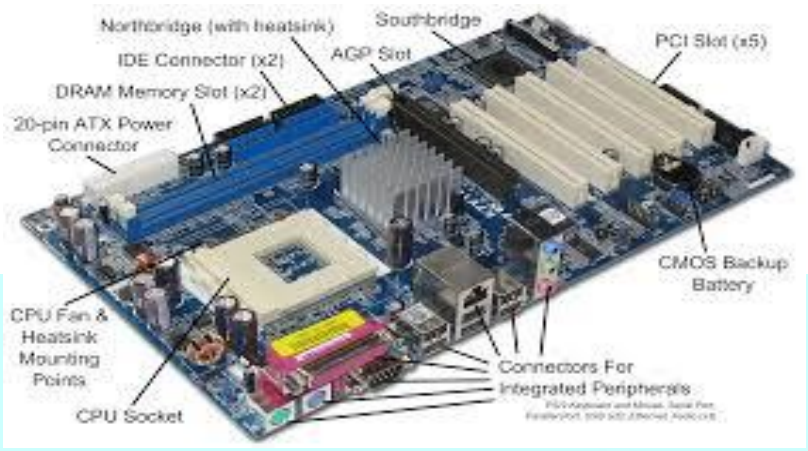
The instruction cycle (also known as the fetch–decode–execute cycle, or simply the fetch-execute cycle) is the cycle that the central processing unit (CPU) follows from boot-up until the computer has shut down in order to process instructions.

In a basic computer, each instruction cycle consists of the following phases:

- **Fetch instruction from memory.**
- **Decode the instruction.**
- **Read the effective address from memory.**
- **Execute the instruction.**

- **MOTHERBOARD**
  Alternatively referred to as the mb, mainboard, mboard, mobo, mobd, backplane board, base board, main circuit board, planar board, system board, or a logic board on Apple computers. The motherboard is a printed circuit board and foundation of a computer that is the biggest board in a computer chassis.

COMPUTER HARDWARE



The functions of a computer motherboard are as follows:

- The motherboard acts as the central backbone of a computer on which other modular parts are installed such as the CPU, RAM and hard disks.
- The motherboard also acts as the platform on which various expansion slots are available to install other devices / interfaces.
- The motherboard is also responsible to distribute power to the various components of the computer.
- They are also used in the coordination of the various devices in the computer and maintain an interface among them.
- It allocates power and allows communication to and between the CPU, RAM, and all other computer hardware components.

Popular Manufacturers

- Intel
- ASUS
- AOpen
- ABIT
- Biostar
- Gigabyte
- MSI

Computer - Memory

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one. For example, if the computer has 64k words, then this memory unit has 64 * 1024 = 65536 memory locations. The address of these locations varies from 0 to 65535.

Memory is primarily of three types –

- **Cache Memory**
- **Primary Memory/Main Memory**
- **Secondary Memory**

1. Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

Advantages

1. Cache memory is faster than main memory.
2. It consumes less access time as compared to main memory.
3. It stores the program that can be executed within a short period of time.
4. It stores data for temporary use.

Disadvantages

1. Cache memory has limited capacity.
2. It is very expensive.

2. Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Types of primary Memory-

1) RAM 2) ROM

- **RAM (Random Access Memory)** is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

Access time in RAM is independent of the address, that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup Uninterruptible Power System (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types –

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

Static RAM (SRAM)- The word static indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not be refreshed on a regular basis.

There is extra space in the matrix, hence SRAM uses more chips than DRAM for the same amount of storage space, making the manufacturing costs higher. SRAM is thus used as cache memory and has very fast access.

Characteristic of Static RAM

- Long life
- No need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually refreshed in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory as it is cheap and small. All DRAMs are made up of memory cells, which are composed of one capacitor and one transistor.

Characteristics of Dynamic RAM

- Short data lifetime
- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- Less power consumption

ROM stands for Read Only Memory. - The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

- **PROM (Programmable Read Only Memory)**

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

- **EPROM (Erasable and Programmable Read Only Memory)**

EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is retained for more than 10 years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window (lid). This exposure to ultra-violet light dissipates the charge. During normal use, the quartz lid is sealed with a sticker.

- **EEPROM (Electrically Erasable and Programmable Read Only Memory)**

EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

Advantages of ROM

- Non-volatile in nature
- Cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- Static and do not require refreshing
- Contents are always known and can be verified

- **Flash memory is a type of erasable read-only memory (EEPROM) that clears and rewrites data in chunks for fast, energy-efficient access and rewriting. Flash memory, or flash storage, is non-volatile, which means it remains viable even without an active power source**
- **A buffer contains data that is stored for a short amount of time, typically in the computer's memory (RAM). The purpose of a buffer is to hold data right before it is used.**
- **Virtual memory is a feature of an operating system that enables a computer to be able to compensate shortages of physical memory by transferring pages of data from random access memory to disk storage. This process is done temporarily and is designed to work as a combination of RAM and space on the hard disk. This means that when RAM runs low, virtual memory can move data from it to a space called a paging file. This process allows for RAM to be freed up so that a computer can complete the task**

Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than the main memory. These are used for storing data/information permanently. CPU directly does not access these memories, instead they are accessed via input-output routines. The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

STORAGE DEVICES/MEDIA

Magnetic tape - Magnetic tape is a medium for magnetic recording, made of a thin, magnetizable coating on a long, narrow strip of plastic film. It was developed in Germany in 1928, based on magnetic wire recording. Devices that record and playback audio and video using magnetic tape are tape recorders and video tape recorders respectively. A device that stores computer data on magnetic tape is known as a **tape drive**.

Magnetic Disk- Magnetic Disk devices are-

1) Hard Disk:

It is a rigid magnetic disc that is used to store data. It permanently stores data and is located within a drive unit.

The hard disk is also known as a hard drive. It is a rigid magnetic disc that stores data permanently, as it is a non-volatile storage device. The hard disk is located within a drive unit on the computer's motherboard and comprises one or more platters packed in an air-sealed casing. The data is written on the platters by moving a magnetic head over the platters as they spin. The data stored on a computer's hard drive

generally includes the operating system, installed software, and the user's files and programs, including pictures, music, videos, text documents, etc.

Components of Hard Drive:

The main components of a hard drive include a head actuator, read/write actuator arm, read/write head, platter, and spindle. A circuit board, which is called the disk controller or interface board, is present on the back of a hard drive. It allows the hard drive to communicate with the computer.

2. Floppy Disk: Floppy disks are disks of plastic coated in magnetic material and enclosed in a hard plastic case. The read/write area is covered by a sliding metal flap.

Although, they used to be very common, as they were a convenient way of transporting files from one computer to another, they not much used anymore. Floppy disks are written to and read from, through the use of separate floppy disk drives. The floppy diskette was first created in 1967 by IBM as an alternative to buying hard drives, which were extremely expensive at the time.

Floppy disks are less popular than they have been because :-

- They are easily damaged.
- Have a limited storage capacity in that they can only hold 1.44MB. Photos,

OPTICAL STORAGE

In the optical storage devices, all read and write activities are performed by light. All recording information stores at an optical disk. As per the opinions of data scientist that compact space is most useful for huge data storage. Their big advantages are not more costly, light weight, and easy to transport because it is removable device unlike hard drive.

In the optical storage devices, all data is saved like as patterns of dots which can be easily read with using of LIGHT. Laser Beam is used like as "**Light Source**". The data is read while bouncing laser beam on the surface of storage medium. Laser beam creates the all Dots while reading process, but it is used with high power mode to mark the surface of storage medium, and make a dot. This entire process is also called the "**Burning**" data onto Disc.

Types of Optical Storage Devices

CD-ROM- CD-ROM stands for "Compact Disc Read Only Memory", and CD-ROM comes in the "Random Access" category's devices. These types of disc can capable to store almost 800 MB of digital data. These data can't discard by mistaken.

DVD-ROM- DVD-ROM stands for "Digital Versatile Disc – Read Only Memory", and it also comes in the "Random Access" category's devices. DVD-ROM discs can store data up to 4.7 GB, but Dual Layer DVD device's storage capacity is double. These types of disc are used to store ultra quality video.

Blue Ray- Blue Ray discs are totally replaced by DVDs, because these discs are capable to hold data up to 25-50 GB, as well as double layer Blue Rays discs can store double data. Due to high storage capacity, Blue Ray discs are used to store HD (High Definition) videos.

HD DVD- HD DVD stands for "High Density DVD", and these devices are capable to store data up to 15 GB (Dual Layer HD DVDS have storage capacity double). High-Density DVD discs are also used to hold HD Videos.

DVD-RAM- DVD-RAM stands for "DVD-Random Access Memory", and it is able to Re-Write data. DVD-RAM are available in market like as floppy-disc style case. These types of discs have storage capacity of data similar to DVD (up to 4.7 GB).

DVD-RAM devices are used in several Camcorders such as "Video Recording Cameras", and it can be used for data back-up and archiving.

Recordable Optical Devices

There are two types of discs such as "CD-R and DVD-R" and "CD-RW and DVD-RW".

CD-R & DVD-R- Full form of (CD-R & DVD-R) is "CD-Recordable and DVD Recordable", and they are able to burn data on to them, but not easy to delete data. Users can add any type of data, but they can't discard added data or re-use fully disc.

CD-RW & DVD-RW- CD-RW & DVD-RW stands for "CD-Re Writable and DVD-Re Writable", and they are capable to burn data similar (CD-R and DVD-R) onto them. Users can also delete and Re-Used data.

Advantages of Optical Storage Devices

- It is capable to store vast amount of data.
- Affordable price
- It can be recycled (Re-used).
- It has ultra data stability.
- Countable/uncountable storage units
- Best Durability, Transport-ability, and archiving.

Disadvantages of Optical Storage Devices

- Some traditional PCs are not able to read these disks.
- It is getting trouble while recycling.

Pen drive: Pen drive is a compact secondary storage device. It is also known as a USB flash drive, thumb drive or a jump drive. It connects to a computer via a USB port. It is commonly used to store and transfer data between computers. For example, you can write a report using a computer and then copy or transfer it in the pen drive. Later, you can connect this pen drive to a computer to see or edit your report. You can also store your important documents and pictures, music, videos in the pen drive and keep it at a safe place.

Pen drive does not have movable parts; it comprises an integrated circuit memory chip that stores the data. This chip is housed inside a plastic or aluminium casing. The data storage capacity of the pen drive

generally ranges from 2 GB to 128 GB. Furthermore, it is a plug and play device as you don't need additional drives, software, or hardware to use it.

SD Card: SD Card stands for Secure Digital Card. It is most often used in portable and mobile devices such as smart phones and digital cameras. You can remove it from your device and see the things stored in it using a computer with a card reader.

There are many memory chips inside the SD card that store the data; it does not have moving parts. SD cards are not created equal, so they may differ from each other in terms of speed, physical sizes, and capacity. For example, standard SD cards, mini SD cards, and micro SD cards.

Memory unit is the amount of data that can be stored in the storage unit. This storage capacity is expressed in terms of Bytes.

The following table explains the main memory storage units –

S.No.	Unit & Description
1	**Bit (Binary Digit)** A binary digit is logical 0 and 1 representing a passive or an active state of a component in a electric circuit.
2	**Nibble** A group of 4 bits is called nibble.
3	**Byte** A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character.
4	**Word** A computer word, like a byte, is a group of fixed number of bits processed as a unit, which varies from computer to computer but is fixed for each computer. The length of a computer word is called word-size or word length. It may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of computer words.

The following table lists some higher storage units –

S.No.	Unit & Description
1	**Kilobyte (KB)** 1 KB = 1024 Bytes
2	**Megabyte (MB)** 1 MB = 1024 KB
3	**GigaByte (GB)** 1 GB = 1024 MB
4	**TeraByte (TB)** 1 TB = 1024 GB
5	**PetaByte (PB)** 1 PB = 1024 TB

COMPUTER SOFTWARE

What is Software: Computer software, or only software, is a kind of program that enable a user to perform some specific task or used to operate a computer. It directs all the peripheral devices on the computer system – what to do and how to perform a task. PC Software plays the role of mediator between the user and computer hardware. Without software, a user can't perform any task on a digital computer.

"A computer system can be divided into three components: the hardware, the software, and the users. Bare use of hardware is not easy, so to make it easy, software created. A software product development company is the one which develops software for the users."

There are two types of software –

1. System Software
2. Application Software

System Software- The software that helps to activate the computer system and controls the system hardware and interacts with application software. These software products comprise of programs which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

VARIOUS SYSTEM SOFTWARE ARE-

1. **Operating System (OS)** : Software that helps to activate the computer system and provide common platform to operate the computer system by the user is called OS. It is the first layer of software loaded into computer memory on the time of booting (Starts Up).

Operating System plays an important role in loading programs from disk into memory, displaying message, translating program and in outputting the results. The main function of OS is to manage the disk access, files process etc. Other software is loaded on the environment of OS. Windows Xp, Linux, MS-DOS etc are popular OS.

2. **Device Drivers:** System software helps to activate and recognize the computer hardware devices. To activate and recognize the hardware devices computer system requires special software called device drivers. To work with all devices, we need this software. For example to work with Modem, Printers we have to install their driver software then only these devices will work.
3. **Languages Translator**: Translator program is a computer program that converts then programming instructions written in human convenient form into machine codes. Computer are digital devices. It can work only on the digits which are 0 to 1. All types of commands, data and instructions required to be converted into machine code which is the combination of 0's and 1's. Different types of programming languages accept the data and instructions on natural language like English. But computer can not process such data and instructions on natural language. So they should be translated into machine code. To convert such natural language. So they should be translated into machine code.

Introduction to Computer Languages

'Programming Language is a set of rules called syntax which user has to follow, to instruct the computer what operation are to be performed.'

Computer language are classified into two categories:

1. Low-Level Languages
- Machine level languages

- Assembly languages

2. High-Level Languages

- General Purpose languages (Ex: BASIC, PASCAL, C)
- Specific purpose languages (Ex: COBOL, FORTAN, C++)

Machine Level Language

- Machine level language is the fundamental language of a computer.
- It is written using binary numbers i.e. 0's and 1's.
- A program written in the machine level language is called Machine code.

Assembly Level Language:

- Assembly level language is a low-level programming language that allows a user to write programs using letters, words and symbols called mnemonics, instead of the binary digits used in machine level languages.
- A program written in the assembly level language is called Assembly code.

High-level Languages

- A language designed to make programming easier through the use of familiar English words and symbols.
- High-level languages used English like language, which are easier to learn and use.
- High-level languages are machine independent. Therefore, a program written for one
- computer can be executed on different computers with no or only slight modifications.
- Some of the high-level languages are C, C++, JAVA, FORTRAN, QBASIC, and PASCAL.

Assembler:

- Assembler is system software, which translates an assembly language program into its machine language.
- It recognizes the mnemonics used in the assembly level languages and substitutes the required machine code for each instruction.
- Example: TASM (Turbo Assembler), MASM (Microsoft Macro Assembler) etc.

Compilers:

- Compiler is system software that translates high-level language (source code) into the machine level language (machine/object code).
- It reads the whole program and translates the entire program at once into a series of machine level language instructions.
- Once compiled, the program normally is saved automatically and can be executed directly.
- Examples: C, C++.

Interpreters:

- An Interpreter reads once a statement of a high-level language program at a time, translates it into machine level language, and executes it immediately.
- It continues to read, translate and execute the statements one by one until it reaches the end of the program. Therefore, it is slower than a compiler.
- The machine code produced by the interpreter is not saved and hence, to execute a statement again, it has to be interpreted again.

- Example: BASIC, PROLOG

Linker : A linker is system software that links (combines) smaller programs to form a single program. A source program written in high-level languages may contain a number of modules or segments. To execute properly the modules are to be linked so that execution of the program is sequential. This operation is performed by software called as the linker.

Loader: A loader is system software that loads machine code of a program into the system memory and prepares these programs for execution. Once an executable program is generated someone will have to load the program into the main memory of the computer so that it can be executed. This operation is performed by software called as the loader.

4. **Utility Software:** System software that increases the performance of the computer system is utility software. It helps to maximize the utilization of devices. Utilities are those helpful programs that assist the computer by performing helpful functions like backing up disk, scanning/cleaning viruses etc. E.g. Scan disk, Virus Scanner, disk fragmentation etc.

Utility software is generally called as Application oriented ready-made system programs.

Functions of System Utility:

I. **Disk Cleanup**- Disk Cleanup is a function that comes with all versions of Windows Operating Systems. Disk Cleanup allows for you to scan your entire hard drive to search for extra room by deleting any unneccessary files such as temporary files from the Internet and cookies that are downloaded when you visit webpages. You can find Disk Cleanup in Windows XP by going to the Start menu → All Programs → Accessories → System Tools → Disk Cleanup.

II. **Disk Defragmentation-** Defragmentation is the process of locating the noncontiguous fragments of data into which a computer file may be divided as it is stored on a hard disk, and rearranging the fragments and restoring them into fewer fragments or into the whole file.

III. **System Restore**- System Restore is a Windows utility that allows a user to restore their computer data to a specific former state (known as a restore point), undoing changes made since that time. System Restore can be found by going to Start → All Programs → Accessories → System Tools → System Restore

IV. **Disk Compression**- Disk compression is a type of function that allows for a program to search your hard drive and compress files, particularly old or unused files. It also serves to free up space, which is the main function of disk compression software.

V. **Antivirus**- It is used to scan computer for viruses and prevent the computer system files from being corrupt.

APPLICATION SOFTWARE

Application software is a computer program that performs a specific function, be it educational, personal, or business. It is also known as an end-user program or a productivity program.

Each of the computer application software programs is developed to assist you with a particular process that may be related to creativity, productivity, or better communication. It helps you in completing your tasks, be it jotting down notes, completing your online research, setting an alarm, keeping an account log, and even playing games. Unlike system software, computer application software programs are specific in their functionality and do the job that they are designed to do.

They are categorized as-

1. Presentation software: Presentation software enables you to put forth your thoughts and ideas with ease and with good clarity by using visual information. It lets you display the information in the form of slides. You can make your slide more informative and more engrossing by adding text, images, graphs, and videos. It has three components: Text editor to input and format text, Insert graphics, text, video, and multimedia files, Slideshow to display the information

2. Web browsers: These software applications are used to browse the Internet enabling you to locate and retrieve data across the web. The most popular ones are Google Chrome and Internet Explorer.

3. Multimedia software: This lets you create or record images, and create audio or video files. This software is extensively used in animation, graphics, image, and video editing. Popular examples are the VLC media player and Windows media player.

4. Education and reference software: This application software, also termed as academic software, is specifically designed to facilitate the learning of a particular subject.

5. Graphics software: Graphics software allows you to edit or make changes in visual data or images. It comprises illustration and picture editor software. Adobe Photoshop and PaintShop Pro are a few examples of graphics software.

6. Spreadsheet software: Spreadsheet software is used to perform calculations. In this software, data is stored in a table format. The intersecting area, called cells, are separated to define fields such as text, date, time, and number. It allows users to provide formulas and functions to perform calculations. Microsoft Excel is one good example of spreadsheet software.

7. Database software: Database software is used to create and manage a database. Also known as a DBMS (Database Management System), it helps you organize your data. So, when you run an application, data is fetched from the database, modified, and is stored back in the database. Oracle, MySQL, Microsoft SQL Server, PostgreSQL, MongoDB, and IBM Db2 are some popular databases.

8. Word processing software: It is used to format and manipulate text, thus, creating memos, letters, faxes, and documents. Word processing software is also used to format and beautify the text. It provides you a whole lot of features aside from thesaurus and synonyms and antonyms. Along with Word Art features, the font option lets you change font color, effect, and style as per your choice. Grammar and spell-check options are also available to check for errors.

9. Simulation software: Simulation software is used in the fields of engineering, education, testing, and video games, etc. It is used where work on the actual system is unacceptable, inaccessible, or maybe dangerous. It is a program that lets you study or observe an operation, or phenomenon through simulation without actually doing that operation. The best examples of the simulation are in the field of robotics, flight systems, and weather forecast, etc.

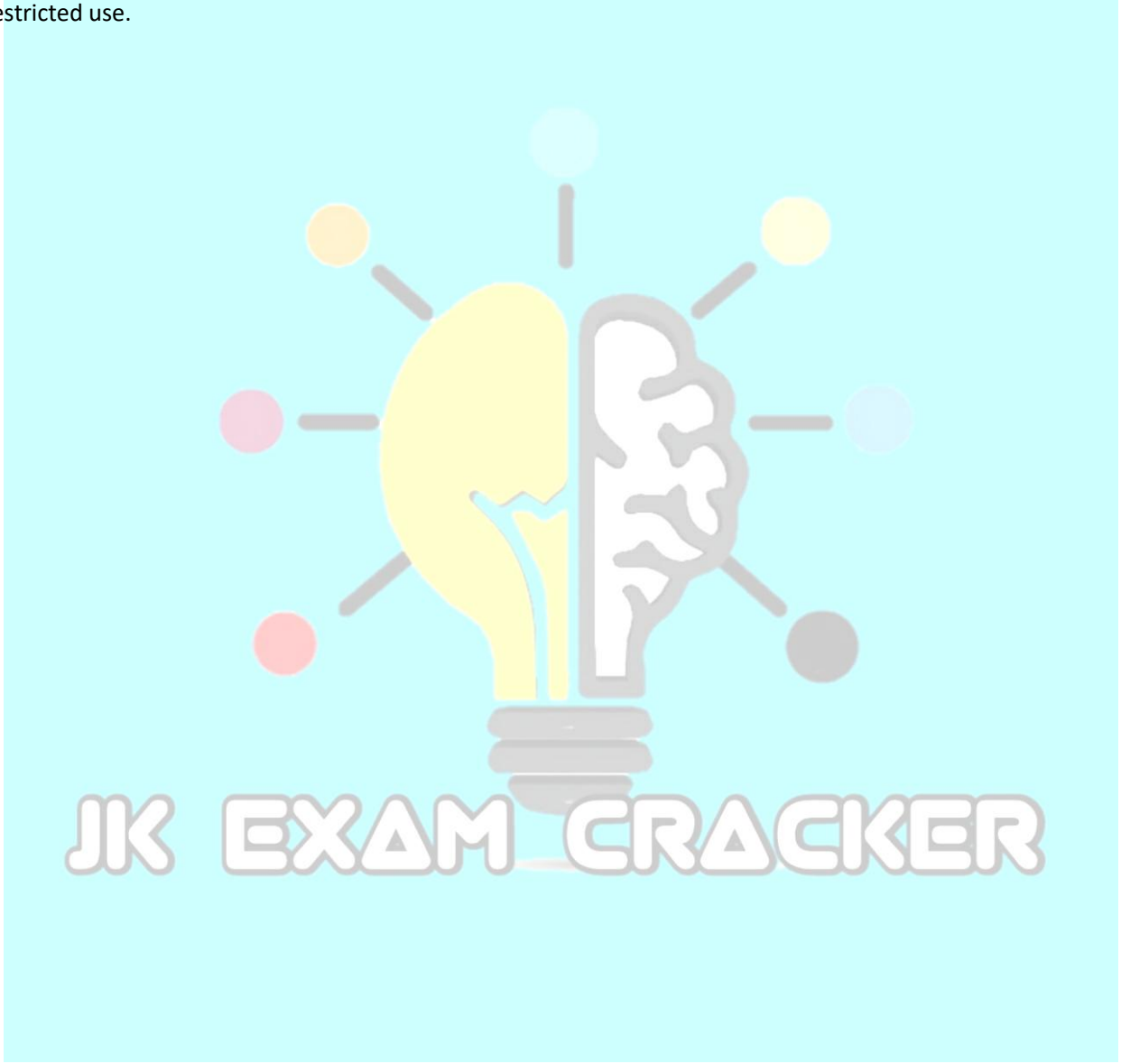
Apart from these, there are several others in the category of application software that serve specific purposes. However, application software can also be classified based on their shareability and availability. Some such categories are:

10. Freeware: As the very name indicates, it is available free of cost. You can download it from the Internet and use it without any fee. However, this software does not allow you to modify it or charge a fee for distributing it. Adobe Reader and Skype are good examples of this software.

11. Shareware: This is distributed freely to the users on a trial basis, usually with a limited time offer. The users are expected to pay if they want to continue to use the software. Some examples of shareware are WinZip and Adobe Acrobat.

12. Open source: This type of software is available along with the source code that allows you to modify the software, and even add features to the software. These could either be free or paid. Moodle and Apache Web Server are some examples.

13. Closed source: Most of the software packages that you use belong to this category. These are usually chargeable and have intellectual property rights or patents over the source code. It usually comes with restricted use.



MS WORD

Microsoft Office, or simply Office, is a family of client software, server software, and services developed by Microsoft. It was first announced by Bill Gates on August 1, 1988, at COMDEX in Las Vegas.

MS office primarily includes Word, Excel, PowerPoint, Access and Outlook.

MS Word

MS Word is a word processor developed by Microsoft. It has advanced features which allow you to format and edit your files and documents in the best possible way. Used to make professional-quality documents, letters, reports, etc.

- Charles Simonyi, a developer and Richard Brodie, a software engineer, where the two creators of MS Word
- This program was initially named "Multi-Tool Word" but later, was renamed as MS Word
- It was introduced in 1983

Using this application program you can add pictures, tables, and charts to your documents. You can also check spelling and grammar.

- Follow these simple steps to open MS Word on your personal computer:

Start → All Programs → MS Office → MS Word.

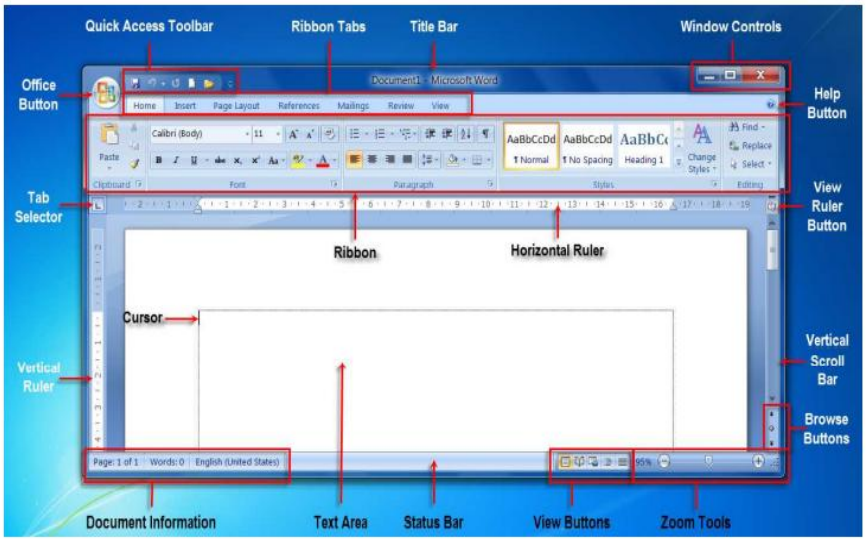
Microsoft Word:

- Microsoft Word is a word processor developed by Microsoft.
- It is used for creating, editing, formatting, storing, retrieving and printing of a text document.
- Microsoft Word's native file formats are denoted either by a .doc or .docx file extension.

ADVANTAGES:

1. Business and workplace use of Microsoft Word
2. MS word uses in Education:
3. Help to create resumes, notes, and assignments
4. You can create books, articles, and newsletters
5. Used to create edit, transcribe, and convert PDF

PARTS OF WORD WINDOW



- **Office Button-** It is located in upper left button corner of the office.

The options available in the Office Button menu are :

1. New - Creates a new document
2. Open - Opens an existing document form disk
3. Save - Saves the open document to disk
4. Save As - Saves the open document to disk under a different name
5. Print - Prints the open document
6. Prepare - Prepares the document for distribution, through such tasks as adding a signature on encryption
7. Send - Sends the document to another user by email or fax
8. Publish - Makes the document publicly available via a document serve or a public web space
9. Close - Exits the open document.

- TITLE BAR: The bar at the top of the window that bears the name of the window, is known as Title Bar.
- MENU BAR: A screen element of MS Word that is usually located below the title bar that provides categorized option, is called Menu Bar.
- TOOL BAR: Toolbars provide shortcuts to menu commands. Toolbars are generally located just below the Menu bar.

Ribbon

The Ribbon is located at the top of the screen and stretches across the window. The Ribbon is organized into 8 different

Tabs; File, Home, Insert, Page Layout, References, Mailings, Review, and View. Each Tab has several Groups, where similar tools and features are found.

(a) Home Tab

The Home tab displays a variety of tools and features used to format and move text. The Home tab can change the color, size, font, and alignment of the text. The Home tab can also cut, copy, and paste text. The Home tab has 5 groups; Clipboard, Font, Paragraph, Styles and Editing

(b) Insert Tab

The Insert tab displays tools and features used to add an item or special format to the document. The Insert tab can add pictures, symbols, or page numbers to the document. The Insert tab has 7 groups; Pages, Tables, Illustrations, Links, Header & Footer, Text, and Symbols.

(c) Page Layout Tab

The Page Layout tab displays tools and features used to change the way text and images will be positioned in the document. The Page Lausert tab controls the margins and page orientation. The Page Lausert tab has 5 groups; Themes, Page Setup, Page Background, Paragraph, and Arrange.

(d) Reference Tab

The References tab displays tools and features used in academic or professional writing. The References tab will assist with using citations, footnotes, and a table of contents. The References tab has 6 groups; Table of Contents, Footnotes, Citations, Captions, Index, and Table of Authorities.

(e) Mailings Tab

The Mailings tab displays tools and features used to print envelopes, labels, and send mass communications. The Mailings tab has 5 groups; Create, Start Mail Merge, Write & Insert Fields, Preview Results, and Finish.

(f) Review Tab

The Review tab displays tools and features used to fix mistakes or write drafts of a document. The Review tab can check spelling and grammar, add comments to a section of the document, or change the language of the document. The Review tab has 7 groups; Proofing, Language, Comments, Tracking, Changes, Compare, and Protect.

(g) View Tab

The View tab displays tools and features to change the way the document looks on the screen. The View tab can change the zoom level, display or position the windows for 2 different documents. The View tab has 5 groups; Document Views, Show, Zoom, Window, and Macros.

- Ruler

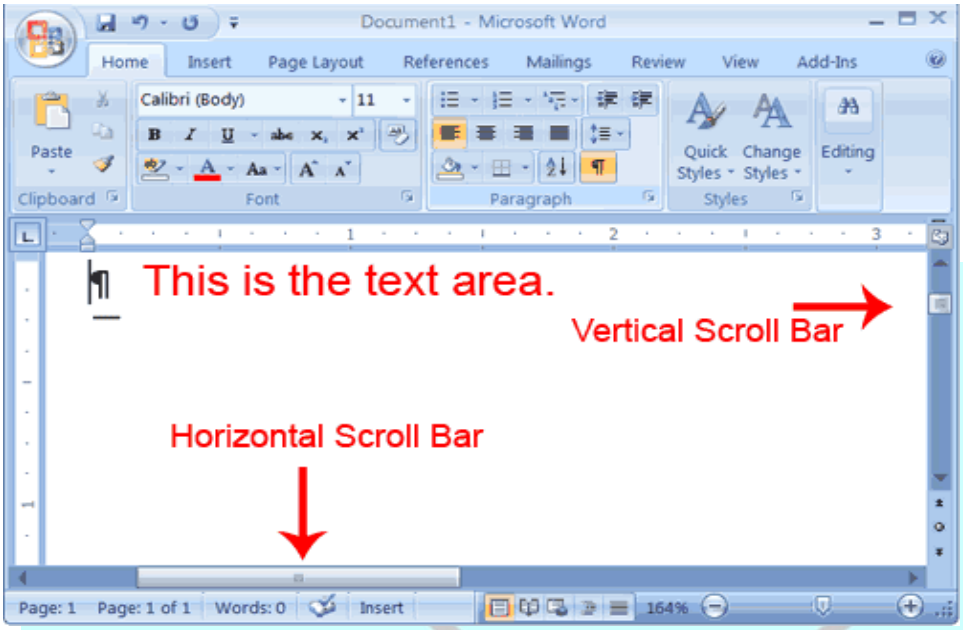
The ruler is a measurement tool found in MS word that allow the user to align graphics, text, tables, or other elements on a page. When enabled the horizontal ruler appears at the top of the document, and the vertical ruler is on the left-side of the document.

- Status Bar

The status bar, which is a horizontal area at the bottom of the document window in Microsoft Word, provides information about the current state of what user are viewing in the window and any other contextual information. It shows the Page number(Shows the page number) and Number of words in the document itself.

- The Vertical and Horizontal and Vertical Scroll Bars

The vertical and horizontal scroll bars enable you to move up, down, and across your window simply by dragging the icon located on the scroll bar. The vertical scroll bar is located along the right side of the screen. The horizontal scroll bar is located just above the status bar. To move up and down your document, click and drag the vertical scroll bar up and down. To move back and forth across your document, click and drag the horizontal scroll bar back and forth. You won't see a horizontal scroll bar if the width of your document fits on your screen.



MS WORD FEATURES

- **TEXT EDITING**

The ability to change text by adding, deleting and rearranging letters, words, sentences and paragraphs. Text editing is the main operation users perform in word processors, which typically also handle graphics and other multimedia files.

- **FIND AND REPLACE**

Find and Replace helps you to find words or formats in a document and can let you replace all instances of a word or format. This is particularly handy in long documents. To use Find and Replace, use the shortcut Ctrl+H or navigate to Editing in the Home tab of the ribbon, then choose Replace.

Go to Home > Replace or press Ctrl+H. Enter the word or phrase you want to locate in the Find box. Enter your new text in the Replace box.

- **ALIGN/ ALIGNMENT**

The alignment keyboard shortcut keys can vary depending on what program is being used and the type of computer. However, generally speaking, use Ctrl+L to left align, Ctrl+E to center, Ctrl+R to right align, and Ctrl+J to justify text.

- **BULLET**

Alternatively referred to as a bullet point, a bullet is an asterisk, black dot, circle, or other mark that is found before the text. They are utilized to identify key items or denote significance. Bullet points are often used in presentations to help organize information and make it easier to read or understand.

- **CLIPBOARD**

The clipboard, also known as pasteboard, is a special location in your computer's memory that temporarily stores cut or copied data from a document. Once, something is stored in the clipboard, it can then be pasted to a new location. The clipboard holds its information until you cut or copy something else, or log out of the computer. For example, a user may copy information from a word processor and paste that information into an e-mail message.

- **AutoCorrect**

AutoCorrect is a software feature commonly found in word processing programs, such as Microsoft Word. As the name implies, this feature automatically corrects misspellings and common typos.

Hit Alt + F7 on your keyboard and it will start with the first misspelled word.

- **FORMATTING TOOLBAR**

Options available in the formatting toolbar

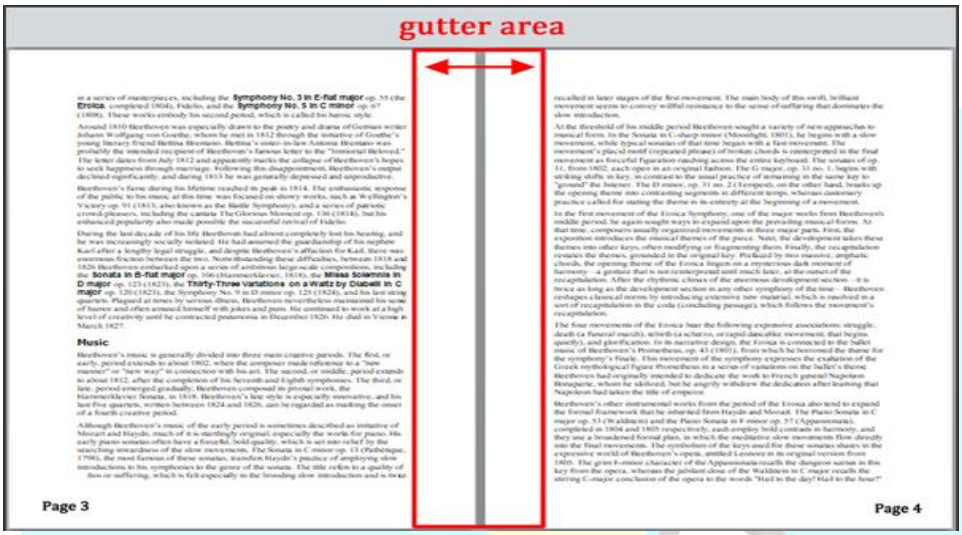
1. Change the font.
2. Change the size of the font.
3. Change the font color.
4. Make the text bold, italics, or underline.
5. Change the alignment.
6. Change the style to currency, percent, or comma.
7. Increase or decrease the decimal and indent.
8. Change the borders.
9. Fill (highlight) the text.

- **GRAMMAR CHECKER**

A grammar checker is software or a program feature found in a word processor and is used to find grammatical errors. That is to say, it checks for improper sentence structure and word usage (e.g., their instead of there), poorly placed or unnecessary punctuation, and other more esoteric errors. An example of a software program that includes its own grammar checker is Microsoft Word. Microsoft Word underlines grammar errors with a green squiggly underline as shown in the picture.

- **GUTTER**

A gutter is a blank area or space that runs between text or pages of a document. Most documents have a gutter at the top and bottom of each page. A gutter may be small or large, depending on the size of the margins on each page. A larger margin results in a larger gutter.



- **THESAURUS**

A thesaurus is a reference tool that is used to locate synonyms (words that are similar in meaning to a particular word.)

- **MAIL MERGE**

Mail Merge is a handy feature that incorporates data from both Microsoft Word and Microsoft Excel and allows you to create multiple documents at once, such as letters, saving you the time and effort of retyping the same letter over and over.

- **SUBSCRIPT AND SUPERSCRIPT**

Subscript

Abbreviated as sub, subscript refers to words or character that are half the height of a standard character and printed lower than the rest of the text.

EXAMPLE- ABCABC

Superscript

Abbreviated as sup, a superscript is a character(s) half the height of a standard character and printed higher than the rest of the text.

EXAMPLE- ABCABC

For superscript, press Ctrl, Shift, and the Plus sign (+) at the same time. For subscript, press Ctrl and the Equal sign (=) at the same time.

MS WORD SHORT CUT KEYS

Function key Shortcuts

- **Press F1 to access online Help or the Office Assistant**
- **Press F2 to move text or graphics**
- **Press F3 to insert an AutoText entry (after Word displays the entry)**
- **Press F4 to repeat the last action**
- **Press F5 to choose the Go To command (Edit menu)**
- **Press F6 to go to next pane or frame**
- **Press F7 to launch the Spelling and Grammar check**
- **Press F8 to extend a selection**
- **Press F9 to update selected fields**
- **Press F10 to activate the Menu Bar**
- **Press F11 to go to the next field**
- **Press F12 to choose the Save As command (File menu)**

Table-I: Standard toolbar

Tools Name	Keyboard Operation	Description
New Blank Document	Ctrl + N	Creates a new blank document based on the default template.
Open (File menu)	Ctrl + O	Opens or finds a file.
Save (File menu)	Ctrl + S	Saves the active file with its current file name, location and file format.
Mail Recipient		Sends document as e-mail body.
Print (File menu)	Ctrl + P	Prints the active file: for more print options go to the File menu and select Print.
Print Preview (File Menu)	Ctrl + F2	Print preview: Shows how the document will look when you print it.
Spelling and Grammar (Tools	F7	Spelling, grammar and writing style checker.

menu)		
Cut (Edit menu)	Ctrl + X	Cut: Removes the selection from the document and places it on the clipboard.
Copy (Edit menu)	Ctrl + C	Copies the selected item(s) to the clipboard
Paste (Edit menu)	Ctrl + V	Places the content of the clipboard at the insertion point.
Undo (Edit menu)	Ctrl + Z	Reverses the last command, uses pull-down menu to undo several steps.
Redo (Edit menu)	Ctrl + Y	Reverses the action of the Undo button, uses the pull-down menu to redo several steps
Hyperlink	Ctrl + K	Inserts hyperlink and displays the destination object, document or page.
Tables and Borders		Displays the Tables and Borders toolbar.
Insert Table		Inserts a table into the document, or makes a table of selected text
Insert Excel		Inserts an Excel spreadsheet into the Word Worksheet document
Zoom		Enlarges or reduces the display of the active document
Office Assistant	F1	Provides help topics and tips to accomplish our task
Format Painter		Copies the format from a selected object or text and applies to other objects or text.

MS POWERPOINT

Microsoft Power point: Microsoft Power point is a part of MS- Office. It was introduced to generate business presentation, slide show and graphics on computer system.

Microsoft PowerPoint is a presentation program, created by **Robert Gaskins and Dennis Austin** at a software company named Forethought, Inc. It was released on **April 20, 1987**, initially for Macintosh computers only. **Microsoft acquired PowerPoint for $14 million three months after it appeared.**

"The actual extension for power point after Microsoft office 2007 is *.pptx and for the older versions, it was *.ppt."

Versions

Versions for Microsoft Windows include:

- **1990 PowerPoint 2.0 for Windows 3.0**
- **1992 PowerPoint 3.0 for Windows 3.1**
- **1993 PowerPoint 4.0 (Office 4.x)**
- **1995 PowerPoint for Windows 95 (version 7.0) – (Office 95)**
- **1997 PowerPoint 97 - (Office 97)**
- **1999 PowerPoint 2000 (version 9.0) (Office 2000)**
- **2001 PowerPoint 2002 (version 10) (Office XP)**
- **2003 PowerPoint 2003 (version 11) (Office 2003)**
- **2007 PowerPoint 2007 (version 12) (Office 2007)**

Use of Power point

1. Creating business application presentation slide.

2. Creating graphical objects with animations.

3. Create artistic slides for general use using art gallery.

4. To provide training in business world.

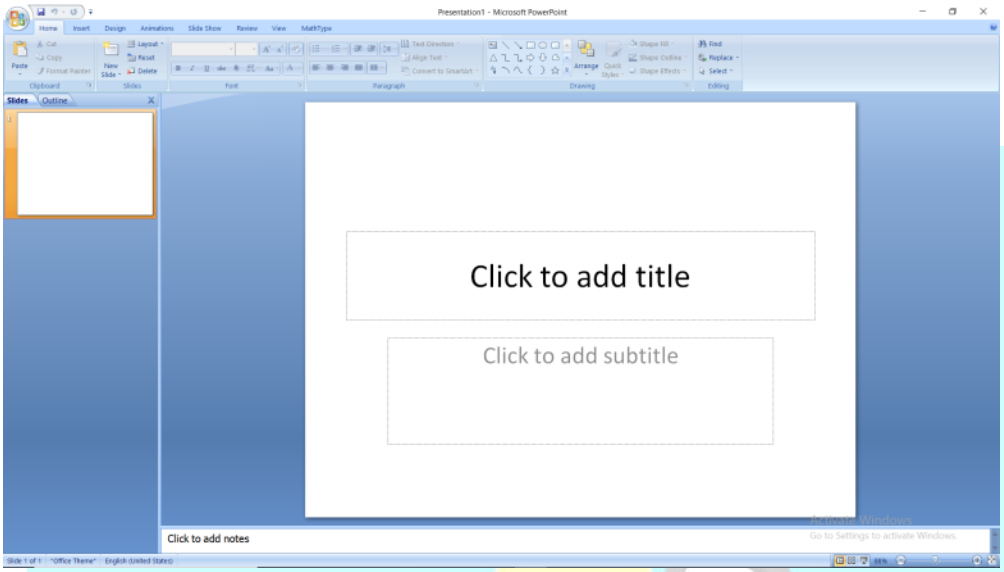
Question: How to open MS PowerPoint on a personal computer?

Answer: Follow the steps below to open MS PowerPoint on a personal computer:

1. Click on the start button
2. Then choose "All Programs"
3. Next step is to select "MS Office"
4. Under MS Office, click on the "MS PowerPoint"

MS POWERPOINT

A blank presentation is open on the screen. According to the requirement, a person can modify the template for a presentation and start using the program.



Question: What is a PowerPoint presentation or PPT?

Answer: A combination of various slides depicting a graphical and visual interpretation of data, to present information in a more creative and interactive manner is called a PowerPoint presentation or PPT.

Question: What is a slide show in a PowerPoint presentation?

Answer: When all the slides of a PowerPoint presentation are set in series and then presented to a group of people, where each slide appears one after the other, is a set pattern, this is known as a PowerPoint slide show.

Question: What all elements can be added to a slide?

Answer: The following elements can be added to a Powerpoint slide:

1. Clip Art
2. Graphs
3. Tables
4. Photographs
5. Charts
6. Media Clips
7. Videos

MS POWERPOINT

Parts of Power Point

1. The Microsoft Office Button

In the upper-left corner of the PowerPoint 2007 window is the Microsoft Office button. It›s similar to the old File Menu. When user click the button, a menu appears. User can use the menu to create a new file, open an existing file, save a file, print, and perform many other tasks.

2. The Quick Access Toolbar

Next to the Microsoft Office button in the upper left corner is the Quick Access toolbar outlined in red in the image above.

The Quick Access toolbar provides with access to commands that are frequently used. By default, Save, Undo, and Redo appear on the Quick Access toolbar. User use Save to save the file, Undo to rollback an action user have taken, and Redo to reapply an action user have rolled back. User can customize this toolbar by right clicking on it or click the small black down arrow to the right.

3. The Title Bar

The Title bar is located at the top in the center of the PowerPoint window. The Title bar displays the name of the presentation on which user are currently working. By default, PowerPoint names presentations sequentially, starting with Presentation1. When user save user file, user can change the name of user presentation.

4. The Ribbon

The Ribbon holds all of the commands and features of each of the tabs in the Ribbon. The Tabs are located across the top of the ribbon under the Title Bar. These contextual tabs will appear when user have something highlighted that calls for it. For example, if user have a picture highlighted on its slide, a Picture Tools tab will appear.

Similar tools are located in Command Groups across the ribbon.

Each Command Group includes Command Buttons to perform various actions on that group of tools.

- **Clipboard : Contains the cut, copy, paste commands. The Format Painter tool is located here as are the Paste Special, Paste as Hyperlink, and Duplicate commands.**
- **Slides : All the commonly used commands for creating new slides**
- **Font : Includes the most commonly used commands for formatting font**
- **Paragraph : Includes all of the paragraph formatting commands, vertical and horizontal alignments, text direction, bullets, numbering, indenting, spacing before and after, columns, etc. It also includes**

the dialog box for tabs.

- **Drawing : Allows to add shapes and draw on slides. This is Format Shape Dialog Box. The Status bar generally appears at the bottom of the window.**

5. Status bar

The Status bar displays the number of the slide that is currently displayed, the total number of slides, and the name of the design template in use or the name of the background.

The Outline tab displays the text contained in presentation in an outline format. The Slides tab displays a thumbnail view of all slides. User can click the thumbnail to view the slide in the Slide pane.

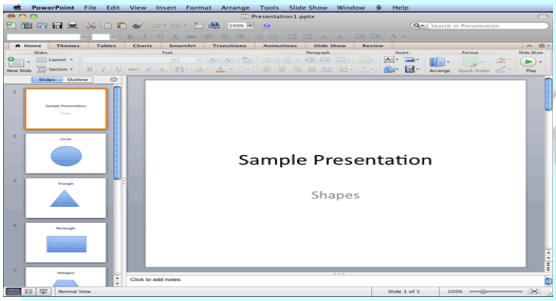
The View buttons appear near the bottom of the screen. User can use the View buttons to change between Normal view, Slider Sorter view, and the Slide Show view.

POWERPOINT VIEWS

Normal View

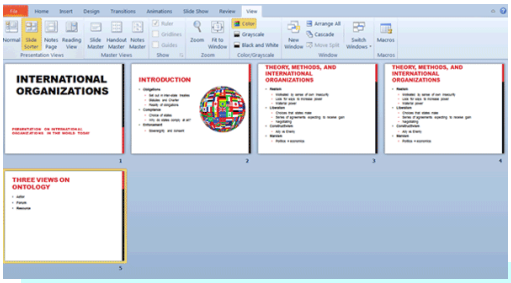
Normal view splits the screen into three major sections: the Outline and Slides tabs, the Slide pane, and the Notes area.

- **The Outline and Slides tabs are on the left side of window. They enable to shift between two different ways of viewing your slides. The Slides tab shows thumbnails of your slides. The Outline tab shows the text on slides.**
- **The Slide pane is located in the center of your window. The Slide pane shows a large view of the slide on which user currently working.**
- **The Notes area appears below the Slide pane. User can type notes on the Notes area.**



Slide Sorter View

Slide Sorter view shows thumbnails of all slides. In Slide Sorter view, user can easily add, delete, or change their order of your slides.



Slide Show View

Use the Slide Show view when want to view slides, as they will look in final presentation. When in Slide Show view:

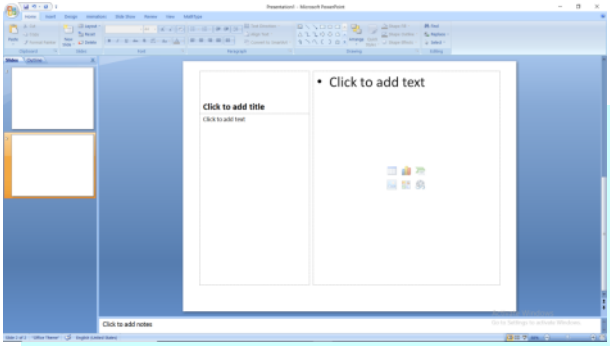
- Esc - Returns to the view using previously.
- Left-clicking - Moves you to the nextslide or animation effect. When reach the last slide, automatically return to previous view.
- Right-clicking - Opens a pop-up menu. User can use this menu to navigate the slides, add speaker notes, select a pointer, and mark presentation.

Zoom In & Zoom Out

- MINIMUM ZOOM- 10%
- MAXIMUM ZOOM- 400%

COMPONENTS OF SLIDE

- Title Placeholder : It is use to write title of slide
- Text Placeholder: It is use to descriptive text
- Object Placeholder: It is use to insert picture, graphics, chart etc.



Add New slide

- Click CTRL+M from keyboard or select New Slide option from Insert Menu
- Slide Layout pane will be appear on right side, click on appropriate layout.

Template

A template, also called a presentation design, lets you create a presentation without worrying about design elements. The template defines the color, background, and font of the slides. PowerPoint has many templates, which you can preview and select in the New Presentation window.

PowerPoint also lets you customize the templates. For instance, you can change the background color or typeface of a template.

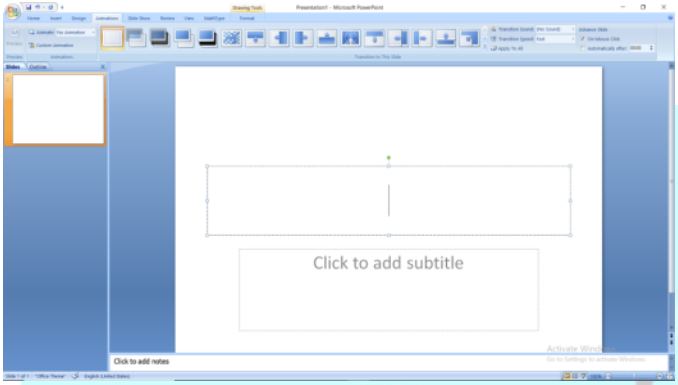
EXIT OR QUIT FROM POWERPOINT

- Choose Exit Option from File menu
  OR
- Press ALT+F4
  OR
- Click X button at the top right corner on title bar of the PowerPoint
  OR
- CTRL+W

ANIMATIONS

To add a special visual or sound effect to text or an object is called Animation.

For example, you can have your text bullet points fly in from the left, one word at a time, or hear the sound of applause when a picture is uncovered. Animations makes presentation more effect. There are variety of options available for adding animations to presentation.



Slide Transition

A slide transition is how one slide is removed from the screen and the next slide is displayed during a presentation.

To add transitions to a presentation click on the slide sorter view, located at the bottom of the screen. Thumbnails of all the slides in your presentation will appear. Click on the Transitions tab. The transitions tab contains the Transitions to This Slide group. From this group choose a special effect to be applied during the transition between the previous slide to the next slide.

To apply transition schemes to all the slides in your presentation select Apply to All.

Triggers

Triggers give you specific click points for controlling animation, and are especially useful when you want several effects on a slide. In the Animation Pane, select the animated shape or other object that you want to trigger to begin playing when you click it.

In MS Powerpoint, we can add many types of Image and Sound formats such as : .gif, .png, .bmp, .jpg, .wav, .mid, mp4 etc

MS POWERPOINT

IMPORTANT SHORTCUTS

Ctrl + Letters

Ctrl + A Selects all the objects on the active slide

Ctrl + B Toggles bold on the current selection

Ctrl + C Copies the current selection to the clipboard (Edit > Copy)

Ctrl + D Make a duplicate of the selected slide (Edit > Duplicate)

Ctrl + E Centre aligns the current selection

Ctrl + F Displays the (Edit > Find) dialog box

Ctrl + G Displays the (View > Grid and Guides) dialog box

Ctrl + H Displays the (Edit > Replace) dialog box

Ctrl + I Toggles italics on the current selection

Ctrl + J Justifies the current selection

Ctrl + K Displays the (Insert > Hyperlink) dialog box (in a textbox)

Ctrl + L Left aligns the current selection

Ctrl + MInserts a new slide (Insert > New Slide)

Ctrl + N Creates a new presentation (File > New)

Ctrl + O Displays the (File > Open) dialog box

Ctrl + P Displays the (File > Print) dialog box

Ctrl + R Right aligns the current selection

Ctrl + S Saves, Displays the (File > Save As) dialog box if a new presentation

Ctrl + T Displays the (Format > Font) dialog box

Ctrl + U Toggles (continuous) underlying of the selection

Ctrl + V Pastes the entry from the clipboard (Edit > Paste)

Ctrl + W Closes the active presentation or window (File > Close)

Ctrl + X Cuts the current selection to the clipboard (Edit > Cut)

Ctrl + Y Repeats the last Presentation action (Edit > Repeat)

Ctrl + Z Undo the last Presentation action (Edit > Undo)

Function Keys

F1 Display Help or the Office Assistant

F2 Select the text box containing an object or text

F4 Repeats the last presentation action (Edit > Repeat) (not Format Autoshape dialog)

F5 Runs the presentation (View > Slide Show)

F6 Moves to the next pane in the presentation (clockwise)

F7 Displays the (Tools > Spelling) dialog box

F10 Toggles the activation of the Menu Bar

F12 Displays the (File > Save As) dialog box

Ctrl + Function

Ctrl + F4 Closes the active presentation or window (File > Close)

Ctrl + F5 Restore the size of the active presentation or window

Ctrl + F6 Moves to the next presentation window

Ctrl + F7 Activates the Move window command

Ctrl + F8 Activates the Resize window command

Ctrl + F9 Minimises the size of the active presentation or window

Ctrl + F10 Maximise the size of the active presentation or window

Ctrl + F12 Displays the (File > Open) dialog box

MS ACCESS

- ✓ **MS Access is a Database Management system which was launched by Microsoft. It is a part of the Microsoft Office suite and stores data in its own format.**
- ✓ **Microsoft Access is a database management system (DBMS) that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools.**

❖ It handles data management tasks.
❖ Microsoft Access allows users to manipulate large amounts of information and retrieve any part of the information.
❖ It is a structured database containing data tables that are arranged in a uniform structure of records and fields.
❖ A spreadsheet is a table used by small organisations that operates with a limited amount of data but for big organisations a Database Management System is preferred because it needs storing huge amount of data and retrieves it much faster.
❖ In database management system the content and the location of the data is defined by meta data.

- On November 13, 1992, the first version on MS Access was released by Microsoft
- Before MS Access 2007, the file extension was '.mdb', but in MS Access 2007 the extension has been changed to '.accdb' extension.
- Early versions of Access cannot read accdb extensions but MS Access 2007 and later versions can read and change earlier versions of Access.

Differences between Access and Excel

Microsoft Access and Excel are very similar yet very different. Here, are some important difference points between both of them-

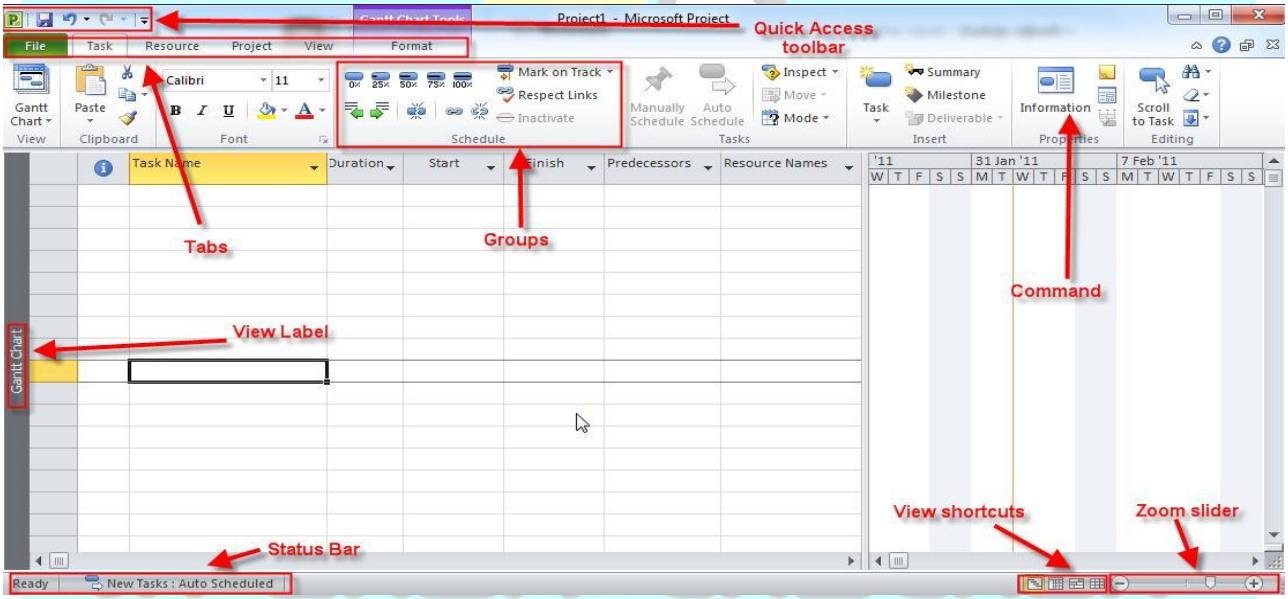
Access	Excel
Deals with text, numbers, files and all kinds of data	Microsoft Excel generally deals with numerical data
All the data is stored one time, in one place.	Lots of worksheets or documents are a store with similar, repeated data.
Helps you to build highly functional data entry forms and report templates.	Only the primary data entry screen is available.

Users will be able to enter the data more efficiently and accurately.	**Data accuracy and speed is not much because of the format.**

USES OF MS ACCESS

MS Access can be used to develop application software and is generally used by data architects, software developers and power users. Following are the major uses of MS Access:

- Manage accounts and bills
- Store data in the form of tables and edit or customise them later as per the requirement of the user
- It can be used to make our websites
- Comparing data or finding a relationship between the existing data can be done using Access

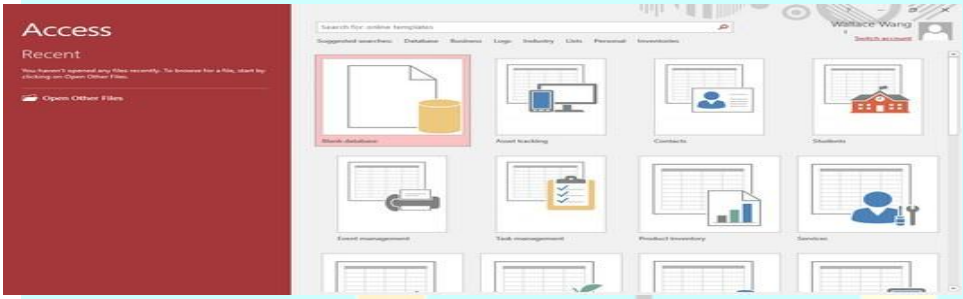


How to start MS Access Program

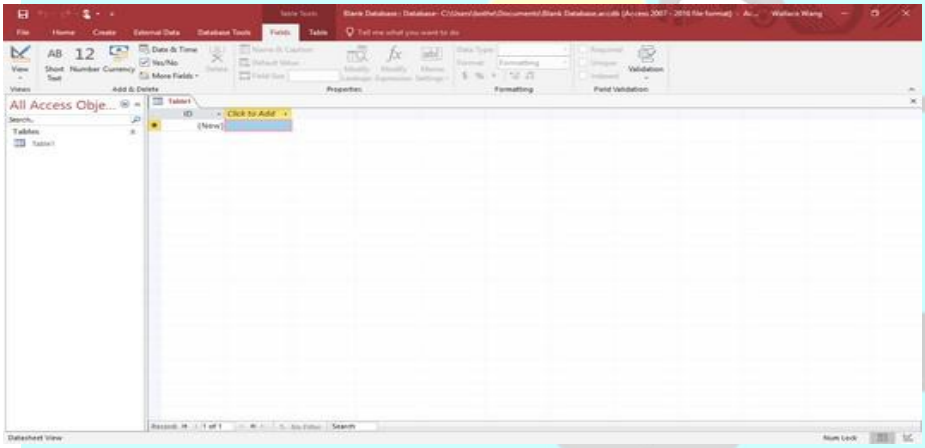
Click start → All programs → Microsoft office → Microsoft Access.

How to Create an Access Database

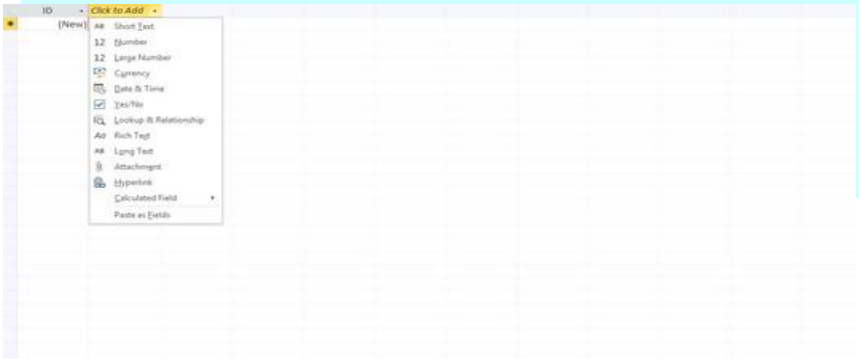
- Click the File tab.
- Choose New.
- Access displays a variety of database templates you can use.
- Click an icon, such as Blank Database, or any database template. When you click a template, a window appears; you see a preview of your template.
- Click in the File Name text box and type a descriptive name for your database.
- Click the Create button to create your database file.



- Access displays a blank database.



- Click the Click to Add heading. Access displays a menu for defining what type of data that field can hold, such as text or numbers.



- Choose Long Text. Access displays a generic field name, such as Field1.
- Type a name for your field (such as First Name or Salary).
- Press Enter.
  Access displays another Click to Add column; its menu lets you choose the type of data to store in the next field.
- Choose Long Text or any other data type you want the field to hold. Access displays another generic field, such as Field1.
- Type a name for your field, such as Last Name.
- Repeat Steps 9 through 11 for each additional field you want to create.
- When you have finished adding fields, press Esc on the keyboard.

MS ACCESS OBJECTS

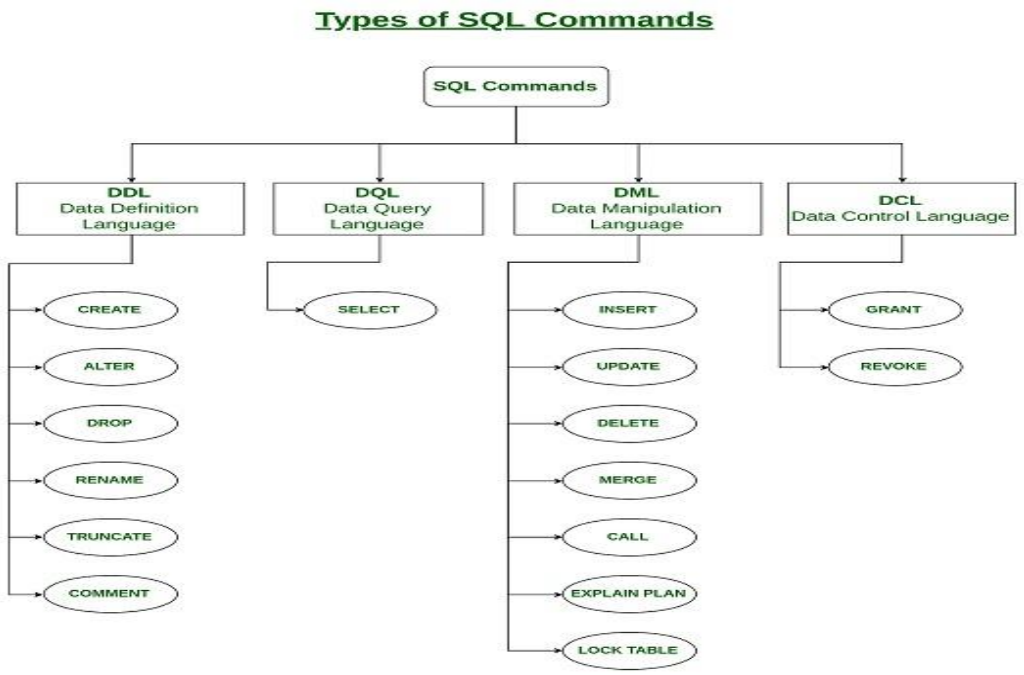
Tables: Tables are where the actual data is defined and entered. Tables consist of records (rows) and fields (columns).

- **Field : A space allocated for a particular item of information is field. Afield is a column in a table. SQL Server supports more fields, but only 255 fields are visible in Access. The definition of a field includes the name of the field, the type of data that is stored in the field, and any validation rules that you must have to validate the stored data. For example a tax form, contains a number of fields such as name, address, income and so on. In database systems, fields are the smallest units of information. In spreadsheets, fields are called cells.**

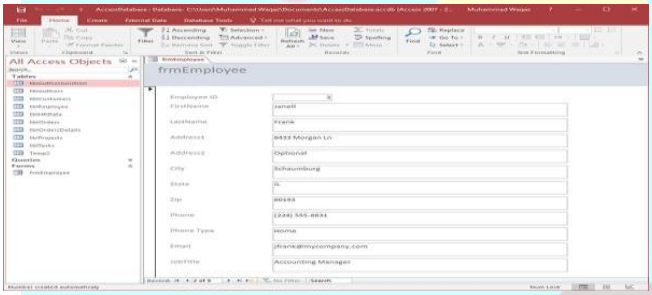
- **Record : In database management systems, a record is a row in a table.We may store any number of records in a table. Records are composed of fields, each of which contains one item of information. A set of records makes a file. For example, a personnel file contains records that have fields such as name, address and a phone number etc.**

Queries: Queries are basically questions about the data in a database. A query consists of specifications indicating which fields, records, and summaries want to see from a database. Queries allow to extract data based on the criteria user define.

Query Type	Description
Select query	Retrieves data from one or more tables and displays the record set in a datasheet. This is the most common type of query.
Parameter query	Prompts the user to enter values that define the query, such as specified region for sales results or a specified price range for houses.
Cross-tab query	Arranges a recordset to make it more easily visible, using both row headings and column headings.
Action query	Creates a new table or changes an existing table.
SQL query	An advanced query that is created by using an SQL statement.



Forms : Forms are designed to ease the data entry process. For example, To create a data entry form that looks exactly like a paper form.



Reports: When a user want to print records from user database, design a report. Access even has a wizard to help produce mailing labels.

Pages: A data access page is a special type of Web page designed for viewing and working with data from the Internet or an intranet. This data is stored in a Microsoft Access database or a Microsoft SQL Server database.

Macros: A macro is a set of one or more actions that each performs a particular operation, such as opening a form or printing a report. Macros can help user automate common tasks. For example, user can run a macro that prints a report when a user clicks a command button.

Modules: A module is a collection of Visual Basic for Applications declarations and procedures that are stored together as a unit. This allows a set of pre-defined instructions to be created by a programmer in the database. They can be used throughout the database.

OTHER IMPORTANT TERMS

Database File : A database is a collection of related information that is organized so that it can easily be accessed, managed and updated. We organize files by storing them in folders.

"The process of arranging data in logical sequence is called sorting."

It is an integrated collection of logically-related records that provide data for one or more multiple uses. We can also perform operations on the data that is in a database.

File updating : In computing, reviewing and altering the records in a file to ensure that the information they contain is accurate and up-to-date. Three basic processes are involved:

- adding new records,
- deleting existing records,
- amending existing records.

Database engine : A database engine is a part of a DBMS. It provides a link between the DBMS and the physical data on the hard disk.

Field Name : It is a label provide for a field that specifies the type of information contained in a particular field.

Rules for naming field

a. It can be up to 64 characters long.
b. The naming cannot include control characters.
c. It cannot begin with leading spaces.
d. It can include any combination of letters, numbers, spaces and special characters except a period (.), an exclamation mark (!), an accent grave (`) and brackets ([ ]).

Field Type/Data Type : It specifies the type of data stored in the field such as textual data and numerical data or combination of both. The default size of data type is 50 in MS-Access.

Data type	Field length or Field size
Text	0-255 characters
Memo	0.65535 characters
Number	1, 2, 4 or 8 bytes
Date/Time	8 bytes
Currency	8 bytes
Auto Number 4 bytes	4 bytes
Yes/No	1 bit (0 or 1)
OLE object	Upto 1 GB
Hyperlink	Each part contains 2048 characters

Field Length : Field refers length or width to the maximum number of characters that a field can contain.

MS ACCESS

MS-Access View- You can create a table by two most popular ways

a. **Database View** : It shows the data in the database and also allows you to enter and edit the data but not allow to change the database.
b. **Design View** : It allows you to create or change the table and also set the keys.
c. **Filtering Data** : It enables to display only those records in a table that meet a specified filter criterion.

Primary Key - Primary key is a field or group of fields that uniquely identify records in a table. Every table can have only one primary key Primary key cannot be null value it always has unique value. Primary key is used to relate one table to another as a foreign key. Foreign key: Foreign key is a key in a table that refers to primary key Held in another table.

The differences between primary key and foreign key

Primary Key	Foreign Key
• It is a column or a set of column that can be used to uniquely identify a row in a table.	• It is a column or a set of column that refer to a primary key or a candidate key of another table.
• A table can have a single primary key that can reference different tables.	• A table can have multiple foreign key that can reference different tables.

POINTS TO REMEMBER

✓ **Filtering Data** : It enables to display only those records in a table that meet a specified filter criterion.

✓ **Validation Rule** : It is a condition that must be met before the data is accepted into the database.
✓ **Validation Text** - It appears if a validation rule is not satisfied.

✓ **The Required field** - property makes data entry compulsory so that the field cannot be left blank.

✓ **Relationship** : It is an association between access table or quarries that use related field. It is a link between tables and enables us to accessed data from both tables simultaneously.
Relationship can be divided in three categories; One-in-One, One-to-Many and Many-to-Many.

✓ **Attributes** : Attributes can be defined as the characteristics of an entity to identify in uniquely. Such as student's attributes are his Roll-No, Section, Name etc.

✓ **Memo**- It allows long blocks of text, that use text formatting

✓ **OLE Object-** it is an acronym for object linking embedding. It can store objects such as a video clip. a picture, word document etc.

MS EXCEL

Microsoft Excel is a spreadsheet developed by Microsoft for Windows, macOS, Android and iOS. It features calculation, graphing tools, pivot tables, and a macro programming language called Visual Basic for Applications (VBA). Microsoft Excel is a spreadsheet tool capable of performing calculations, analyzing data and integrating information from different programs.

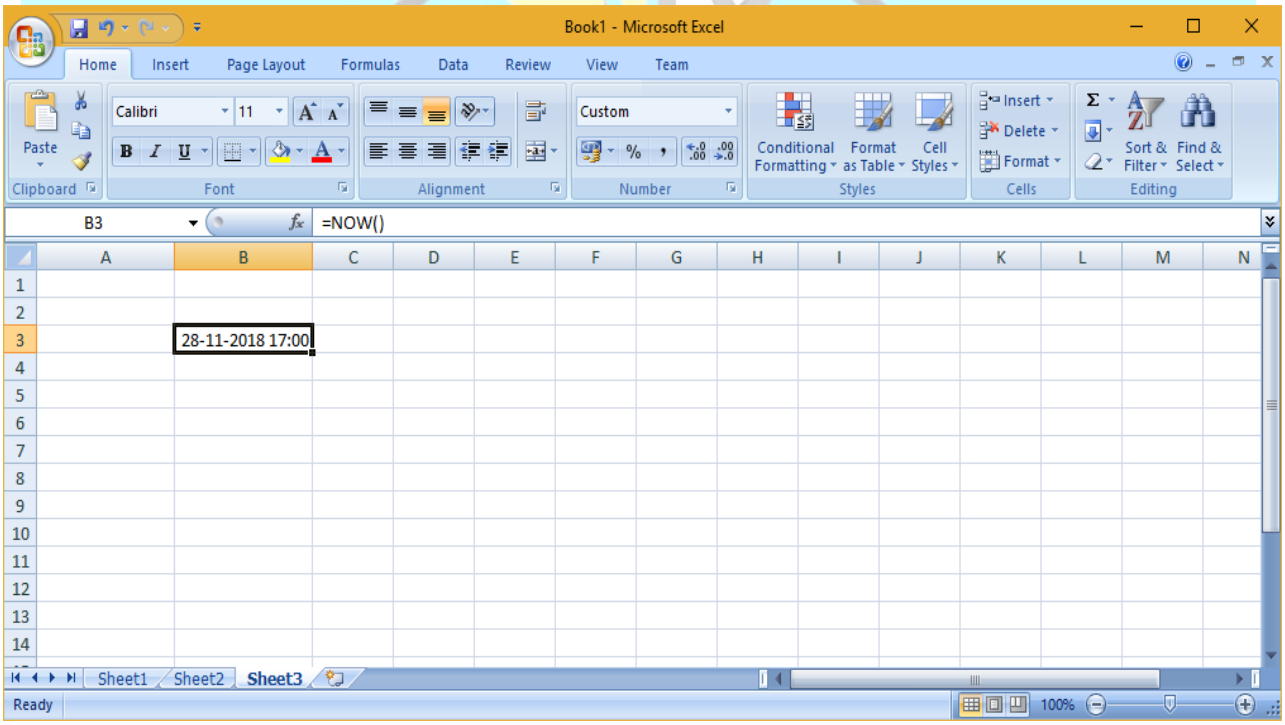
Running Excel is not different from running any other Windows program.

1. **Click on start menu**
2. **Point to all programs**
3. **Point to Microsoft Excel**
4. **Click on Microsoft Excel**

‘ By default, documents saved in Excel (2007 onwards) are saved with the .xlsx extension whereas the file extension of the prior Excel Versions(2003) are .xls’

EXCEL 2007 versus EXCEL 2003 and earlier

- **For basic data analysis using the Data Analysis Toolpack, such as descriptive statistics and regression, versions of Microsoft Excel from 1997 on are adequate.**
- **However, the user interface for Excel 2007 is much different from that in earlier versions.**
- **The File Menu is replaced with the Microsoft Office Button . This is used to open, save and print files.**
- **The other Menus (Edit, View, Insert, Format, Tools, Data, Window and Help) and drop-down dialog boxes and toolbar icons have been greatly rearranged and replaced by the Microsoft Office fluent user interface that uses Ribbons and Groups.**



SPREADSHEET

- An electronic document in which data is arranged in the rows and columns of a grid and can be manipulated and used in calculations.
- A spreadsheet is collection of electronic sheet which contain various type of data in to rows and columns.
- An arrangement of cells in columns and rows used to organize, analyze, calculate, and report information.

The Microsoft Office Button- In the upper-left corner of the Excel 2007 window is the Microsoft Office button.When you click the button, a menu appears. You can use the menu to create a new file, open an existing file, save a file, print and perform many other tasks.

The Quick Access Toolbar

Next to the Microsoft Office button is the Quick Access toolbar. The Quick Access toolbar gives you quick access to commands you frequently use.

The Title Bar

Next to the Quick Access toolbar is the Title bar. On the Title bar, Microsoft Excel displays the name of the workbook you are currently using. At the top of the Excel window, you should see "Book 1 - Microsoft Excel" or a similar name.

The Ribbon Bar

The commands are organized by Tab and Group. At the highest level is the Ribbon for each Tab. Here this is is shown for the Home Tab.

Various editing and formatting can be done on an Excel spreadsheet. Discussed below are the various features of MS Excel.

1. **Home**

Comprises options like font size, font styles, font colour, background colour, alignment, formatting options and styles, insertion and deletion of cells and editing options

2. **Insert**

Comprises of options like table format and style, inserting images and figures, adding graphs, charts and sparklines, header and footer option, equation and symbols

3. **Page Layout**

Themes, orientation and page setup options are available under the page layout option

4. Formulas

Since tables with a large amount of data can be created in MS excel, under this feature, you can add formulas to your table and get quicker solutions

5. Data

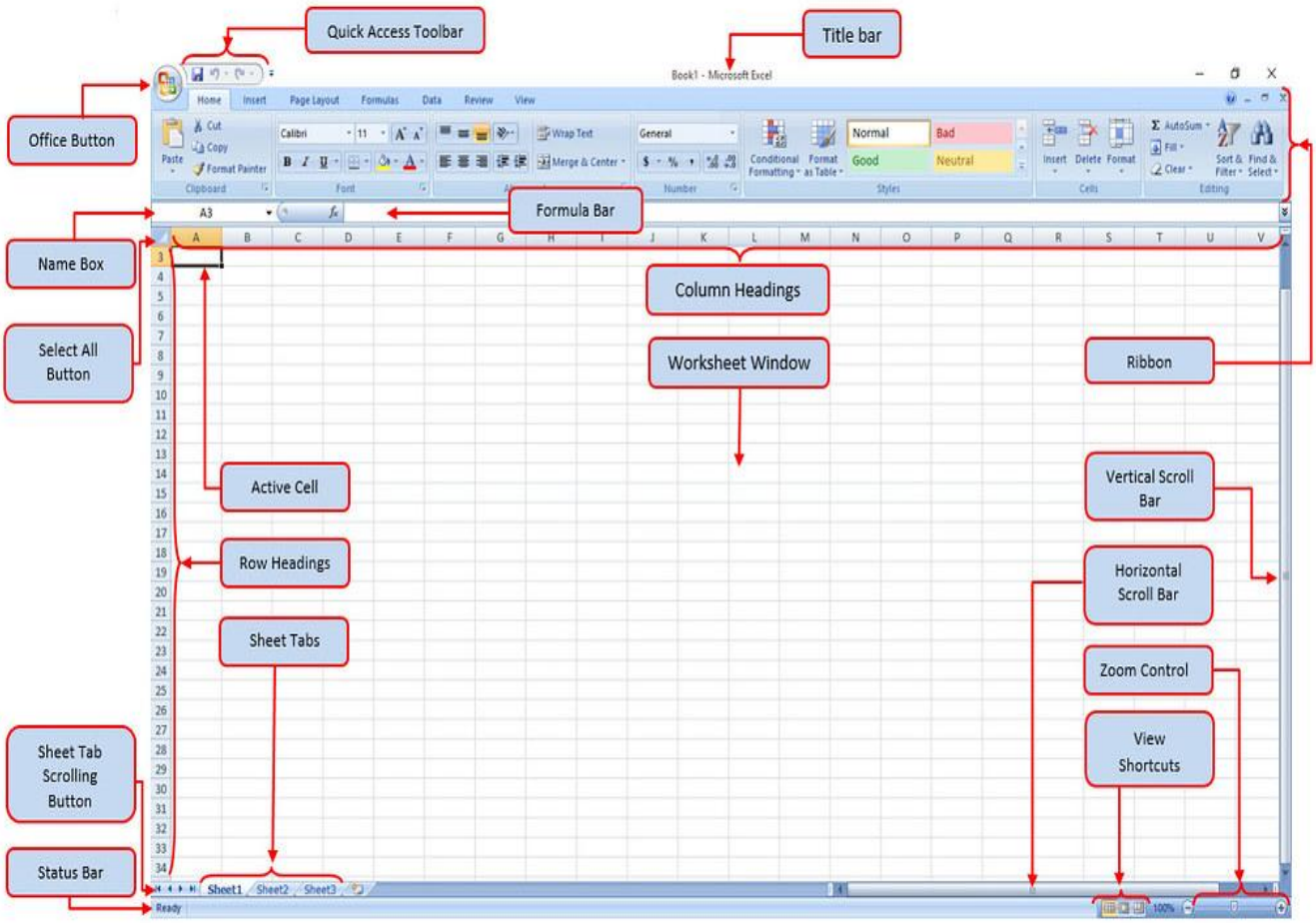
Adding external data (from the web), filtering options and data tools are available under this category

6. Review

Proofreading can be done for an excel sheet (like spell check) in the review category and a reader can add comments in this part

7. View

Different views in which we want the spreadsheet to be displayed can be edited here. Options to zoom in and out and pane arrangement are available under this category



- **CELL**- The intersection of a row and column is called a cell.

- **Active Cell**: The active cell is the cell in the spreadsheet that is currently selected for data entry. You can change which cell is the active cell by clicking the left mouse button once or using the arrow keys on the keyboard. The current active cell can be identified as being the one that has a darker black border around it. Also, the active cell reference is listed in the Name Box directly above the spreadsheet's column headings.

- **CELL NAME/ADDRESS**- Cells are identified by the Cell Name (or Reference, which is found by combining the Column Letter with the Row Number. For example the cell in Column "C" in Row "3" would be cell C3. Cells may contain Labels, Numbers, Formulas or Functions.

- **COLUMNS AND ROWS**- Upto Excel 2003, the standard amount of columns was 256 and 65536 rows. (columns represented in alphabets & rows represented in numbers)
  EXCEL 2007 onwards , maximum number of rows per sheet increased to 1048576 and columns to 16384.

- **Name Box:** The name box appears to the left of the formula bar and displays the name of the current cell. Unless you define a cell or range of cells with a specific name, the name box will display the cell reference of the active cell.

- **Formula Bar**: The formula bar appears directly above the column headings of a spreadsheet and will display what has been typed into the active cell. For example, if you click on a cell that contains the formula =A3+C3, the cell itself will show the result of the formula. The formula bar, however, will display what has actually been typed into the cell which, in this case, is =A3+C3.

- **Function**: Functions are built-in formulas that are used to enter either commonly used or very complex formulas. Like formulas, functions begin with an equal sign "=" and use cell references in their format. One commonly used function is the Sum function, which will add up the values in a range. The function: =sum(H2:H25) would add all values contained in cells H2 through H25 and return the result when the enter key is pressed.

- **Workbook:** A workbook is a collection of worksheets that are saved together in one file. Individual worksheets can be given descriptive names and you can switch from one worksheet to another by using the sheet tabs that appear beneath the worksheet grid area.
- **Merging Cells:** Ms excel allows merging of one cell with adjacent cell (that are blank) to form a big cell. It is useful especially while creating a decorative title for thr worksheet.

To merge and center two or more cells follow these steps: Select the cells. Press and release ALT key, following by H, M, and M key on keyboard.

The basics of Excel formulas

FORMULAE: Excel formulae can be used to perform simple calculations on the data like addition, subtraction, multiplication and division. One of the significant features of a spreadsheet program is its ability to manipulate data and perform simple and complex calculations effieicntly. Formulae usually consist of one or more cell addresses or values and a mathematical operator such as +, -, * and /.

For example, =A2+A2+A3+A4 is a formula that adds up the values in cells A2 through A4.

Operators:

- () PARANTHESIS
- ^ EXPONENTIAL
- * MULTIPLICATION
- / DIVISION
- + ADDITION
- - SUBSTRACTION

Functions: Functions are pre-designed formulas that save you the time and trouble of creating commonly used or complex equations. Excel includes hundreds of functions that you can use alone or in combination with other formulas or functions. Functions perform a variety of calculations, from adding, averaging, and counting, to more complicated tasks, such as calculating the monthly payment amount of a loan. you can enter a function manually if you know its name and all the required arguments, or you can easily insert a function using the paste Function feature.

For example, instead of specifying each value to be summed like in the above formula, you can use the SUM function to add up a range of cells: =SUM(A2:A4)

Excel Macros: An Excel macro is an action or a set of actions that you can record, give a name, save and run as many times as you want and whenever you want. Macros help you to save time on repetitive tasks involved in data manipulation and data reports that are required to be done frequently.

MS EXCEL SHORT CUTS

- Ctrl + N Create a new workbook.
- Ctrl + O Open an existing workbook.
- Ctrl + S Save the active workbook.
- Ctrl + W Close the active workbook.
- Ctrl + C Copy the contents of the selected cells to Clipboard.
- Ctrl + X Cut the contents of the selected cells to Clipboard.
- Ctrl + V Insert the contents of the Clipboard into the selected cell(s).
- Ctrl + Z Undo your last action.
- Ctrl + P Open the "Print" dialog.

Navigating and viewing data

- Ctrl + F1 Show / hide the Excel Ribbon. Hide the ribbon to view more than 4 rows of data.
- Ctrl + Tab Switch to the next open Excel workbook.
- Ctrl + PgDown Switch to the next worksheet. Press Ctrl + PgUp to switch to the previous

sheet.

- Ctrl + G Open the "Go to" dialog. Pressing F5 displays the same dialog.
- Ctrl + F Display the "Find" dialog box.
- Home Return to the 1st cell of the current row in a worksheet.
- Ctrl + Home Move to the beginning of a worksheet (A1 cell).
- Ctrl + End Move to the last used cell of the current worksheet, i.e. the lowest row of the rightmost column.

Selecting Cells

- Shift+Left/Right Arrow: Extend the cell selection to the left or right
- Shift+Space: Select the entire row
- Ctrl+Space: Select the entire column
- Ctrl+Shift+Space: Select the entire worksheet
- Ctrl + A Select the entire worksheet. If the cursor is currently placed within a table, press once to select the table, press one more time to select the whole worksheet.

Formatting Cells

- Ctrl+B: Add or remove bold to the contents of a cell, selected data, or selected cell range
- Ctrl+I: Add or remove italics to the contents of a cell, selected data, or selected cell range
- Ctrl+U: Add or remove underline to the contents of a cell, selected data, or selected cell range
- Alt+H+H: Select a fill color
- Alt+H+B: Add a border
- Ctrl+Shift+&: Apply outline border
- Ctrl+Shift+_ (Underline): Remove outline border
- Ctrl+9: Hide the selected rows
- Ctrl+0: Hide the selected columns
- Ctrl+1: Open the Format Cells dialog box
- Ctrl+5: Apply or remove strikethrough

ONE LINERS FOR MS EXCEL

- Maximum Length of formula contents- 8,192 characters
- Maximum Users who can open and share a shared workbook at the same time- 256
- What do you mean by a Workspace- Group of Workbooks
- The first cell in EXCEL worksheet is labeled as- A1
- What happens when dollar signs ($) are entered in a cell address- An absolute cell address is created
- What are the tabs that appear at the bottom of each workbook called Sheet tabs
- What is the keyboard shortcut for creating a chart from the selected cell range- F11
- Which of the following shortcuts can be used to insert a new line in the same cell- Alt + Enter
- If particular workbook have to open each time Excel started, where that workbook should be laced- XLSTART Folder
- What is the shortcut key to hide entire row- CTRL + 9
- What is the shortcut key to insert a new comment in a cell- Shift + F2
- What is the shortcut key to insert new sheet in current workbook- Shift + F11
- Which one is the last column header in Excel 2007- XFD
- In maximum, how many sheets can be set as default while creating new workbook- 255
- In EXCEL, you can sum a large range of data by simply selecting a tool button called- Auto sum
- Getting data from a cell located in a different sheet is calledReferencing
- Concatenation of text can be done using- Ampersand (&)
- Which language is used to create macros in Excel- Visual Basic
- Multiple calculations can be made in a single formula using- Array Formula

INTERNET AND EMAIL

INTERNET- The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP- called the backbone of internet) to link various billion devices worldwide. It is an international network of networks that consists of millions of private, public, academic, business, and government packet switched networks, linked by a broad array of electronic, wireless, and optical networking technologies.

HISTORY OF INTERNET

The Internet emerged in the United States in the 1970s but did not become visible to the general public until the early 1990s. By 2020, approximately 4.5 billion people, or more than half of the world's population, were estimated to have access to the Internet.

The first workable prototype of the Internet came in the late 1960s with the creation of ARPANET, or the Advanced Research Projects Agency Network. Originally funded by the U.S. Department of Defense, ARPANET used packet switching to allow multiple computers to communicate on a single network.

The technology continued to grow in the 1970s after scientists Robert Kahn and Vinton Cerf developed Transmission Control Protocol and Internet Protocol, or TCP/IP, a communications model that set standards for how data could be transmitted between multiple networks.

ARPANET adopted TCP/IP on January 1, 1983, and from there researchers began to assemble the "network of networks" that became the modern Internet. The online world then took on a more recognizable form in 1990, when computer scientist Tim Berners-Lee invented the World Wide Web. While it's often confused with the internet itself, the web is actually just the most common means of accessing data online in the form of websites and hyperlinks.

During 1991-1993 commercial use of Internet took its speed.

- For the first time, on 15 August 1995 VSNL (Videsh Sanchar Nigam Limited) and ISP (Internet Service Provider) launched Internet services in india.
- The First political party of India is Bharatiya Janata Party, which created its own website on internet.
- First telephone directory on internet was made available by Sikkim state.
- India's first Hi-speed rural broadband network has been commissioned in district of Idukki, Kerala.

Ways To Connect To Internet

The different ways in which one can connect to the Internet are discussed below in brief:

Dial-Up – In such connections, users are required to link their phone line to a computer to access the Internet. Under this connection, the user cannot make or receive phone calls through tier home phone service

Broadband – Provided either through cable or phone companies, Broadband is a high-speed internet connection which is widely used today. The term broadband is shorthand for broad bandwidth. Broadband Internet connections such as DSL and cable are considered high-bandwidth connections. Although many DSL connections can be considered broadband, not all broadband connections are DSL.

- DSL : DSL which stands for Digital Subscriber Line, uses existing 2-wire copper telephone line connected to one's home so service is delivered at the same time as landline telephone service. Customers can still place calls while surfing the Internet.

- Cable : Cable Internet connection is a form of broadband access. Through use of a cable modem, users can access the Internet over cable TV lines. Cable modems can provide extremely fast access to the Internet.

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Wireless Connection – Wi-fi and Mobile service providers fall under this category. Internet connectivity is made via radio waves and the Internet can be connected anywhere, irrespective of the location. Given below are a few examples of wireless connection:

Wi-fi – Wireless Fidelity or wi-fi allows high-speed internet connectivity without the use of wires

WI-MAX- Wi-Max stands for Wireless Inter-operability for Microwave Access. Wi-Max uses spectrum to deliver connection to network and handle a larger inter-operable network. Wi-Max is used in MAN applications. Wi-Max uses spectrum to deliver connection to network. Wi-Max is used to provide internet services such as Mobile Data and hotspots.

Sr. No.	Key	Wifi	WiMax
1	**Definition**	Wifi stands for Wireless Fidelity.	WiMax stands for Wireless Inter-operability for Microwave Access.
2	**Usage**	WiFi uses Radio waves to create wireless high-speed internet and network connections. A wireless adapter is needed to create hotspots.	WiMax uses spectrum to deliver connection to network and handle a larger inter-operable network.
3	**IEEE**	Wifi is defined under IEEE 802.11x standards where x defines various WiFi versions.	WiMax is defined under IEEE 802.16y standards where y defines various WiMax versions.
4	**Usage**	Wifi is used in LAN applications.	WiMax is used in MAN applications.
5	**QoS**	Wifi does not gurrantee Quality of Service, QoS.	WiMax guarantees Quality of Service, QoS.
6	**Network Range**	Wifi network ranges at max 100 meters.	WiMax network ranges to max 90 kms.
7	**Transmission speed**	Wifi transmission speed can be upto 54 mbps.	WiMax transmission speed can be upto 70 mbps.

Hotspots: Hot-spots are sites that offer Internet access over a wireless local area network (WLAN) by way of a router that then connects to an Internet service provider. Hot-spots utilize Wi-Fi technology, which allows electronic devices to connect to the Internet or exchange data wirelessly through radio waves. Hotspots can be phone-based or free-standing, commercial or free to the public.

Mobile Phones – All smartphones are now equipped with an option for Internet connectivity which can be availed using Internet vouchers and packs. No external connection or wire is required for these

Satellite – Where broadband connections are unavailable, satellites are used for wireless Internet connectivity

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Integrated Services Digital Network – ISDN allows users to sent audio or video data using telephone lines.The installation of an ISDN adapter is required at both ends of the transmission—on the part of the user as well as the Internet access provider.

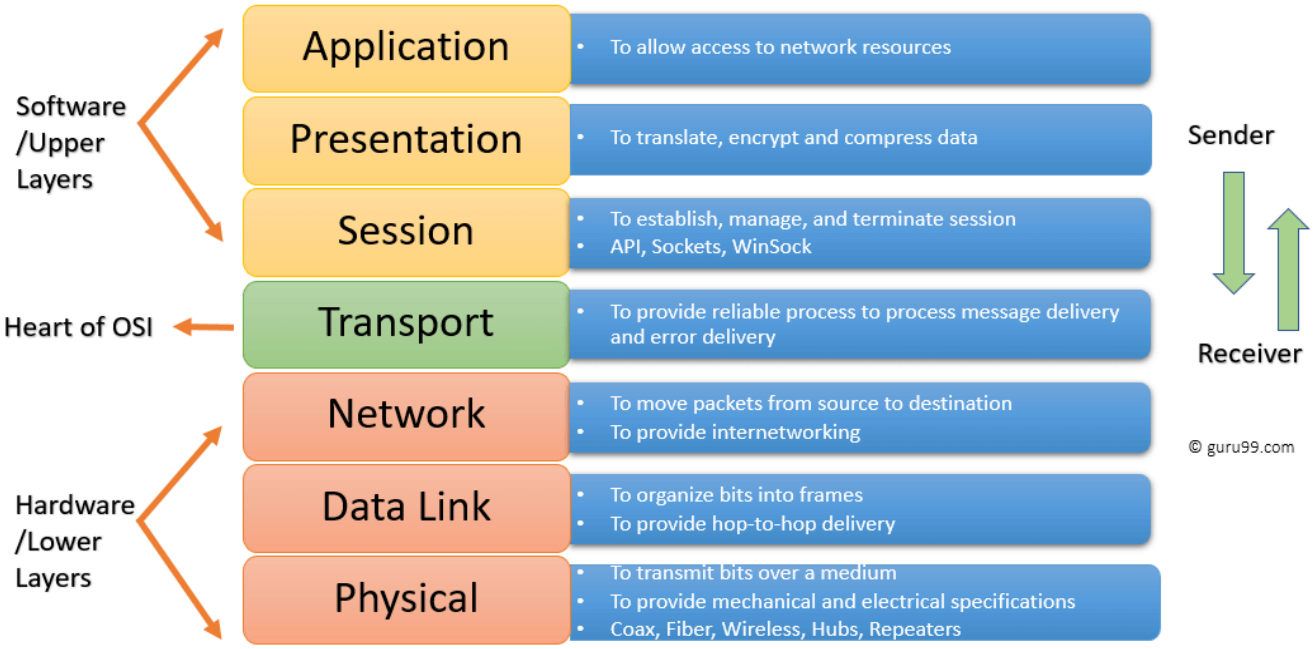
NETWORK PROTOCOLS

In networking, a protocol is a set of rules for formatting and processing data. Network protocols are like a common language for computers. The computers within a network may use vastly different software and hardware; however, the use of protocols enables them to communicate with each other regardless.

On the Internet, there are different protocols for different types of processes. Protocols are often discussed in terms of which OSI model layer they belong to.

ISO/OSI Network Model

The standard model for networking protocols and distributed applications is the International Standard Organization's Open System Interconnect (ISO/OSI) model. It defines seven network layers.



There are various types of protocols that support a major and compassionate role in communicating with different devices across the network. These are:

1. **Transmission Control Protocol (TCP):** TCP is a popular communication protocol which is used for communicating over a network. It divides any message into series of packets that are sent from source to destination and there it gets reassembled at the destination.
2. **Internet Protocol (IP):** IP is designed explicitly as addressing protocol. It is mostly used with TCP. The IP addresses in packets help in routing them through different nodes in a network until it reaches the destination system. TCP/IP is the most popular protocol connecting the networks.
3. **User Datagram Protocol (UDP):** UDP is a substitute communication protocol to Transmission Control Protocol implemented primarily for creating loss-tolerating and low-latency linking between different applications.
4. **Post office Protocol (POP):** POP3 is designed for receiving incoming E-mails.

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5. **Simple mail transport Protocol (SMTP):** SMTP is designed to send and distribute outgoing E-Mail.
6. **File Transfer Protocol (FTP):** FTP allows users to transfer files from one machine to another. Types of files may include program files, multimedia files, text files, and documents, etc.
7. **Hyper Text Transfer Protocol (HTTP):** HTTP is designed for transferring a hypertext among two or more systems. HTML tags are used for creating links. These links may be in any form like text or images. HTTP is designed on Client-server principles which allow a client system for establishing a connection with the server machine for making a request. The server acknowledges the request initiated by the client and responds accordingly.
8. **Hyper Text Transfer Protocol Secure (HTTPS):** HTTPS is abbreviated as Hyper Text Transfer Protocol Secure is a standard protocol to secure the communication among two computers one using the browser and other fetching data from web server. HTTP is used for transferring data between the client browser (request) and the web server (response) in the hypertext format, same in case of HTTPS except that the transferring of data is done in an encrypted format. So it can be said that https thwart hackers from interpretation or modification of data throughout the transfer of packets.
9. **Telnet**: Telnet is a set of rules designed for connecting one system with another. The connecting process here is termed as remote login. The system which requests for connection is the local computer, and the system which accepts the connection is the remote computer.
10. **Gopher**: Gopher is a collection of rules implemented for searching, retrieving as well as displaying documents from isolated sites. Gopher also works on the client/server principle.
11. **PPP**: In computer networking, Point-to-Point Protocol (PPP) is a data link layer (layer 2) communication protocol between two routers directly without any host or any other networking in between. It can provide connection authentication, transmission encryption, and data compression.

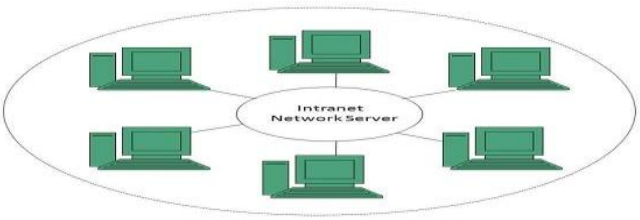
PPP is used over many types of physical networks, including serial cable, phone line, trunk line, cellular telephone, specialized radio links, ISDN, and fiber optic links such as SONET. Internet service providers (ISPs) have used PPP for customer dial-up access to the Internet, since IP packets cannot be transmitted over a modem line on their own without some data link protocol that can identify where the transmitted frame starts and where it ends.

12. **VoIP**- VoIP (voice over Internet Protocol) is the transmission of voice and multimedia content over an internet connection. VoIP allows users to make voice calls from a computer, smartphone, other mobile devices, special VoIP phones.

Intranet

Intranet is defined as private network of computers within an organization with its own server and firewall. Moreover we can define Intranet as:

- Intranet is system in which multiple PCs are networked to be connected to each other. PCs in intranet are not available to the world outside of the intranet.
- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.
- Every computer in internet is identified by a unique IP address.
- Each computer in Intranet is also identified by a IP Address, which is unique among the computers in that Intranet.



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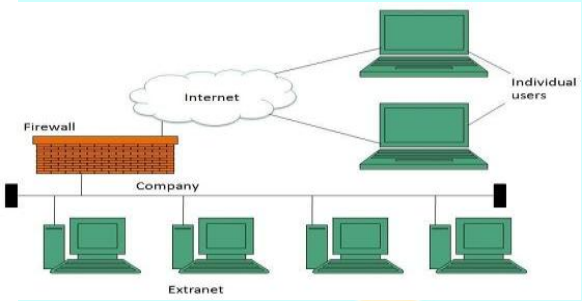
Extranet

Extranet refers to network within an organization, using internet to connect to the outsiders in controlled manner. It helps to connect businesses with their customers and suppliers and therefore allows working in a collaborative manner.

Extranet is implemented as a Virtual Private Networks (VPN) because it uses internet to connect to corporate organization and there is always a threat to information security. VPN offers a secure network in public infrastructure (Internet).



IMPORTANT TERMS RELATED TO INTERNET

WWW (World Wide Web)- The World Wide Web (abbreviated as WWW or W3 commonly known as the Web) is a system of interlinked hypertext documents that are accessed via the Internet. With a web browser, one can view web pages that may contain text, images, videos, and other multimedia and navigate between them via hyperlinks.

Website- A website is a collection of webpages that are under 1 domain (such as google.com). For example if there is a company that owns abccompany.com then this website will have several Webpages like Home, About Us, Contact Us, Testimonials, Products, Services, FAQ's, and others. All of these pages together make up a Website.

Web Pages- A webpage is an independent page of a Website. For example a webpage would be the testimonials page. A web page can be accessed by typically one URL in a browser and that page can be copied and or send to a friend for review whereas websites are collections of multiple page that must be navigated to view other content.

Home Page - The home page is the first page that a visitor discovers when he wants to visit your site. There is usually just one.

Web Address/URLs (Uniform Resource Locator)- A URL (Uniform Resource Locator; also known as a web address) is a distinct web address on the Internet for a web page, a PDF file or any other file format available. It is easy for humans to remember URLs but the computer cannot "understand" this format. For example, the URL of a web page may be www.xyz.com, and its IP address 123.456.789.011.

Syntax:

Every HTTP URL consists of the following, in the given order:

- the scheme name (commonly called protocol)
- a colon, two slashes
- a host, normally given as a domain name but sometimes as a literal IP address
- optionally a colon followed by a port number

- the full path of the resource 130 Basics of Internet Technology

Web Server- A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer either to the entire system, or specifically to the software that accepts and supervises the HTTP requests. The most common use of web servers is to host websites, but there are other uses such as gaming, data storage, running enterprise applications, handling email, FTP, or other web uses.

Three of the most popular web servers on the web are:

- **Apache HTTP Server**- Apache HTTP Server (also referred to as simply "Apache") has, at the time of writing, been the most popular web server on the web since 1996. Apache is developed and maintained by the Apache Software Foundation, which consists of a decentralized team of developers. The software is produced under the Apache licence, which makes it free and open source. Apache is available for a range of operating systems, including Unix, Linux, Novell Netware, Windows, Mac OS X, Solaris, and FreeBSD.
- **Microsoft Internet Information Services (IIS)-** IIS is, at the time of writing, the second most popular web server on the web. It is however, gaining market share, and if the current trend continues, it won't be long before it overtakes Apache.IIS comes as an optional component of most Windows operating systems. You can install IIS by usingAdd/Remove Windows Components from Add or Remove Programs in the Control Panel.
- **Sun Java System Web Server**- Based on the Sun One Web Server, the Sun Java System Web Server is designed for medium to large business applications. Sun Java System Web Server is available for most operating systems.

Difference between Web Server and Application Server

- **A Web server can be either a computer program or a computer running a program that is responsible for accepting HTTP requests from clients, serving back HTTP responses along with optional data contents, which usually are web pages such as HTML documents and linked objects on it.**
- **An application server is the kind of software engine that will deliver various applications to another device. It is the kind of computer found in an office or university network that allows everyone in the network to run software off of the same machine.**

Web Browser- A web browser is an interface that helps a computer user gain access to all the content that is on the Internet and the hard disk of the computer. It can view images, text documents, audio and video files, games, etc. More than one web browser can also be installed on a single computer. The user can navigate through files, folders and websites with the help of a browser. When the browser is used for browsing web pages, the pages may contain certain links which can be opened in a new browser. Multiple tabs and windows of the same browser can also be opened.

Some popular Web Browsers:

- **Internet Explorer** : Internet Explorer (IE) is a product from software giant Microsoft. This is the most commonly used browser in the universe

- **Safari** : Safari is a web browser developed by Apple Inc. and included in Mac OS X. It was first released as a public beta in January 2003. Safari has very good support for latest technologies like XHTML, CSS2 etc.
- **Firefox** : Firefox is a browser derived from Mozilla. It was released in 2004 and has grown to be the second most popular browser on the Internet.
- **Opera** : Opera is smaller and faster than most other browsers, yet it is full- featured. Fast, user-friendly, with keyboard interface, multiple windows, zoom functions, and more. Ideal for newcomers to the Internet, school children, handicap and as a front-end for CD-Rom and kiosks.
- **Google Chrome** : This web browser was developed by Google. Its beta and commercial versions were released in September 2008 for Microsoft Windows. It has soon become the fourth-most widely used.

- **The first web browser - or browser-editor rather - was called WorldWideWeb as, after all, when it was written in 1990 it was the only way to see the web. Much later it was renamed Nexus in order to save confusion between the program and the abstract information space (which is now spelled World Wide Web with spaces).**
- **Hidden Reflex, an Indian startup running since 2008, developed and launched India's first web browser entitled 'Epic'.**

Domain Name -It is the unique name that identifies an Internet site. Domain Names always have two or more parts, separated by dots. The part on the left is the most specific, the part on the right is the most general. A given machine can have more than one Domain name but a given Domain Name points to only one machine. For example: google.com etc

Domain abbreviation- Domain are organised by the type of organisations and by country. A three letter abbreviation indicating the organisation and usually two letter abbreviation indicating the country name. Most common abbreviations for organisation are –

- .org Organisation
- .net Network
- .com Commercial
- .edu Education
- .gov Government
- .mil Military

Some domain abbreviations for country are :

- .in India
- .an Australia
- .fr France
- .nz New Zealand
- .uk United kingdom

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INTERNET AND EMAIL

Domain Name System (DNS) - The DNS stores and associates many types of information with domain names, but most importantly, it translates domain names (computer host name) to IP address. It also lists mail exchange series accepting E-mail for each domain.

IP ADDRESS- IP address stands for internet protocol address; it is an identifying number that is associated with a specific computer or computer network. When connected to the internet, the IP address allows the computers to send and receive information.

There are two versions of IP that currently coexist in the global Internet: IP version 4 (IPv4) and IP version 6 (IPv6). IP addresses are made up of binary values and drive the routing of all data over the Internet. IPv4 addresses are 32 bits long, and IPv6 addresses 128 bits long.

HyperText Markup Language (HTML)- HTML (Hypertext Markup Language) is the set of markup symbols or codes inserted in a file intended for display on a World Wide Web browser page. The <html> tag tells the browser that this is an HTML document. The <html> tag represents the root of an HTML document.

Hypertext : Hypertext is a cross referencing tool which connects the links to other text using hyperlinks.

Hypermedia : Hypermedia is the extension of Hypertext which includes multiple forms of media such as text, graphics, audio or video etc rather than only text based like hypertext.

Hyperlink: The hyperlink contains the URL of the webpages. In a general way, a hyperlink is referenced when a hypertext navigated. These hyperlinks are hidden under the text, image, graphics, audio, video, and gets highlighted once we hover the mouse over it.

TYPES OF NETWORKS

- **LAN (Local Area Network) -** Can go up to 1 KM radius. A local area network (LAN) is a group of computers and associated devices that share a common communications line or wireless link to a server. Typically, a LAN encompasses computers and peripherals connected to a server within a distinct geographic area such as an office or a commercial establishment.
- **WAN (Wide Area Network)** - No Limit. A wide area network (WAN) is a network that exists over a large-scale geographical area. A WAN connects different smaller networks, including local area networks (LANs) and metro area networks (MANs). This ensures that computers and users in one location can communicate with computers and users in other locations. WAN implementation can be done either with the help of the public transmission system or a private network.
- **WLAN(Wireless Local Area Network)** - A wireless local area network (WLAN) is a wireless computer network that links two or more devices using wireless communication within a limited area such as a home, school, computer laboratory, or office building. This gives users the ability to move around within a local coverage area and yet still be connected to the network. Through a gateway, a WLAN can also provide a connection to the wider Internet.
  Most modern WLANs are based on IEEE 802.11 standards and are marketed under the Wi-Fi brand name.
- **MAN(Metropolitan Area Network)** - A metropolitan area network is a computer network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN). The term is applied to the interconnection of networks in a city into a single larger network

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(which may then also offer efficient connection to a wide area network). It is also used to mean the interconnection of several local area networks by bridging them with backbone lines. The latter usage is also sometimes referred to as a campus network.

- **PAN(Personal Area Network)-** Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters. Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network. **Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network**. Personal Area Network covers an area of 30 feet.Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.

NETWORKING DEVICES (Hardware)

Hardware devices that are used to connect computers, printers, fax machines and other electronic devices to a network are called network devices. These devices transfer data in a fast, secure and correct way over same or different networks.

- **Modem**- Modem is a device that enables a computer to send or receive data over telephone or cable lines. The data stored on the computer is digital whereas a telephone line or cable wire can transmit only analog data.
  The main function of the modem is to convert digital signal into analog and vice versa. Modem is a combination of two devices − modulator and demodulator. The modulator converts digital data into analog data when the data is being sent by the computer. The demodulator converts analog data signals into digital data when it is being received by the computer.
  Types of Modem
  Modem can be categorized in several ways like direction in which it can transmit data, type of connection to the transmission line, transmission mode, etc.
  Depending on direction of data transmission, modem can be of these types –
  - **Simplex – A simplex modem can transfer data in only one direction, from digital device to network (modulator) or network to digital device (demodulator).**
  - **Half duplex – A half-duplex modem has the capacity to transfer data in both the directions but only one at a time.**
  - **Full duplex – A full duplex modem can transmit data in both the directions simultaneously.**
- **Router**- A router is a network layer hardware device that transmits data from one LAN to another if both networks support the same set of protocols. So a router is typically connected to at least two LANs and the internet service provider (ISP). It receives its data in the form of packets, which are data frames with their destination address added. Router also strengthens the signals before transmitting them. That is why it is also called repeater.
- **Switch**- Switch is a network device that connects other devices to Ethernet networks through twisted pair cables. It uses packet switching technique to receive, store and forward data packets on the network. The switch maintains a list of network addresses of all the devices connected to it.
  On receiving a packet, it checks the destination address and transmits the packet to the correct port. Before forwarding, the packets are checked for collision and other network errors. The data is transmitted in full duplex mode
- **Hub**- A network hub is a device that allows multiple computers to communicate with each other over a network. It has several Ethernet ports that are used to connect two or more network devices together.

Services of Internet

- **Online banking** : Online banking is an electronic payment system that enables customers of a financial institution to conduct financial transactions on a website operated by the institution, such as a retail bank, virtual bank, credit union or building society. Online banking is also referred as Internet banking, e-banking, virtual banking and by other terms.
- **E-commerce :** E-commerce (electronic commerce or EC) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the Internet.
- **M-commerce** : M-commerce stands for Mobile Commerce wherein commercial transactions are done using cellular or mobile phones that have access to the Internet.
- **E-Shopping** - (Electronic shopping) : It is the process of buying goods and services from merchants who seel an the Internet. some E-shopping websites are flipkart, amazon, jabong etc.
- **E-Reservation (Electronic Reservation)** : Electronic Reservation means making a reservation for a services via Internet. Example of E-Reservation are - www.irctc.com, www.makingtrip.com etc. Social Networking : Social Networking services is an online service, platform or site that focuses on facilitating the building of social networks or social relations among people. The most popular sites are facebook, Twitter etc.
  - **Real time Updates** : There are various websites on the internet which provides you with the real time updates in every field be it in business, sports, finance, politics, entertainment and others. Many a time the decisions are taken on the real time updates that are happening in various parts of the world and this is where internet is very essential and helpful.
  - **Education** : There are a number of books, reference books, online help centres, expert's views and other study oriented material on the internet that can make the learning process very easier as well as a fun learning experience. There are lots and lots of websites which are related to different topic. You can visit them and can gain endless amount of knowledge that you wish to have. With the use of internet for education, you are non-longer dependent on some other person to come and teach you. There are various number of tutorials available over the internet using which you can learn so many thing very easily.

  - **E-MAIL-** ELECTRONIC MAIL

  It is the most widely used application on the Internet. It is simple, very fast and a reliable tool for sending and receiving messages from an individual or a group of people across the world via the Internet as similar to writing a letter.

In 1971, Ray Tomlinson created the first ARPANET email application, so he is considered to be the father of E-mail.

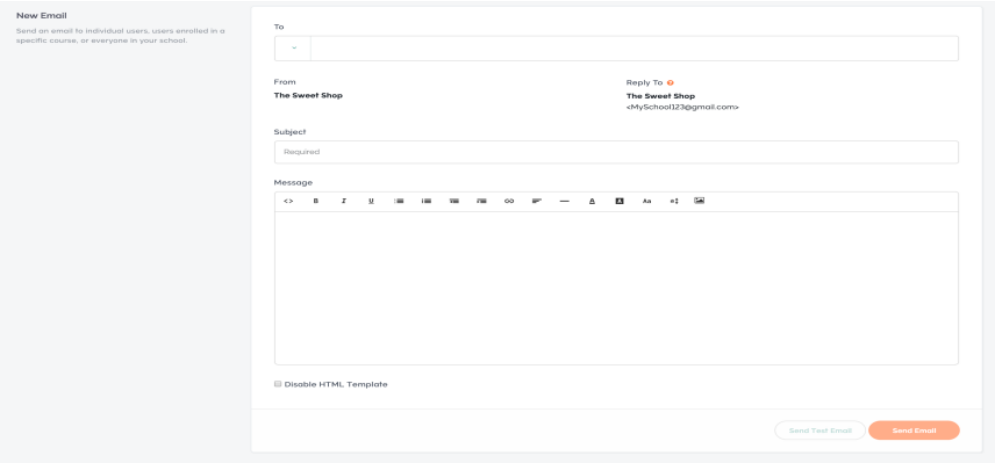
Hotmail was the first free email service launched in June 1996 by Sabeer Bhatia. Today, hotmail is still one of the biggest free email services.

E-mail addresses are written with a custom username at the beginning followed by the email service provider's domain name, with an @ sign separating the two. Here's an example: name@gmail.com. More plainly, e-mail is a message that may contain text, files, images, or other attachments sent through a network to a specified individual or group of individuals.

Writing an e-mail

When writing an e-mail message, it should look something like the example window below. As you can see, several fields are required when sending an e-mail:

Email-jkexamcracker@gmail.com
Contact no. 9469860788



The To field is where the e-mail address of the person receiving the e-mail is placed.

The From field should contain your e-mail address. If you are replying to a message, the To: and From: fields are automatically filled out. If it's a new message, you'll need to specify the recipients in the To: field by selecting them from your contact list or by typing the e-mail addresses. If you enter more than one recipient (e.g., group e-mail), the addresses should be separated by a comma and a space, or by pressing the Tab key.

The Subject should consist of a few words describing the e-mail's contents. The subject lets the recipient see what the e-mail is about, without opening and reading the full e-mail. This field is optional.

The CC ("Carbon Copy") field allows you to specify recipients who are not direct addressees (listed in the "To" field). For instance, you can address an e-mail to Jeff and CC Linda and Steven. Although the e-mail is addressed to Jeff, Linda and Steven also receive a copy and everyone can see who received the e-mail. This field is optional.

The BCC ("blind carbon copy") field is similar to CC, except the recipients are secret. Each BCC recipient will receive the e-mail, but will not see who else received a copy. The addressees (anyone listed in the "To" field) remain visible to all recipients. This field is optional.

Finally, the Message Body is the location you type your main message. It often contains your signature at the bottom; similar to a handwritten letter.

Advantages of e-mail

There are many advantages of e-mail and the usage of e-mail versus postal mail. Some of the main advantages are listed below.

- Free delivery - Sending an e-mail is virtually free, outside the cost of Internet service. There is no need to buy a postage stamp to send a letter.
- Global delivery - E-mail can be sent to nearly anywhere around the world, to any country.
- Instant delivery - An e-mail can be instantly sent and received by the recipient over the Internet
- File attachment - An e-mail can include one or more file attachments, allowing a person to send documents, pictures, or other files with an e-mail.
- Long-term storage - E-mails are stored electronically, which allows for storage and archival over long periods of time.
- Environmentally friendly - Sending an e-mail does not require paper (paperless), cardboard, or packing tape, conserving paper resources

Email-jkexamcracker@gmail.com
Contact no. 9469860788

OPEN SOURCE TECHNOLOGY

What is open source software?

Open source software (OSS) is software that is distributed with its source code, making it available for use, modification, and distribution with its original rights. Source code is the part of software that most computer users don't ever see; it's the code computer programmers manipulate to control how a program or application behaves. Programmers who have access to source code can change a program by adding to it, changing it, or fixing parts of it that aren't working properly. OSS typically includes a license that allows programmers to modify the software to best fit their needs and control how the software can be distributed.

What is the history of OSS?

The idea of making source code freely available originated in 1983 from an ideological movement informally founded by Richard Stallman, a programmer at MIT. Stallman believed that software should be accessible to programmers so they could modify it as they wished, with the goal of understanding it, learning about it, and improving it.i Stallman began releasing free code under his own license, called the GNU Public License. This new approach and ideology surrounding software creation took hold and eventually led to the formation of the Open Source Initiative in 1998.

Open Source Initiative- The Open Source Initiative (OSI) was created to promote and protect open source software and communities.ii In short, the OSI acts as a central informational and governing repository of open source software. It provides rules and guidelines for how to use and interact with OSS, as well as providing code licensing information, support, definitions, and general community collaboration to help make the use and treatment of open source understandable and ethical.

Examples of Open source softwares-

- **GNU/Linux**
- **Mozilla Firefox**
- **VLC media player**
- **SugarCRM**
- **GIMP- GNU Image Manipulation Program.**
- **VNC- Virtual Network Computing, or VNC, is an open source application that provides screen sharing services and is available for virtually all operating systems such as Windows, Linux, and of course OS X.**
- **Apache web server**
- **LibreOffice**
- **jQuery**
- **Linux operating system.**
- **Android by Google.**
- **Open office.**
- **Firefox browser.**
- **Moodle- Learning Platform or course management system (CMS) - a free Open Source software package designed to help educators create online courses.**
- **ClamWinantivirus.**
- **WordPress content management system.**
- **MySql-reely downloadable version of the world's most popular open source database.**
- **Magento**

OPEN SOURCE TECHNOLOGY

- Audacity
- Thunderbird Email client.
- Php scripting language.
- Blender- It is a 3D graphics and animation tool that supports motion tracking, simulation, animation, video editing, rendering, modeling and much more.
- Python- is common programming and scripting language used by custom software developers.
- Shotcut- a video editor that offers powerful features including audio and webcam capture, color, text, noise, and counter generators, support of popular image formats, EDL export and much more.

Difference between Open Source Software and Closed Source Software :

S.No.	OPEN SOURCE SOFTWARE	CLOSED SOURCE SOFTWARE
01.	Open source software refers to the computer software which source is open means the general public can access and use.	Closed source software refers to the computer software which source code is closes means public is not given access to the source code.
02.	Open Source Software in short also referred as OSS.	Closed Source Software in short also referred as CSS.
03.	The source code of open source software is public.	In closed source software the source code is protected.
04.	This code can be modified by other users and organizations means that the source code is available for anyone to look at.	The only individual or organization who has created the software can only modify the code.
05.	The price of open source software is very less.	The price of closed source software is high.
06.	There is no so much restrictions on users based on usability and modification of software.	There is so much restrictions on users based on usability and modification of software.
07.	Programmers compete with each other for recognition.	Programmers do not compete with each other for recognition.
08.	Programmers freely provide improvement for recognition if their improvement is accepted.	Programmers are hired by the software firm/organization to improve the software.
09.	If the program is popular then very large number of programmers may	There is a limitation on the number of programmers/team who will work on

	work on the project.	**the project.**
10.	**It is purchased with its source code.**	**It is not purchased with its source code.**
11.	**Open software can be installed into any computer.**	**Closed software needs have a valid license before installation into any computer.**
12.	**Open source software fails fast and fix faster.**	**Closed source software has no room for failure.**
13.	**In closed source software no one is responsible for the software.**	**In closed source software the vendor is responsible if anything happened to software.**
14.	**Examples are Firefox, OpenOffice, Gimp, Alfresco, Android, Zimbra, Thunderbird, MySQL, Mailman, Moodle, TeX, Samba, Perl, PHP, KDE etc.**	**Examples are Skype, Google earth, Java, Adobe Flash, Virtual Box, Adobe Reader, Microsoft office, Microsoft Windows, WinRAR, mac OS, Adobe Flash Player etc.**

Advantages

1. Open source software is free.
2. Open source is flexible; developers can examine how the code works and freely make changes to dysfunctional or problematic aspects of the application to better fit their unique needs.
3. Open source is stable; the source code is publicly distributed, so users can depend on it for their long-term projects since they know that the code's creators cannot simply discontinue the project or let it fall into disrepair.
4. Open source fosters ingenuity; programmers can use pre-existing code to improve the software and even come up with their own innovations.
5. Open source comes with a built-in community that continuously modifies and improves the source code.
6. Open source provides great learning opportunities for new programmers.

Disadvantages

1. Open source can be harder to use and adopt due to difficulty setting it up and the lack of friendly user interfaces.
2. Open source can pose compatibility issues. When attempting to program proprietary hardware with OSS, there is often a need for specialized drivers that are typically only available from the hardware manufacturer.
3. Open source software can pose liability issues. Unlike commercial software, which is fully controlled by the vendor, open source rarely contains any warranty, liability, or infringement indemnity

protection. This leaves the consumer of the OSS responsible for maintaining compliance with legal obligations.

4. Open source can incur unexpected costs in training users, importing data, and setting up required hardware.

PRACTICE QUESTIONS

1. Which of the following is not an open source software?

a) LibreOffice
b) Microsoft Office
c) GNU image manipulation
d) MySQL

ANS-B

2. OSI stands for?

a) Open Source Index
b) Open Source Image
c) Open Source Initiative
d) Open Source Instant

ANS-C

3. Who was the founder of Linux?

a) Linus Torvalds
b) IBM
c) Christopher Markin
d) Bill Gates

ANS-A

4. Which of the following is the most famous example of open source software?

a) Microsoft Windows
b) Mac OS X
c) UNIX
d) Linux

ANS-D

5. What is another name given to 'proprietary software'?

a) Open source software
b) Bespoke software
c) Tailor Made software
d) Closed source software

ANS-D

6. Which of the following is an advantage of 'open source' software?

a) You can edit the source code to customise it
b) You need to be an expert to edit code
c) You have to pay
d) Can sometimes be too generic for specialist purposes

ANS-A

7. What is an Open Source Software?

a) Computer software for which the source code is made available for users.
b) Practice of distributing software under two or more different terms and conditions.
c) Distribution strategy of business software.
d) A single software product available under two different licenses.

ANS-A

8. The open source definition is based on the _____.

a) software license.
b) free software foundation.
c) debian free software guidelines.
d) open source initiative.

ANS-D

9. Developing open source software can mean _____.

a) basing it on open source technologies and open standards.
b) working collaboratively with other groups.

c) to redistribute the source code widely.
d) to use the source code widely.

ANS-C

10. An image editor similar to Adobe photoshop is

a) Nvu
b) Open office
c) Bluefish
d) GIMPshop

ANS-D

11. The users must agree to the_____ terms and agreements when they use an open source software.

a) system
b) license
c) community
d) programmer

ANS-D

OPERATING SYSTEM

What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware.
- An operating System is a collection of system programs that together control the operations of a computer system.

Some examples of operating systems are UNIX, Mach, MS-DOS, MS-Windows, Windows/NT, Chicago, OS/2, MacOS, VMS, MVS, and VM.

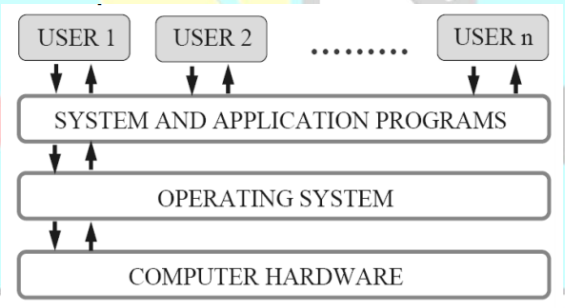
Operating system goals:

- Execute user programs and make solving user problems easier.
- Make the computer system convenient to use.
- Use the computer hardware in an efficient manner.

Computer System Components

1. **Hardware** – provides basic computing resources (CPU, memory, I/O devices).
2. **Operating system** – controls and coordinates the use of the hardware among the various application programs for the various users.
3. **Applications programs** – Define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).
4. **Users** (people, machines, other computers).

Abstract View of System Components



Operating System Definitions

- **Resource allocator** – manages and allocates resources.
- **Control program** – controls the execution of user programs and operations of I/O devices .
- **Kernel** – The one program running at all times (all else being application programs).

Components of OS: OS has two parts. (1)Kernel.(2)Shell.

1. **Kernel** is an active part of an OS i.e., it is the part of OS running at all times. It is a programs which can interact with the hardware. Ex: Device driver, dll files, system files etc.
2. **Shell** is called as the command interpreter. It is a set of programs used to interact with the application programs. It is responsible for execution of instructions given to OS (called commands).

OPERATING SYSTEM

Operating systems can be explored from two viewpoints: the user and the system.

1. **User View**: From the user's point view, the OS is designed for one user to monopolize its resources, to maximize the work that the user is performing and for ease of use.
2. **System View**: From the computer's point of view, an operating system is a control program that manages the execution of user programs to prevent errors and improper use of the computer. It is concerned with the operation and control of I/O devices.

Functions of Operating System(OS):

Main functions of the operating system are as follows:

- Memory Management
- Process Management
- Device Management
- File Management
- Protection and Security
- User interface or Command interpreter.

Memory Management:

The activities of memory management handled by OS are:

- Allocate memory
- Free Memory
- Re-allocate memory to a program when a used block is freed
- Keep track of memory usage.

Process Management:

The activities of process management handled by OS are:

- Control access to shared resources like file, memory I/O and CPU
- Control execution of applications
- Create, execute and delete a process
- Cancel or resume a process
- Schedule a process
- Synchronization, communication and deadlock handling for process

Device Management:

The activities of device management task handled by OS are:

- Open, close and write device drivers.

- Communication, control and monitor the device drivers.Prof. K. Adisesha (Ph.D.)

File Management:

The activities of file management task handled by OS are:

- Create and delete both files and directories
- Provide access to files
- Allocate space for files
- Keep back-up of files
- Secure files

Protection and Security:

- OS protects the resource of system.
- User authentication, file attributes like read, write, encryption and back-up of data are used by OS to provide basic protection.

User Interface or Command Interpreter:

- OS provides an interface between the user and the computer hardware.
- The user interface is a set of commands or a Graphical User Interface via which the user interacts with the application and the hardware.

Different Operating Systems

1. MS-DOS:

MS-DOS which is short for Microsoft Disk Operating System is a non-graphical command line operating system developed for IBM compatible computers with x86 microprocessor. The operating system used a command line interface for the user to input commands to navigate, open and manipulate files on their computer.

2. Windows Operating System:

Windows is an operating system designed by Microsoft to be used on a standard x86 Intel and AMD processors. It provides an interface, known as a graphical user interface(GUI) which eliminates the need to memorize commands for the command line by using a mouse to navigate through menus, dialog boxes, buttons, tabs, and icons. The operating system was named windows since the programs are displayed in the shape of a square. This Windows operating system has been designed for both a novice user just using at home as well as for professionals who are into development.

3. LINUX Operating System:

The Linux OS is an open source operating system project that is a freely distributed, cross-platform operating system developed based on UNIX. This operating system is developed by Linus Torvalds. The name Linux comes from the Linux kernel. It is basically the system software on a computer that allows apps and users to perform some specific task on the computer. The development of Linux operating system pioneered the open source development and became the symbol of software collaboration.

4. Solaris Operating System:

Solaris or SunOS is the name of the Sun company's Unix variant operating system that was originally developed for its family of Scalable Processor Architecture-based processors (SPARC) as well as for Intel-based processors. The UNIX workstation market had been largely dominated by this operating system during its time. As the Internet grew Sun's Solaris systems became the most widely installed servers for Web sites. Oracle purchased Sun and later renamed to Oracle Solaris.

5. Android Mobile Operating System:

Android is a Google's Linux based operating system it is designed primarily for touch screen mobile devices such as smart phones and tablet computers. The hardware which can be used to support android is based on three architectures namely ARM, Intel and MIPS design lets users manipulate the mobile devices intuitively, with finger movements that mirror common motions, such as pinching, swiping, and tapping making these applications comfortable for the users.

6. iOS Mobile Operating System:

iOS which is short for iPhone OS is a mobile operating system created and developed by Apple Inc. exclusively for its hardware like A12 Bionic chip that presently powers many of its mobile devices, including the iPhone, iPad, and iPod. The iOS user interface is based upon using multi-touch gestures such as swipe, tap, pinch, and reverse pinch. The purpose of these finger actions is to provide the user with fast responsive inputs given from multiple fingers to the multi-touch capacitive screen display.

7. UNIX Operating System:

UNIX is an operating system which was first developed in the 1960s, and has been under constant development ever since. By operating system, we mean the suite of programs which make the computer work. It is a stable, multi-user, multi-tasking system for servers, desktops and laptops.

UNIX systems also have a graphical user interface (GUI) similar to Microsoft Windows which provides an easy to use environment. However, knowledge of UNIX is required for operations which aren't covered by a graphical program, or for when there is no windows interface available, for example, in a telnet session.

Types of Operating System(OS):

The different types of operating system are:

- Single user Operating System
- Batch Operating System
- Multiprogramming Operating System
- Multitasking Operating System
- Multiuser Operating System
- Time sharing System (Online /Multiuser)
- Real time system
- Distributed Operating System

- Network Operating System

1. **Single User Operating System:**

- This OS allows only one user to share the system resource including the CPU.
- These are mainly the operating system configured for the use of desktop PC and laptops.
- DOS and Windows- 95, Win-98, Apple Macintosh etc are example.

2. **Batch Operating System:**

- Batch is defined as a group of job with similar needs and similar resource requirements.
- The operating system that allows users to create batches and execute each batch sequentially, processing all jobs of batch considering them as a single process is called "Batch Operating system"
- It allows litter or no interaction between users and executing programs.
- This is well suited for applications with large computation time and no user interaction.
- Payroll, forecasting, statistical analysis are programs example for its usage.

Advantages:

- User need not wait during its execution.
- It will function in FIFO (First In First Out) order.

Disadvantages:

- Non-interactive mode of execution
- Offline debugging
- IBM System/360 Operating system is an example for Batch Operating system
- In DOS, we can emulate the batch processing using .BAT file.

3. **Multiprogramming Operating System:**

- Multiprogramming is the capability of CPU to execute two or more programs concurrently.
- Two or more programs are stored concurrently in primary storage, and the CPU moves from one program to another, partially executing each in turn.
- Early computer system and many personal computers execute program in the order in which it is read into the system. Only one program is executed at a time.

4. **Multitasking Operating System:**

- Multitasking operating systems allow more than one program to run at a time.
- In gives you the perception of 2 or more tasks running at the same time. It does this by dividing system resources amongst these tasks.
- Multitasking is usually implemented by code and data of several programs in memory simultaneously and multiplexing processor and I/O device among them.
- Multitasking is also called context switching.
- Multitasking usually refers to a single user.
- Example: Windows 98

5. **Multi-user Operating System:**

- A multi-user operating system allows multiple users on different computers or terminal to access a

single system with one OS on it.

- It creates and maintains individual user environments, individual authentication and security level privileges, provides per user resource usage accounting.

6. Time-Sharing Operating System:

- Time-Sharing operating system allows many users to share the computer resource simultaneously.
- Time sharing refers to the allocation of computer resource in time slots to several programs simultaneously.
- Large CAD and text processing systems belong to timesharing OS.
- Most of the time-sharing operating systems adopted time slicing/ round robin scheduling algorithm. Each user/process will receive a portion of the time slot.
- UNIX, Windows Server is the example for multiprogramming, multi-use and time sharing systems.

7. Real-time Operating System:

- Real time systems refer to a computer and software systems that respond to events before the events become obsolete.
- The primary objective of real-time systems is to provide quick event – response times and thus meeting the scheduling deadlines.
- The main applications where real time systems are used include medical imaging systems, industrial control systems, flight control and military application.
- Windows CE, Symbian, Linux OS are example for real-time systems.

8. Distributed Operating System:

- A distributed operating system is a collection of autonomous computer systems capable of communication and cooperation via the software and hardware interconnections.
- For example: if we have 'N' systems in a distributed environment then the distributed OS helps us in balancing the load by sharing processors, I/O devices etc.
- The ATM centers of a bank are example of distributed operating system.

9. Network Operating System:

- A network operating system is a collection of software and associated protocols that allow a set of autonomous computer which are interconnected by a computer network.
- It can be used in a convenient and cost-effective manner.
- In a network operating system the user are aware of the existence of multiple computers and can log in to remote machines and copy files from one machine to another machine.
- Windows NT, windows server, LINUX are example.

✓ Difference between CUI and GUI:

CUI Interface	GUI Interface
Command-line User Interface	Graphical User Interface
The user must type the commands at command prompt to interact with the computer	The user must click on icons, menus, dialog boxes etc. to interact with the computer.
The user must remember the commands and their parameters	The user need not remember any commands, as it is available in the form of menus and icons on monitor.
Mouse operation not available for DOS	Mouse operation required to select the commands.

SOME IMPORTANT CONCEPTS RELATED TO OPERATING SYSTEM

✓ Threads:

A thread is a lightweight process or sub-process and forms the basic unit of CPU utilization. A process can perform more than one task at the same time by including multiple threads.

There are two types of threads:

- User threads
- Kernel threads

User threads are implemented by users. OS doesn't recognize user level threads.

kernel threads are implemented by OS. Kernel threads are recognized by OS.

✓ Process:

A process is a program under execution. Each process is represented by a Process Control Block (PCB).

✓ **Process Scheduling: Below are different times with respect to a process.**

1. Arrival Time – Time at which the process arrives in the ready queue.
2. Completion Time – Time at which process completes its execution.
3. Burst Time – Time required by a process for CPU execution.
4. Turn Around Time – Time Difference between completion time and arrival time.
   Turn Around Time = Completion Time - Arrival Time
5. Waiting Time (WT) – Time Difference between turn around time and burst time.
   Waiting Time = Turn Around Time - Burst Time

✓ **PROCESS SCHEDULING:** A typical process involves both I/O time and CPU time. In a uniprogramming system like MS-DOS, time spent waiting for I/O is wasted and CPU is free during this time. In multiprogramming systems, one process can use CPU while another is waiting for I/O. This is possible only with process scheduling.

Different Scheduling Algorithms:

1. **First Come First Serve (FCFS) :** Simplest scheduling algorithm that schedules according to arrival times of processes.
2. **Shortest Job First (SJF):** Process which have the shortest burst time are scheduled first.
3. **Shortest Remaining Time First (SRTF):** It is preemptive mode of SJF algorithm in which jobs are scheduled according to the shortest remaining time.
4. **Round Robin (RR) Scheduling:** Each process is assigned a fixed time, in cyclic way.
5. **Priority Based scheduling (Non Preemptive):** In this scheduling, processes are scheduled according to their priorities, i.e., highest priority process is schedule first. If priorities of two processes match, then scheduling is according to the arrival time.
6. **Highest Response Ratio Next (HRRN):** In this scheduling, processes with highest response ratio is scheduled. This algorithm avoids starvation.
   Response Ratio = (Waiting Time + Burst time) / Burst time
7. **Multilevel Queue Scheduling (MLQ):** According to the priority of process, processes are placed in the different queues. Generally high priority process are placed in the top level queue. Only after completion of processes from top level queue, lower level queued processes are scheduled.
8. **Multi level Feedback Queue (MLFQ) Scheduling:** It allows the process to move in between queues. The idea is to separate processes according to the characteristics of their CPU bursts. If a process uses too much CPU time, it is moved to a lower-priority queue.

✓ **The Critical Section Problem**

- Critical Section is the part of a program which tries to access shared resources. That resource may be any resource in a computer like a memory location, Data structure, CPU or any IO device.
- The critical section cannot be executed by more than one process at the same time; operating system faces the difficulties in allowing and disallowing the processes from entering the critical section.

In order to synchronize the cooperative processes, our main task is to solve the critical section problem. We need to provide a solution in such a way that the following conditions can be satisfied.

1. Mutual Exclusion

By Mutual Exclusion, we mean that if one process is executing inside critical section then the other process must not enter in the critical section.

2. Progress

Progress means that if one process doesn't need to execute into critical section then it should not stop other

processes to get into the critical section.

3. Bounded Waiting

We should be able to predict the waiting time for every process to get into the critical section. The process must not be endlessly waiting for getting into the critical section.

- ✓ **Deadlock:**

A situation where a set of processes are blocked because each process is holding a resource and waiting for another resource acquired by some other process. Deadlock can arise if following four conditions hold simultaneously (Necessary Conditions):

1. **Mutual Exclusion – One or more than one resource are non-sharable (Only one process can use at a time).**
2. **Hold and Wait – A process is holding at least one resource and waiting for resources.**
3. **No Preemption – A resource cannot be taken from a process unless the process releases the resource.**
4. **Circular Wait – A set of processes are waiting for each other in circular form.**

Methods for handling deadlock: There are three ways to handle deadlock

1. **Deadlock prevention or avoidance:** The idea is to not let the system into deadlock state.
2. **Deadlock detection and recovery :** Let deadlock occur, then do preemption to handle it once occurred.
3. **Ignore the problem all together – :** If deadlock is very rare, then let it happen and reboot the system. This is the approach that both Windows and UNIX take.

PETERSON'S SOLUTION FOR CRITICAL SECTION PROBLEM

Peterson's Solution is a classical software based solution to the critical section problem.

Peterson's algorithm is a concurrent programming algorithm developed by Gary L. Peterson in a 1981 paper. It is known as a simple algorithm when compared to others. Peterson's algorithm is used for mutual exclusion and allows two processes to share a single-use resource without conflict. It uses only shared memory for communication. Peterson's formula originally worked only with two processes, but has since been generalized for more than two.

FIRMWARE AND HUMANWARE

FIRMWARE- Firmware is data that is stored on a computer or other hardware device's ROM (read-only memory) that provides instruction on how that device should operate. Unlike normal software, firmware cannot be changed or deleted by an end-user without using special programs, and remains on that device whether it's on or off.

Ascher Opler coined the term "firmware" in a 1967 Datamation article.

STORAGE MEDIA FOR FIRMWARE

Originally, firmware was strictly written on ROM chips. That allowed it to be cheap to manufacture and ensured it did not get deleted or tampered with.

Programmable Read-Only Memory (PROM) chips were also used and allowed for a wider array of firmware. But using ROM and PROM to store firmware means that when a device's firmware becomes outdated, it cannot be updated, only replaced.

As technology advanced more rapidly, firmware started becoming outdated sooner, before the hardware got worn down. Manufacturers then switched to using Erasable Programmable Read-Only Memory (EPROM) chips, which allowed for firmware updates. But since EPROM chips were expensive to manufacture and time-consuming to program and update, firmware eventually evolved to flash memory chips, as they are cheap and easy to write and rewrite on.

Depending on where it is stored and the complexity of its functionality, firmware has three levels:

1. Low Level Firmware: This level of firmware is stored on non-volatile memory chips such as ROM, PROM—also known as One-Time Programmable (OTP) memory—and Programmable Logic Array (PLA) structures. Because low level firmware is often stored on read-only chips that cannot be rewritten or updated, it is considered an intrinsic part of the hardware.

2. High Level Firmware: This firmware is used with flash memory chips to allow for updates. It often has more complex instructions than low level firmware, making it closer to software than hardware.

3. Subsystems: A subsystem is a device or unit that is a semi-independent part of a larger system. Because this firmware level has its microcode embedded in flash chips, CPUs, and LCD units, and is similar to high level firmware, it often resembles its own device.

TYPES OF FIRMWARE

1. BIOS- Basic Input/Output System (BIOS) is a type of Firmware used during the booting process (power-on/start up) on IBM PC compatible computers. It can interact with the hardware and check for any unknown errors. It then signals another program called bootloader which does the job of waking up the operating system sleeping inside the hard drive and put it in the random access memory. So, BIOS is primarily responsible for handling your computer's hardware components and ensure that they function properly. Although good, the low-level software has remained almost unchanged for the last two decades, and because of this, it is now becoming outdated and un-supportive of modern technologies. For instance, BIOS still uses

FIRMWARE AND HUMANWARE

16-bit code while most laptops and PCs run 32 and 64-Bit code.

2. UEFI- **EFI-Extensible Firmware Interface (DEVELOPED BY INTEL) , also referred to as Unified Extensible Firmware Interface (UEFI)** has certain advantages over BIOS. It is a specification for a new generation of system firmware that provides the first instructions used by the CPU to startup hardware and passes the control to the bootloader. It supports 32 and 64 bit processor. For instance, it helps ensure that your PC boots using only software that is trusted by the PC manufacturer, i.e., it supports a feature called 'Secure Boot' to improve security.

HUMANWARE

"Humanware is defined in IT as hardware or software that is built around user capabilities and user needs. This often involves creating a particular visual or physical interface for a given set of users. The design and engineering of humanware starts with the user's interests and needs first, and designs the infrastructure accordingly."

- Humanware is the method of adding a human facet into the development of computer programs. The main goal of developing humanware is to make hardware and software as functional as possible. The philosophy behind humanware is that instead of starting with an implementation goal, the software or IT architecture design process starts with an understanding of what users will need.

A computer system is made up of three major components—hardware, software, and humanware. While software and hardware make up an actual computer, humanware is necessary for enhancing user experience (UX) by making improvements in the system's user interface (UI). Humanware is the combination of hardware and software elements that make human interaction with a device as good as possible. Often, developing humanware begins by defining who the computer's potential users are, what they are interested in, and what they need before designing the infrastructure.

The process of building humanware generally consists of these steps:

- **Step 1: Defining Users and Their Capabilities**
  To understand what user capabilities must be present in a product, the development team must first identify their target users. That may require as many details as possible to address many needs. These details include demographics (age, location, career, familial status, etc.), motivations (mindset, power, incentivization, fears, etc.), previous product experience, and everything else that helps developers get to know target users.
  This first step is often the most crucial. It takes some time to finish because developers need to be as exhaustive as possible. It also requires considering how customers will evolve.
- **Step 2: Specifying Usability Objectives**
  Using the target users and their needs as pegs, the development team then needs to come up with goals. This step requires developers to think of all possible humanware capabilities they can integrate into the system they are building. If possible, all these objectives must be measurable for future improvements.
- **Step 3: Building a Prototype**
  The next step is building a prototype. This device will allow developers to test if the product can indeed

meet the goals they set. It involves asking actual users to test the prototype. The development team gets user feedback and incorporates suggestions or recommendations into the current design to address flaws. The prototype should undergo various testing cycles until the product passes quality and usability testing.

- **Step 4**: Get feedback from users and continually improve the product.

Practice Qusetions

1. The software substituted for hardware and stored in ROM.
a) Synchronous Software
b) Package Software
c) Firmware
d) Middleware
ANS-C

2. Storage of firmware is _____
a) Cache Memory
b) RAM
c) External
d) ROM
ANS-D

3. Computer firmware is present in
a) volatile memory
b) non- volatile memory
c) Cache memory
d) RAM
ANS-B

4. Which of the following is related to the people or professionals working in a computer center?
a) Software
b) hardware
c) firmware
d) humanware
ANS-D

5. BIOS and ROM chips are called
a) software
b) hardware
c) firmware
d) Booting
ANS-C

6. _____ are stored in the permanant memory of a system at the time of manufacturing of a digital device.
a) Software
b) firmware
c) hardware
d) ROM
ANS-B

7. The_____is firmware that contain a computer's startup instruction.
a) POST
b) BIOS
c) CMOS
d) DIOS
ANS-B

8. Fullform of UEFI
a) United Extensible Firmware Interface

b) Unified Extensible Firmware Interface
c) Universal Extensible Firmware Interface
d) None of these.
B

9. Bios supports
a) 16 bit processor
b) 32 bit processor
c) 64 bit processor
d) none of these.
ANS-A

10. Which one is not an example of Firmware
a) Traffic lights
b) Digital watch
c) Mobile phones
d) Programmers
ANS-D

11. The personnel which are related to installation, maintenance, operation and testing of a computer are called
a) humanware
b) Firmware
c) software
d) CPU
ANS-A

PDF- COMPUTER KNOWLEDGE

The Portable Document Format (PDF) is a file format developed by Adobe in the 1990s to present documents, including text formatting and images, in a manner independent of application software, hardware, and operating systems.

PDF (Portable Document Format) is a file format that has captured all the elements of a printed document as an electronic image that you can view, navigate, print, or forward to someone else. PDF files are created using Adobe Acrobat , Acrobat Capture, or similar products. To view and use the files, you need the free Acrobat Reader, which you can easily download. Once you've downloaded the Reader, it will start automatically whenever you want to look at a PDF file.

Adobe's Acrobat Reader is the official tool for reading PDFs. It's free, and it's available for Windows, macOS, iOS, and Android.

The latest version of PDF Reader is known as Acrobat Reader DC.(VERSION 15.0)

WHO INVENTED PDF?

In 1991, Adobe co-founder Dr. John Warnock launched the "paper-to-digital revolution" with an idea he called, The Camelot Project. The goal was to enable anyone to capture documents from any application, send electronic versions of these documents anywhere, and view and print them on any machine. By 1992, Camelot had developed into PDF. Today, it is the format trusted by businesses around the world.

- **Adobe Systems made the PDF specification available free of charge in 1993. In the early years PDF was popular mainly in desktop publishing workflows, and competed with a variety of formats such as DjVu, Envoy, Common Ground Digital Paper, Farallon Replica and even Adobe's own PostScript format.**

- **PDF was a proprietary format controlled by Adobe until it was released as an open standard on July 1, 2008, and published by the International Organization for Standardization as ISO. ISO is also in charge of updating and developing future versions.**

  Opening PDF files

  Opening and viewing a PDF file is pretty simple. Most modern web browsers will open PDF files directly in your browser window instead of downloading them to your computer. If your browser can't do this, it should prompt you to download the file instead. Try clicking this link to see how it works on your computer.

  If your computer uses Windows 7 or earlier, you may need to download a free PDF viewer (such as Adobe Reader) before you can view PDF files.

10 Best PDF Readers .

1. **Adobe Acrobat Reader DC**
2. **SumatraPDF**
3. **Expert PDF Reader**
4. **Nitro Reader**
5. **Foxit Reader**
6. **Google Drive**
7. **Web Browser**
8. **Slim PDF**
9. **Javelin PDF Reader**
10. **PDF-XChange Editor**

PDF- COMPUTER KNOWLEDGE

Editing PDF files

As we mentioned earlier, PDFs are primarily meant for viewing, not editing. However, there may be times when you encounter a PDF that allows you to enter certain information, like name and address. These PDFs use a special feature called form fields, which allow you to type new information into the document and save your changes.

PDF advantages

- Graphic integrity

A PDF displays the exact same content and layout no matter which operating system, device or software application it is viewed on.

- Multi-dimensional

The PDF format allows you to integrate various types of content – text, images and vector graphics, videos, animations, audio files, 3D models, interactive fields, hyperlinks, and buttons. All of these elements can be combined within the same PDF file and organized as a report, a presentation or a portfolio.

- Convenient

PDFs are easy to create, read and use by everyone.

- Secure

Offers options to set up different levels of access to protect the content and the whole document, such as watermarks, passwords or digital signatures.

PDF Limitations

- The PDF was developed as an exchange format for documents. The original goal was to preserve and protect the content and layout of a document - no matter what platform or computer program it is viewed on. This is why PDFs are hard to edit and sometimes even extracting information from them is a challenge.

- Absolutely all programs for editing PDF files are paid, free analogues allow only reading.

Virus and Antivirus

Computer security (also known as cyber security or IT security) is information security as applied to computing devices such as computers and smart phones, as well as computer networks such as private and public networks,including the whole Internet.

Traditionally, computer facilities have been physically protected for three reasons:

- To prevent theft of or damage to the hardware
- To prevent theft of or damage to the information
- To prevent disruption of service

The Basic Components of Security

1. Confidentiality : Confidentiality is the concealment of information or resources. The need for keeping information secret arises from the use of computers in sensitive fields such as government and industry. For example, military and civilian institutions in the government often restrict access to information to those who need that information. The first formal work in computer security was motivated by the military's attempt to implement controls to enforce a "need to know" principle. This principle also applies to industrial firms, which keep their proprietary designs secure lest their competitors try to steal the designs. As a further example, all types of institutions keep personnel records secret.

2. Integrity : Integrity refers to the trustworthiness of data or resources, and it is usually phrased in terms of preventing improper or unauthorized change. Integrity includes data integrity (the content of the information) and origin integrity (the source of the data, often called authentication). The source of the information may bear on its accuracy and credibility and on the trust that people place in the information. This dichotomy illustrates the principle that the aspect of integrity known as credibility is central to the proper functioning of a system.

3. Availability : Availability refers to the ability to use the information or resource desired. Availability is an important aspect of reliability as well as of system design because an unavailable system is at least as bad as no system at all. The aspect of availability that is relevant to security is that someone may deliberately arrange to deny access to data or to a service by making it unavailable.

4. Access Control System : Any system designed to prevent and restrict access to users. For example, a primary form of access control is only allowing users who have accounts to login to a system or only allowing the user access to files he or she should be able to see.

Transport Layer Security- Transport Layer Security (TLS) is a protocol that ensures privacy between communicating applications and their users on the Internet.

Malware or malicious software typically consists of code developed by cyber attackers, designed to cause extensive damage to data and systems or to gain unauthorized access to a network. Malware is typically delivered in the form of a link or file over email and requires the user to click on the link or open the file to execute the malware.

Types of malware can include computer viruses, worms, Trojan horses , root kits, adware and spyware.

VIRUS - A computer virus is a type of computer program that, when executed, replicates itself by modifying other computer programs and inserting its own code. When this replication succeeds, the affected areas are then said to be "infected" with a computer virus.

Virus and Antivirus

The terms "virus" and "malware" are often used interchangeably. Malware is a catch-all term for any type of malicious software, regardless of how it works, its intent, or how it's distributed. A virus is a specific type of malware that self-replicates by inserting its code into other programs.

"VIRUS: Vital Information Resources Under Seize"

Top Some Sources of Computer Virus Attack

1. **Downloadable Programs** : Downloadable files are one of the best possible sources of virus. Any type of executable program including games, freeware, screen savers as well as executable files are one of the major sources of computer virus attacks. Executable files having an extension of ".com", ".exe" and "coolgame.exe" contain virus sources too. If in the case a user want to download programs from the internet then it is necessary to scan every program before downloading them.

2. **Illegal Software** : Most people who download cracked and illegal versions of software online are unaware about the reality that they may contain virus sources as well. Such illegal files contain viruses and bugs that are difficult to detect as well as to remove. Hence, it is always a preferable option to download software from the appropriate source.

3. **Email Attachments** : Email attachments are one of the other popular sources of computer virus attacks. Hence, a user must handle email attachments with extreme care, especially if the email comes from an unknown sender. Installation of a good antivirus assumes prime necessity if one desires to eliminate the possibility of virus attacks.

4. **Using Internet** : Using internet is one of the common sources of virus infection. Majority of all computer users are unaware as when viruses attack computer systems. Almost every computer user click/download everything that comes their way and hence unknowingly invites the possibility of virus attacks.

5. **Booting from Unknown CD** : Most computer users believe that one of the most common ways of virus infection is through Data CD. It is a good practice to remove the CD when the computer system is not working. If you do not remove the CD after switching off the computer system then it is every possibility that the computer system may start to boot automatically from the disc.

6. **Using Pendrive/USB Flash drive** : Using pen drive/USB flash drive is another source of virus attacks. It is a good practice to scan the pendrive when it is connected to computer.

7. **Not running the latest updates** : Many of the updates, especially those associated with Microsoft Windows and other operating systems and programs, are security updates. Running a program or operating system that is not up-to-date with the latest updates can be a big security risk and can be a way your computer becomes infected.

HISTORY OF VIRUS

- Creeper, named for a character on the "Scooby Doo" cartoon show, is generally recognized at the first computer virus. It was written in 1971 by Bob Thomas of BBN Technologies and spread through DEC PDP-10 computers on ARPANET, displaying the message, "I'm the creeper, catch me if you can!"
- Elk Cloner, written in 1982 by then-15-year-old Rich Skrenta of Pittsburgh, was a boot-sector virus designed to infect Apply II computers.

Virus and Antivirus

- Brain, created in Pakistan in 1986, by two brothers Basit and Amjad Farooq Alvi, it was the first PC virus boot sector to hit Microsoft running computers then other popular operating system MS-DOS

If your system has fallen victim to a computer virus then there may be a number of symptoms you might be experiencing:

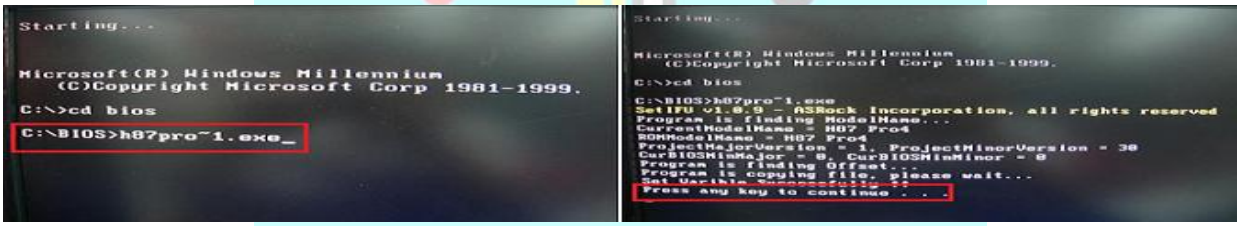
1. **Slow computer performance**
2. **Erratic computer behaviour**
3. **Unexplained data loss**
4. **Frequent computer crashes**

TYPES OF VIRUS

1. **Boot Sector Virus-** Boot sector viruses are one of the oldest forms of computer virus out there. They infect the boot sector or partition table of a hard drive so that they're initiated the moment the computer is switched on.
   A Boot Sector virus isn't a specific virus, it's a particular way in which viruses can affect your computer. A boot sector is a physical sector on your hard drive which is required to start the boot process and load your operating system.

By placing a virus here, it means the virus is activated every time you start your computer, even before your operating system begins to boot up. Often, you won't even realize it's happening which makes the threat potentially even worse. Boot sector viruses can even spread to other hard drives you have installed or physical media you have plugged into your system.

Examples- Elk cloner, Brain etc.



2. Direct Action Virus

When it comes to these types of viruses, direct action viruses infect your files and are one of the two main types of computer virus that does this. It doesn't hide in your computer's memory nor install itself. The way it works is through particular file types like .EXE or .COM, which they attach into.

Once you click on the infected file, it becomes active. It then looks for other files in the infected file's location so it can spread more. While it's annoying, it doesn't cripple your system's performance since it only makes your files inaccessible.

You can remove it with a simple anti-virus program, so it's not much of a threat compared to the Boot Sector virus.

3. Resident Virus

Like its direct action counterpart, the resident virus is a file infector. But its primary difference from the former is that they install themselves on your PC unit. They become even dangerous because they can persist even after the primary source of the virus infection gets removed.

Depending on the virus's programming, it can be difficult to spot it and remove it from your system. It depends on whether the resident virus is a fast infector or a slow infector. The former causes damage as fast as it can while the latter progresses its damage at a much slower pace.

4. Multipartite Virus

More nefarious than most viruses, multipartite viruses are an amalgamation of the different types of computer viruses regarding how it spreads. It spreads using various means, and it could take a wide variety of actions depending on several factors. For example, it can act in a different manner depending on your PC's operating system.

It can infect your boot sector and executable files, making it act and spread faster. This makes it tougher to remove and might require a complete reformat to prevent a recurrence.

Example – Ghostball, Tequila, Ywinz etc.

5. Polymorphic Virus

These are complex file infectors that can create modified version of itself to avoid detection. This type of virus is dangerous because anti-virus programs have a hard time detecting it. Most programs take days or months formulating routines necessary to identify a single polymorphic virus.

Detection takes a long time because of the way anti-virus programs function. These software types can only blacklist a single virus variant. Polymorphic viruses take advantage of this by changing its signature when it reproduces, making it look like a different, otherwise harmless file.

6. Overwrite Virus

An overwriting virus is a malicious program which, after infection, will effectively destroy the original program code, typically by overwriting data in the system's memory.

7. Spacefiller Virus

A spacefiller virus also called cavity virus or Chernobyl virus or CIH is a rare type of computer virus that attempts to install itself by filling in empty sections of a file. By only using empty sections of a file, the virus can infect a file without changing the size of the file, making it more difficult to detect.

8. Memory Resident Virus

It is a malicious code that installs in the memory and then infects future programs. Also known as the Terminate and Stay Resident (TSR), it finds a way to load in the computer's RAM and then infects the executable files that are opened by the user when a certain conditions are met. A few examples of this kind of virus are Jerusalem Virus, Onehalf virus, Magistr, Junkie, Satanbug etc.

9. Web Scripting Virus

These viruses often transmit themselves into your computer's system through the programming used for websites. Placing images, videos, and layouts require a certain degree of coding. That means you might download the viruses without your knowledge if you click on malicious websites' links or watch their videos.

The best way to prevent this is to have security programs that detect malicious coding when browsing the internet.

10. Browser Hijacker

This type of virus is one of the most straightforward and easy-to-detect viruses. It will interfere with your work by leading you off to different websites even if you enter the internet address you want to go to. A good practice is to be careful with your downloads and toolbars.

11. Macro Virus

In computing terminology, a macro virus is a virus that is written in a macro language: a programming language which is embedded inside a software application (e.g., word processors and spreadsheet applications). Some applications, such as Microsoft Office, Excel, PowerPoint allow macro programs to be embedded in documents such that the macros are run automatically when the document is opened, and this provides a distinct mechanism by which malicious computer instructions can spread. This is one reason it can be dangerous to open unexpected attachments in e-mails. Many antivirus programs can detect macro viruses; however, the macro virus' behavior can still be difficult to detect.

OTHER IMPORTANT TERMS

- **Worms**

Worms are spread via software vulnerabilities or phishing attacks. Once a worm has installed itself into your computer's memory, it starts to infect the whole machine and in some case your whole network. Depending on the type of worm and your security measures, they can do serious damage. These parasitic nasties can-

- Modify and delete files
- Inject malicious software onto computers
- Replicate themselves over and over to deplete system resources
- Steal your data
- Install a convenient backdoor for hackers
- They can infect large numbers of computers fast, consuming bandwidth and overloading your web server as they go.
- Examples: Bagle, I love you, Morrie, Nimada etc.

- **Trojan Horses**

Just as it sounds, a Trojan Horse is a malicious program that disguises itself as a legitimate file. Because it looks trustworthy, users download it and… hey presto, in storms the enemy.

Trojans themselves are a doorway. Unlike a worm, they need a host to work. Once you've got the Trojan on your device, hackers can use it to…

- Delete, modify and capture data

- Harvest your device as part of a botnet
- Spy on your device
- Gain access to your network
- Examples- Beast, zero access, Root kit , Sub7.zeus etc.

- **Ransomware**

Ransomware denies or restricts access to your own files. Then it demands payment (usually with crypto-currencies) in return for letting you back in.

In May 2017, a ransomware attack spread across 150 countries and compromised over 200k computers within just one day. Aptly named WannaCry, the attack caused damage estimated in the hundreds of millions to billions of dollars.

WannaCry affected MS Operating systems that did not have the latest patch installed for a known vulnerability. To reduce the risk of ransomware attacks…

- Always keep your Operating System up to date
- Keep your Anti-Virus software up to date
- Back-up your most important files
- Don't open attachments from unknown sources (WannaCry was spread via a .js attachment)

Examples- WannaCry ransomeware, locky ransomeware, bad Rabbit etc.

- **Adware & Scams**

Adware is one of the better-known types of malware. It serves pop-ups and display ads that often have no relevance to you.

Some users will put up with certain types of adware in return for free software (games for example). But not all adware is equal. At best, it's annoying and slows down your machine. At worst, the ads link to sites where malicious downloads await unsuspecting users. Adware can also deliver Spyware and is often easily hacked, making devices that have it installed a soft target for hackers, phishers and scammers.

- **Spyware**

Spyware secretly records your online activity, harvesting your data and collecting personal information such as usernames, passwords and surfing habits.

Spyware is a common threat, usually distributed as freeware or shareware that has an appealing function on the front end with a covert mission running in the background that you might never notice. It's often used to carry out identity theft and credit card fraud.

Once on your computer, spyware relays your data to advertisers or cyber criminals. Some spyware installs additional malware that make changes to your settings.

Examples- Zango, Zlob Trojan, Keyloggers etc.

- **Spam & Phishing**

Virus and Antivirus

Phishing is a type of social engineering attack, rather than a type of malware. But is a common method of cyber attack. Phishing is successful since the emails sent, text messages and web links created look like they're from trusted sources. They're sent by criminals to fraudulently acquire personal and financial information.

Some are highly sophisticated and can fool even your most savvy users. Especially in cases where a known contact's email account has been compromised and it appears you're getting an instruction from your boss or IT colleagues. Others are less sophisticated and simply spam as many emails as they can with a message about 'checking your bank account details'.

- **Spoofing**: Spoofing is when someone or something pretends to be something else in an attempt to gain our confidence, get access to a system, steal data, or spread malware.
- **Hacking** : The process of attempting to gain or successfully gaining, unauthorized access to computer resource."
- **Cracking** : The act of breaking into a computer system, often on a network maliciously, for personal gain."
- **Rootkits** : A rootkit is a type of malicioussoftware that is activated each time your system boots up. Rootkits are difficult to detect because they are activated before your system's Operating System has completely booted up. A rootkit often allows the installation of hidden files, processes, hidden user accounts, and more in the systems OS. Rootkits are able to intercept data from terminals, network connections, and the keyboard

Solutions to Computer Security Threats

ANTIVIRUS

Antivirus software helps protect your computer against malware and cybercriminals. Antivirus software looks at data — web pages, files, software, applications — traveling over the network to your devices. It searches for known threats and monitors the behavior of all programs, flagging suspicious behavior. It seeks to block or remove malware as quickly as possible.

Antivirus software provides protection against these types of threats by performing key tasks:

- Pinpointing specific files for the detection of malicious software
- Scheduling automatic scans
- Scanning either one file or your entire computer at your discretion
- Deleting malicious codes and software
- Confirming the safety of your computer and other devices

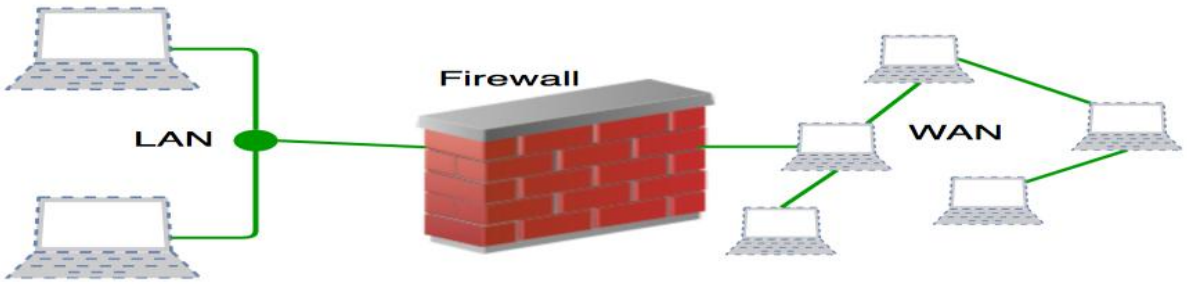
Some of the best antivirus programs available right now include the following:

- Norton
- Avast
- McAfree
- AVG
- Quick Heal
- Panda
- Trend Micro
- BullGuard
- Bitdefender
- Symantec

- Kaspersky
- K7

FIREWALL:

A firewall is a network security device that monitors incoming and outgoing network traffic and permits or blocks data packets based on a set of security rules. Its purpose is to establish a barrier between your internal network and incoming traffic from external sources (such as the internet) in order to block malicious traffic like viruses and hackers. It can be either software based or Hardware based.



Scan Internet Downloads –

Ensure that all files downloaded from the Internet are scanned for computer viruses before being used. Ideally this scanning should be done from one central point on the network to ensure that all files are properly scanned.

Password –

A password is an unspaced sequence of characters used to determine that a computer user requesting access to a computer system is really that particular user.

- Strong password : Term used to describe a password that is an effective password that would be difficult to break. Often a strong password has between six and ten characters (the more the better), numbers, other characters, and both upper and lowercase characters. Below is an example of a strong password.
- Weak password : A password that is not an effective password because it's easy to remember. Names, birth dates, phone numbers, and easily guessable words are considered weak passwords. Below is an example of a weak password.

Digital Signature –

Alternatively referred to as digitally signed, a digital signature is a mathematical scheme used to verify the authenticity of a digital document or message. They are used when determining authenticity and avoiding tampering are important, such as in financial transactions.

Digital signatures are often used as a means to implement electronic signatures that are encrypted which allows for both authentication and non-repudiation (the signer cannot deny signing a document while claiming his/her private key has not been compromised).

Virus and Antivirus

PRACTICE QUESTIONS

1. _____ was a boot-sector virus designed to infect Apple II computers.

1. Brain
2. Elk Cloner
3. Direct Action Virus
4. None of these.

2. A virus that is written in a macro language and embedded inside software applications like word processors and spreadsheet applications is called as _____

1. Macro Virus
2. Browser Hijacker
3. Web Scripting Virus
4. Memory Resident Virus

3. Which malware attack spread across 150 countries and compromised over 200k computers within just one day?

1. I Love you
2. WannaCry
3. Root kit
4. Beast

4. Which of the following is not an antivirus?

1. Panda
2. Norton
3. Symantec
4. Zango

5. _____ is the part of malware such as worms or viruses which performs the malicious action; deleting data, sending spam or encrypting data.
A) Denial of service
B) Exploits
C) Scams
D) Payload
E) Spamming

6. The attack that focuses on capturing small packets from the network transmitted by other computers and reading the data content in search of any type of information is ____.
A) Phishing
B) Eavesdropping
C) Scams
D) Exploits
E) Denial of service

7. What is the software called which when get downloaded on computer scans your hard drive for personal information and your internet browsing habits?
A) Backdoors
B) Key-logger
C) Malware
D) Antiware
E) Spyware

8. Which of the following is the type of software that has self-replicating software that causes damage to files and system?
A) Viruses
B) Trojan horses
C) Bots
D) Worms
E) Backdoors

9. What is the name of first computer virus?

1. The Famous
2. HARLIE
3. PARAM
4. Creepe

5. None

10. Delayed payload of some viruses is also called as

1. Time
2. Bomb
3. Anti-virus
4. None of the above

Virus and Antivirus

11. What is “Trend Micro”?

1. It is anti-virus software
2. It is just a program
3. It is virus program
4. None of the above

12. _____ means to prove/verify the identity of the entity that tries to access the system’s resources.
(a) Entity authentication
(b) Message authentication
(c) Password authentication
(d) All of the above
(e) None of these

13. Which of the following is/are threat(s) for electronic payment system?
(a) Trojan horse
(b) Computer virus
(c) Computer worms
(d) All of the above
(e) None of these

14. Which of the following describes programs that can run independently travel from system to system and disrupt computer communication?
(a) Trojans
(b) Viruses
(c) Worm
(d) Droppers
(e) All of these

15. Which of the following would most likely not be a symptom of a virus?
(a) Existing program files and icons disappear
(b) The CD-ROM stops functioning
(c) The web browser opens to an unusual home page
(d) Odd message or images are displayed on the screen
(e) None of these

16. Biometric authentication works on the basis of

1. Human characteristics
2. Passwords
3. Smart cards
4. Pin

17. Hacking refers to ____.

1. data access without permission
2. data updation without permission
3. data deletion without permission
4. all of the above

18. Which of the following is the first PC virus detected on ARPANET in 1970s?

1. Michelangelo virus
2. Brain
3. Creeper
4. Carzy. A

19. The viruses that change their appearance to avoid detection are called___.

1. MBR viruses
2. DBR viruses
3. Parasitic viruses
4. Polymorphic viruses

20. Which of the following actions is performed by an antivirus software on a virus infected file?

1. Repairs the infected file
2. Deletes the infected file
3. Quarantines the infected file
4. All the above

21. _____ is also known as cavity virus.

1. Polymorphic Virus
2. Space-filler Virus
3. Overwrite Virus
4. Non-resident virus

22. _____viruses infect executable program files:

1. File Infector Viruses
2. Macro Viruses
3. Multi Partite Viruses
4. None of These

23. Computer Security Day on _____reminds us to protect our computers.

1. November 30th
2. November 20th
3. November 22th
4. November 10th

24. World Computer Literacy Day was launched by Indian computer company NIIT to mark its 20th anniversary in 2001 and It occurs annually on_____.

1. 4 December
2. 2 December
3. 10 December
4. 22 December

Answer key

1. 2
2. 1
3. 2
4. 4
5. 5
6. 2
7. 5
8. 4
9. 4
10. 2
11. 1
12. 2
13. 4
14. 3
15. 2
16. 1
17. 4
18. 3
19. 4
20. 1
21. 2
22. 1
23. 1
24. 2

ROLE OF IT IN GOVERNANCE

What is information technology?

Information technology is the technology used to store, manipulate, distribute or create information. All these can be summed up easily – It's having knowledge, and knowledge comes from having information. Gaining knowledge through information is the role of ''information technology'' IT in today's informed world.

IT is a set of tools that can help provide the right people with the right information at the right time. Though IT is not a solution to every thing, for IT to work, people must learn how to use it. So you can not assume that IT will work for you to share information across the organization when people in the organization don't know how to use it.

Definition of e-Governance

Electronic governance or e-governance implies government functioning with the application of ICT (Information and Communications Technology). Hence e-Governance is basically a move towards SMART governance implying: simple, moral, accountable, responsive and transparent governance.

What is SMART Governance?

- **Simple — implies simplification of rules and regulations of the government and avoiding complex processes with the application of ICTs and therefore, providing a user-friendly government.**
- **Moral — meaning the emergence of a new system in the administrative and political machinery with technology interventions to improve the efficiency of various government agencies.**
- **Accountable — develop effective information management systems and other performance measurement mechanisms to ensure the accountability of public service functionaries.**
- **Responsive — Speed up processes by streamlining them, hence making the system more responsive.**
- **Transparent — providing information in the public domain like websites or various portals hence making functions and processes of the government transparent.**

Interactions/ Types in e-Governance

There are 4 kinds of interactions in e-governance, namely:

1. **G2C (Government to Citizens) — Interaction between the government and the citizens.**
- This enables citizens to benefit from the efficient delivery of a large range of public services.
- Expands the accessibility and availability of government services and also improves the quality of services
- The primary aim is to make the government citizen-friendly.

2. **G2B (Government to Business):**
- It enables the business community to interact with the government by using e-governance tools.

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- The objective is to cut red-tapism which will save time and reduce operational costs. This will also create a more transparent business environment when dealing with the government.
- The G2B initiatives help in services such as licensing, procurement, permits and revenue collection.

3. G2G (Government to Government)

- Enables seamless interaction between various government entities.
- This kind of interaction can be between various departments and agencies within government or between two governments like the union and state governments or between state governments.
- The primary aim is to increase efficiency, performance and output.
- Read about government to government initiatives in the linked article.

4. G2E (Government to Employees)

- This kind of interaction is between the government and its employees.
- ICT tools help in making these interactions fast and efficient and thus increases the satisfaction levels of employees.

Some Initiatives in the same field

Government to Citizen (G2C) Initiatives:

- **Computerization of Land Records:** In collaboration with NIC. Ensuring that landowners get computerized copies of ownership, crop and tenancy and updated copies of Records of Rights (RoRs) on demand.
- **Bhoomi Project:** Online delivery of Land Records. Self-sustainable e-Governance project for the computerized delivery of 20 million rural land records to 6.7 million farmers through 177 Government-owned kiosks in the State of Karnataka
- **Gyandoot**: It is an Intranet-based Government to Citizen (G2C) service delivery initiative. It was initiated in the Dhar district of Madhya Pradesh in January 2000 with the twin objective of providing relevant information to the rural population and acting as an interface between the district administration and the people.
- **Lokvani Project in Uttar Pradesh**: Lokvani is a public-private partnership project at Sitapur District in Uttar Pradesh which was initiated in November, 2004. Its objective is to provide a single window, self-sustainable e-Governance solution with regard to handling of grievances, land record maintenance and providing a mixture of essential services.
- **Project FRIENDS in Kerala**: FRIENDS (Fast, Reliable, Instant, Efficient Network for the Disbursement of Services) is a Single Window Facility providing citizens the means to pay taxes and other financial dues to the State Government.The services are provided through FRIENDS Janasevana Kendrams located in the district headquarters.
- **e-Mitra Project in Rajasthan:** e-Mitra is an integrated project to facilitate the urban and the rural masses with maximum possible services related to different state government departments through Lokmitra-Janmitra Centers/Kiosks.
- **e-Seva (Andhra Pradesh):** This project is designed to provide 'Government to Citizen' and 'e-Business to Citizen' services. The highlight of the eSeva project is that all the services are delivered

online to consumers /citizens by connecting them to the respective government departments and providing online information at the point of service delivery.

- **Admission to Professional Colleges – Common Entrance Test (CET):** With the rapid growth in the demand as well as supply of professional education, the process of admission to these institutions became a major challenge in the early 1990s. Recourse was then taken to ICT to make the process of admission transparent and objective. One of the pioneering efforts was made by Karnataka. The State Government decided to conduct a common entrance test based on which admission to different colleges and disciplines was made.

Government to Business (G2B) Initiatives:

- **e-Procurement Project in Andhra Pradesh and Gujarat:** To reduce the time and cost of doing business for both vendors and government.
- **MCA 21:** By the Ministry of Corporate Affairs. The project aims at providing easy and secure online access to all registry related services provided by the Union Ministry of Corporate Affairs to corporates and other stakeholders at any time and in a manner that best suits them.

Government to Government (G2G) Initiatives:

- **Khajane Project in Karnataka**: It is a comprehensive online treasury computerization project of the Government of Karnataka. The project has resulted in the computerization of the entire treasury related activities of the State Government and the system has the ability to track every activity right from the approval of the State Budget to the point of rendering accounts to the government.
- **SmartGov (Andhra Pradesh):** SmartGov has been developed to streamline operations, enhance efficiency through workflow automation and knowledge management for implementation in the Andhra Pradesh Secretariat.

Central government initiatives as mission mode projects (MMP)

e-office- The Government of India has recognized the need to modernize the Central Government offices through the introduction of Information and Communications Technology. e-Office is aimed at increasing the usage of work flow and rule based file routing, quick search and retrieval of files and office orders, digital signatures for authentication, forms and reporting components.

Immigration, Visa and Foreigner's Registration & Tracking (IVFRT)- India has emerged as a key tourist destination, besides being a major business and service hub. Immigration Check Post is the first point of contact that generates public and popular perception about the country, thus necessitating a state of the art system for prompt and user-friendly services.

UID- The unique identification project was conceived as an initiative that would provide identification for each resident across the country and would be used primarily as the basis for efficient delivery of welfare services. It would also act as a tool for effective monitoring of various programs and schemes of the government.

ROLE OF IT IN GOVERNANCE

Pensions- The pensions MMP is primarily aimed at making the pension/ retirement related information, services and grievances handling mechanism accessible online to the needy pensioners, through a combination of interactive and non-interactive components, and thus, help bridge the gap between the pensioners and the government.

Banking- The Banking MMP is yet another step towards improving operational efficiency and reducing the delays and efforts involved in handling and settling transactions. The MMP which is being implemented by the banking industry aims at streamlining various e-services initiatives undertaken by individual banks. Implementation is being done by the banks concerned, with the banking Department providing a broad framework and guidance.

Posts- Modernization of Postal Services has been undertaken by the Department of Posts through computerization and networking of all post offices using a central server-based system, and setting up of computerized registration centers (CRCs).

State Mission Mode projects

e-Governance in Municipalities

It is a unique initiative of the Government of India conceptualized under the umbrella of the overall National e-Governance Plan (NeGP) and the Jawaharlal Nehru National Urban Renewal Mission (Jnnurm) aimed at improving operational efficiencies within Urban Local Bodies (ULBs).

Crime and Criminal Tracking Network & Systems

Crime and Criminal Tracking Network & Systems (CCTNS) MMP aims at creating a comprehensive and integrated system for enhancing the efficiency and effective policing at all levels and especially at the Police Station level through adoption of principles of e-Governance, and creation of a nationwide networked infrastructure for evolution of IT-enabled state-of-the-art tracking system.

Public Distribution System

Computerization of the PDS is envisaged as an end-to-end project covering key functional areas such as supply chain management including allocation and utilization reporting, storage and movement of food grains, grievance redressal and transparency portal, digitization of beneficiary database, Fair Price Shop automation, etc.

Health

ICT for programme management has been undertaken by the Ministry of Health & Family Welfare in the Mother and Child Tracking System (MCTS) programme and the Ministry envisages a more comprehensive use of ICT including for Hospital Information Systems, supply chain management for drugs and vaccines, providing

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ICT tools to ASHA and ANM workers, programme management of National Rural Health Mission (NRHM), etc through this MMP.

e-panchayat

The Panchayati Raj Institutions (PRIs) are saddled with the problems of inadequate physical and financial resources, technical capabilities and extremely limited computerization. As a result, the potential of PRIs as the preferred delivery channel for the schemes of State and Centre as well as for citizen services has not been fully realized. While some computerization efforts for PRIs have been made by NIC over the years, the e-Governance revolution sweeping the country has not touched the PRIs yet in significant measure. The Ministry of Panchayati Raj, Government of India has therefore decided to take up the computerization of PRIs on a mission mode basis.

e-District

e-District is one of the 31 Mission Mode Projects under National e Governance Plan (NeGP) with the DIT, GoI being the nodal ministry. This project aims at providing support to the basic administrative unit i.e. District Administration by undertaking backend computerization to enable electronic delivery of high volume citizen centric government services which would optimally leverage and utilize the three infrastructure pillars of State Wide Area Networks (SWAN), State Data Centers (SDC) and Common Service Centers (CSCs) to deliver services to the citizen at his doorsteps.

Recent Initiatives

Direct Cash transfer

To facilitate disbursements of Government entitlements like NREGA, Social Security pension, Handicapped Old Age Pension etc. of any Central or State Government bodies, using Aadhaar and authentication thereof as supported by UIDAI.

Aadhar Enabled Payment system (AEPS) :

AEPS is a bank led model which allows online interoperable financial inclusion transaction through the Business correspondent of any bank using the Aadhaar authentication. This has helped in financial inclusion. The four Aadhaar enabled basic types of banking transactions are as follows:-

- Balance Enquiry
- Cash Withdrawal
- Cash Deposit
- Aadhaar to Aadhaar Funds Transfer

Digital India program

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ROLE OF IT IN GOVERNANCE

This programme has been envisaged by Department of Electronics and Information Technology (DeitY). The vision of Digital India aims to transform the country into a digitally empowered society and knowledge economy. The programme will be implemented in phases from the current year till 2018.

MyGov citizen portal

Prime Minister launched an online platform mygov.nic.in to engage citizens in the task of "good governance" (surajya) as he completed 60 days in office on Saturday. MyGov is a technology-driven platform that would provide people with the opportunity to contribute towards good governance.

E-Kranti scheme

This is project for linking the internet with remote villages in the country. This scheme will broaden the reach of internet services to the rural areas in the country. The fundamental features of this scheme will be making the records handy to the government with ease. It also includes Expansion of internet and commencement of IT-based jobs in rural areas. It will also boost the use of mobile phones and computers in rural areas. It will also expand the use of IT in agriculture and retail trade too.

Digital Cloud for every Indian

Certificates issued by the government — education, residential, medical records, birth certificates, etc. — are to be stored in individual 'digital lockers' and a communication protocol established for government departments to access them without physically having to see the hard copy. The purpose of government is that copies of certificates issued by the government itself not to be carried around by people to government offices for various services.

M-governance

M-Governance is not a replacement for e-Governance, rather it complements e- Governance. M-Governance, is the use of mobile or wireless to improve Governance service and information "anytime, anywhere". Mobile applications also rely on good back office ICT infrastructure and work processes. It has potential of using mobile phones as input devices in certain areas where last mile connectivity becomes issues for simple data inputs of critical importance for decision making in government departments.

M-Governance is not a new concept. The private sector has been greatly leveraging these of mobile phones for delivery of value added services for the following which however are mostly SMS based: Banking, Media, Airlines, Telecom, Entertainment, News, Sports, Astrology, and Movie Tickets Etc.

M-governance has increased the productivity of public service personnel, improving the delivery of government information and services, increasing channels for public interactions and Lower costs leading to higher participation of people.

ROLE OF IT IN GOVERNANCE

Government initiatives for m-governance

Mobile Seva

It aims to provide government services to the people through mobile phones and tablets. It has been developed as the core infrastructure for enabling the availability of public services through mobile devices.

Mobile Seva enables the integration of the mobile platform with the common e-Governance infrastructure consisting of State Data Centers (SDCs), State Wide Area Networks (SWANs), State and National Service Delivery Gateways (SSDGs/NSDG).

It enables a government department to integrate both web and mobile based services seamlessly and enhances the access to electronic services tremendously leveraging the very high penetration of mobile phones, especially in rural areas

A Mobile Applications Store (m-App Store) has also been developed by DeitY as part of Mobile Seva. The Mobile Governance Portal and the m-App Store can be accessed at http://mgov.gov.in/. The m-Appstore currently hosts over 240 live mobile applications. The live applications can be downloaded and installed free of cost on a mobile phone by any person.

The project, “mobile seva” has won the second prize at the prestigious United Nations’ Public Services Awards in the category “Promoting Whole of Government Approaches in the Information Age” for Asia Pacific.

Advantages of e-governance

Following are the advantages of E-Governance

- Speed: Technology makes communication speedier. Internet, Phones, Cell Phones have reduced the time taken in normal communication.
- Cost Reduction: Most of the Government expenditure is appropriated towards the cost of stationary. Paper-based communication needs lots of stationary, printers, computers, etc. which calls for continuous heavy expenditure. Internet and Phones makes communication cheaper saving valuable money for the Government.
- Transparency: Use of ICT makes governing profess transparent. All the information of the Government would be made available on the internet. The citizens can see the information whenever they want to see. But this is only possible when every piece of information of the Government is uploaded on the internet and is available for the public to peruse. Current governing process leaves many ways to conceal the information from all the people. ICT helps make the information available online eliminating all the possibilities of concealing of information.
- Accountability: Once the governing process is made transparent the Government is automatically made accountable. Accountability is answerability of the Government to the people. It is the

answerability for the deeds of the Government. An accountable Government is a responsible Government.

- Convenience: E-Government brings public services to citizens on their schedule and their venue.
- Improved Customer Service: E-Government allows to redeploy resources from back-end processing to the front line of customer service.
- Increased access to information: E-Government improves the accessibility of government information to citizens allowing it become an important resource in the making the decisions that affect daily life and so it helps in empowerment of citizens