

Chameli Devi Group of Institutions
Department of Computer Science & Engineering
BT205 Basic Computer Engineering
B. Tech, CSE (II Semester)
Unit -1

Syllabus: Computer: Definition, Classification, Organization i.e., CPU, Register, Bus Architecture, Instruction Set, Memory & Storage Systems, I/O Devices and System & Application Software.

Computer Application: e-Business, Bio-Informatics, Health Care, Remote Sensing & GIS, Meteorology and Climatology, Computer Gaming, Multimedia and Animation etc.

Operating System: Definition, Function, Types, Management of File, Process & Memory.
Introduction to MS word, MS Power-point, MS Excel

DEFINITION OF COMPUTER:

Computer is digital electronics machine which takes input , process it and produce useful output. As an existence computer system is combination of interconnected hardware's and set of instruction called software.

Computer system provide a capability for gathering data, performing complex calculation rapidly and accurately, storing huge amount of information, communicating with other computer systems etc.

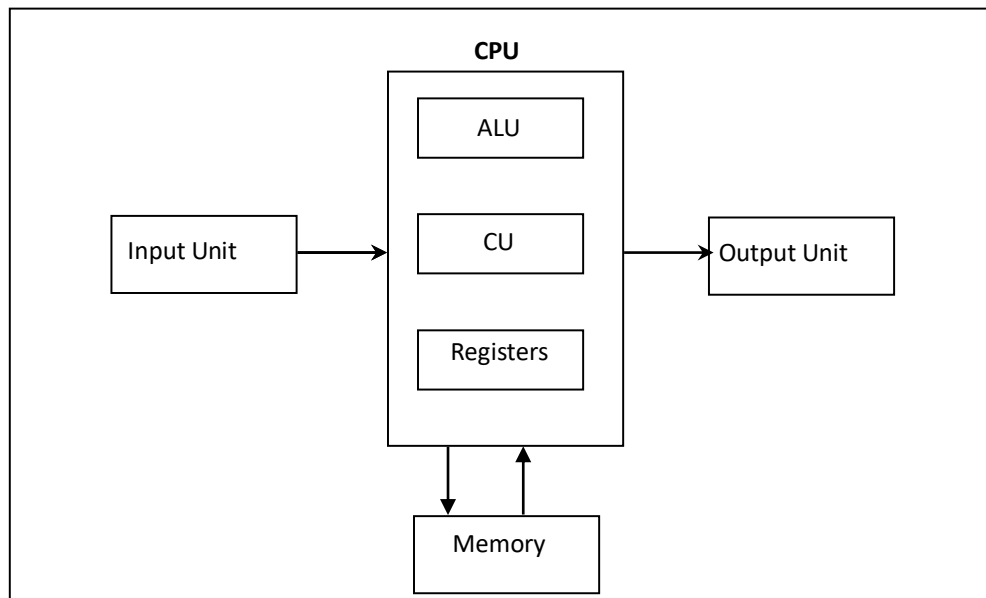


Figure 1.1: Block Diagram of Computer

Computer is also defined as combination of Hardware (CPU, Memory etc.) and Software (System and Application) as mentioned below in layer architecture of Computer.

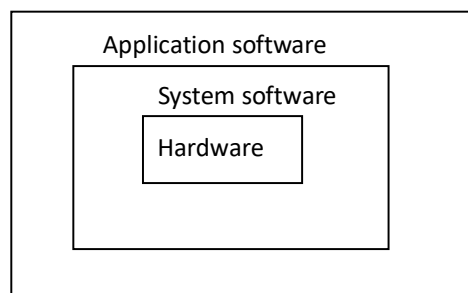


Figure 1.2: Layered Architecture of Computer

CLASSIFICATION OF COMPUTERS:

Based on size, data processing speed, computing ability computers classified as

- **Super computer:**

1. Most powerful computer.
2. Can compute trillion of instruction per second.
3. Such computer can operate fast because they have number of processor
4. Which perform computation in parallel.
5. These computers are very big and expensive.
6. They are used to solve scientific mathematical and engineering problems, weather forecasting, animated movie, nuclear energy research etc.

Examples: Cray-1, Cray-2, Cyber205, PARAM, PARAM Padma.

- **Mainframe Computers:**

1. They are also big in size but smaller than super computers.
2. They are very expensive.
3. They have large capacity of data storage and high processing speed.
4. Such computer can handle processing of many users request at a time.
5. These computers are multiuser, multiprogramming, high storage and fast processing computer.
6. They are used in centralized and expensive database manipulation in big organization such as Insurance and banking sectors, university, big hospitals etc.

Example: CDC6000, MEHDA, IBM ES000 Series.

- **Minicomputers:**

1. Less expensive and also smaller than mainframe computers.
2. They are as powerful as mainframe but can connected to limited numbers of users up to 200.
3. They are used in medium organization like college, Govt. Department etc.

Example: PDP11, IBM8000 Series, VAX 7500, AS/400.

- **Microcomputers:**

1. Super, mainframe and mini computers cannot be used as personal computer(PC) because of their large size and high cost. Microcomputers are smallest in size and cheap in cost.
2. They have good computing speed up to GHz.
3. Such computers also have ability to process multiple application at a time.

Example: Today's Desktop computers, Laptop computers

CENTRAL PROCESSING UNIT (CPU):

It is also known as processor and popularly referred as brain of computer. The CPU in the computer is responsible for processing of Data, execution of instructions and control overall operations and all other components of computer. Therefore, CPU is component where all processing or computing takes place.

The CPU operation includes following four steps. These four steps are also known as CPU cycle.

- Fetching the instruction from the main memory.
- Decoding the instructions to decide what operations to be performed.
- Executing the instruction.
- Storing the results back in the memory.

The CPU is made of following subsystems

- ALU (Arithmetic and Logic unit)

- CU (Control Unit)
- Registers

ALU (Arithmetic and Logic unit):

Arithmetic part of ALU perform arithmetic operations such as addition, subtraction, multiplication, division etc. While logic unit perform logical operation such as greater than, less than, equal to, not equal to etc.

Control Unit:

It is an important component of CPU that controls the flow of data and information, maintain the sequence of operation being performed by CPU. It fetches the instruction from the memory, decode it and transmit the signal to AU or LU for appropriate operation.

Registers:

Registers are special purpose, high speed, temporary storage units inside the CPU for holding the data, instructions, address and intermediate results that are currently being processed. A processor has following types of registers.

- **Program Counter(PC)** : It holds the address of instruction to be executed next.
- **Instruction Register (IR)**: It holds the instruction currently being executed by CPU.
- **Accumulator**: It hold the result or intermediate result produced by ALU.
- **Memory Address Register (MAR)**: It holds the memory address from which data will be fetched to CPU or the address to which data will be sent to memory.
- **Memory Data Register (MDR)**: It holds the data being transferred to process.

MEMORY AND STORAGE SYSTEM:

The purpose of memory in the computer is to store data, instruction or information permanently or temporary. The data, instruction or information may have written into the memory or read from the memory.

Types of Memory

- Base on How long information can be stored into the memory there two types:
 - Volatile
 - Non-volatile

Volatile Memory: The content of memory is erased when computer become power-off.

Example: RAM (Random Access Memory), Cache etc.

Non- Volatile: The content remains in the memory even computer is power-off.

Example: ROM (Read only Memory), Hard disk, Floppy Disk etc.

- Based on access mechanism following are two types.
 - Primary memory
 - Secondary memory.

Primary memory: Primary storage, also known as main storage or memory, is the main area in a computer in which data is stored for quick access by the computer's processor.

Example: RAM (Random Access Memory), ROM (Read Only Memory), Cache etc.

Secondary Memory: Secondary memory or secondary storage (also known as external memory or auxiliary storage), differs from primary storage in that it is not directly accessible by the CPU. The computer usually uses its input/output channels to access secondary storage and transfers the desired data using intermediate area in primary storage. Secondary storage does not lose the data when the device is powered down—it is non-volatile. It is less expensive than primary storage and

found in large capacity such as 80GB,160GB even 1000GB. Example: Hard disk, USB flash drive, CD-ROM etc.

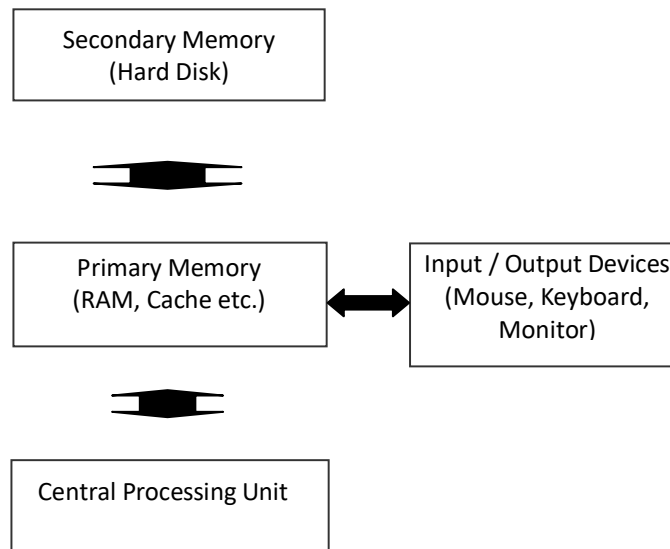


Figure 1.3: Computer

Memory Organization

CACHE MEMORY:

It is primary and volatile memory of computer memory system which reside between CPU and main memory. A cache used by the central processing unit (CPU) of a computer to reduce the average time to access memory. The cache is a smaller, faster memory which stores copies of the data from frequently used main memory locations. Most CPUs have different independent cache, including instruction and data cache, where the data cache is usually organized as a hierarchy of more cache levels (L1, L2 etc.). Primary cache or level-1 L1 cache reside inside the CPU while secondary or level L2 cache resides outside the cache.

When the processor needs to read from or write to a location in main memory, it first checks whether a copy of that data is in the cache. If so, the processor immediately reads from or writes to the cache, which is much faster than reading from or writing to main memory. If the processor finds the data in the cache, a cache hit has occurred. However, if the processor does not find the data in the cache, a cache miss has occurred.

Memory Hierarchy and Access Time:

There are three major level of memory in the computer system, these three-level distinguished by response or access time is called Memory hierarchy. Memory hierarchy can be represented by

- Level-1 Processor Register and Cache memory - Fastest memory
- Level-2 main memory - fast but slower than Level-1 memories
- Level-3 Secondary memory – Slowest, memories.

Access time of different level of memories

CPU register and Cache < primary memory < Secondary memory

BUS ARCHITECTURE:

- **Bus:** Bus is set of wires used to connect various hardware components and peripheral of computer system for the purpose of transferring data, address, control signal and instructions.

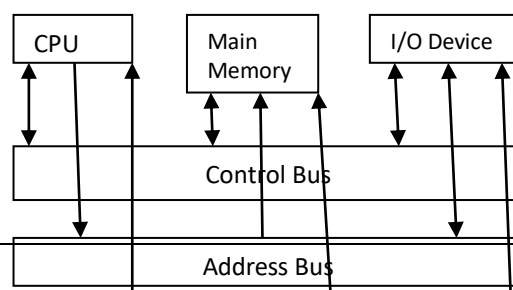


Figure 1.4: Architecture of Bus system

Types of Buses:

There are three types of buses

- **Control Bus:** Control bus manage the flow of data, instructions and data among CPU, memory and Input-output device (I/O device) by transmitting control signals.
- **Data Bus:** Data bus carries the data and instruction between different hardware component of computer system. Modern computer uses 32-bits data bus to transfer 32-bits of data or instructions at a time. Data bus is bidirectional between CPU and RAM.

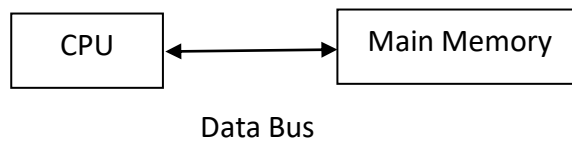


Figure 1.5: Data Bus

- **Address Bus:** It transfer memory address CPU to main memory for read and write memory operation. It contains number of memory lines which determine the range of memory addresses. Address bus is unidirectional between main memory and CPU.

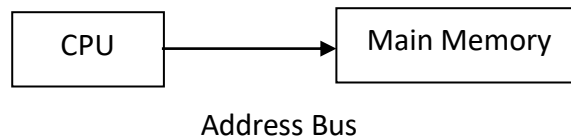


Figure 1.6: Address Bus

INSTRUCTION SET:

- **Instruction:** Instruction is machine language command used by processor to perform a specific task. Instruction has two parts known as opcode and operand.
Opcode: It specify operation to be performed.
Operand: Operand are data on which operation is performed. It also specifies the memory location or register where data is being stored or data to be fetched.
- **Instruction Set:** Set of instructions to perform specific operation is called the instruction set.
- **Type of Instruction set:** There are two types of instruction set, they are based on complexity and number of instructions.
 - **Complex Instruction set:**
 1. No if instructions are 100-250.
 2. Mainly memory-based instructions which involve frequent reference to the memory.
 3. The instructions in this instruction set have variable length instruction format. i.e. One byte, two bytes etc.
 4. The execution of instruction is time consuming as frequent access memory is time consuming as compared to that of registers.
 5. The computer which implement complex instruction set is known as complex instruction set computer or CISC.
 - **Reduced Instruction set:**

1. No if instructions are up to 100.
2. Mainly register based instructions, and very few memory-based instructions.
3. The instructions in this instruction set have fixed length instruction format. It is about 4-Byte.
4. It has few instructions therefore design of hardware circuitry is simple and speed of processing is fast as compared to Complex Instruction set.
5. The computer which implement reduced instruction set is known as reduced instruction set computer or RISC.

SOFTWARE:

Software is program which perform which accomplish a task. It is non-tangible component of computer which make hardware of computer useful. Software is usually written in some High-level programming language.

Based on their goal software are two types: System Software and Application software.

- **System Software:** System software is designed to operate the computer hardware, to provide basic functionality, and to provide a platform for running application software. System software are service provider to user and user programs. System software includes:
 - Operating system which is essential collection of computer programs that manages resources and provides common services for other software.
 - Device driver, a computer program that operates or controls a particular type of device that is attached to a computer. Each device needs at least one corresponding device driver; thus, a computer needs more than one device driver.
 - Utilities, software designed to assist users in maintenance and care of their computers.
- **Application Software:** It uses the computer system to perform useful work or provide entertainment functions beyond the basic operation of the computer itself. Application software is user level program which runs on the operating system and take the services of operating system. Examples of application program includes MS-word, Tally, window media player, internet browser etc.

OPERATING SYSTEM:

An operating system (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is an essential component of the system software in a computer system. Application programs usually require an operating system to function.

Goal of Operating system:

- To make computer system convenient to use.
- To use hardware resource of computer in efficient manner.
- To provide an environment in which a user can work on computer.

Services of Operating system:

OS provides following services to the convenient of the user.

- **Program Execution:** The OS provides an environment where the user can conveniently work on computer. The user done not worry that how the program will run.
- **Input-output operation:** Program require input from input device like keyboard, mouse etc., to

take input and produce output on output device such as monitor, printer etc. OS hides the details of I/O operation from the user.

- **File System Manipulation:** All programs stored in secondary storage in binary form known as row data. OS manage those row data in form of directories and files. By the way of files and directory user can easily locate its program.
- **Process Communication:** There are many instances when a process needs to communicate with other process. To exchange information. It may be between the process running on the same computer or two computers on the network. Copy from program and paste it to second program is an example of process communication.
- **Error detection:** OS constantly monitors the system for detecting the errors.

Functions of operating system: In order to provide various services to user OS has to perform following functions.

- Process management
- Memory Management
- File Management
- Security management
- Device management.

PROCESS MANAGEMENT:

Process: Program under execution is called process. Process contains set of instructions to be executed and are loaded into main memory. When program become process, it utilizes hardware resources like main memory, CPU, cache etc. of computer. When process become end, it releases all resources of computer.

Process management:

Operating system performs following activities in process management.

- It creates the process and allocate resources.
- It maintains the process in one of the following state
 - New state
 - Ready State
 - Running State
 - Waiting State.
 - Terminating State.
- It switches the process from one state to another state. This task is done by various scheduler.
- These schedulers are (a) Job or Long-term scheduler. (b) CPU or short-term scheduler and (c) Midterm scheduler.
- In multiprogramming environment many process run simultaneously to maximum utilization of CPU and to give chance to run all process. But at a time, CPU can be given only one process. Therefore, OS has to schedule process so that every process can turn to execute by processor. This is called scheduling. OS performs scheduling by following methods
 - First come first serve
 - Round robin
 - Shortest job first.
 - Priority scheduling

OS maintains various information about every process in block which is called Process Control Block (PCB), OS maintains following information in PCB

- Process ID.
- Process State.
- Program Counter
- Registers value.
- Scheduling Information.
- Size of process.

State Diagram of Process:

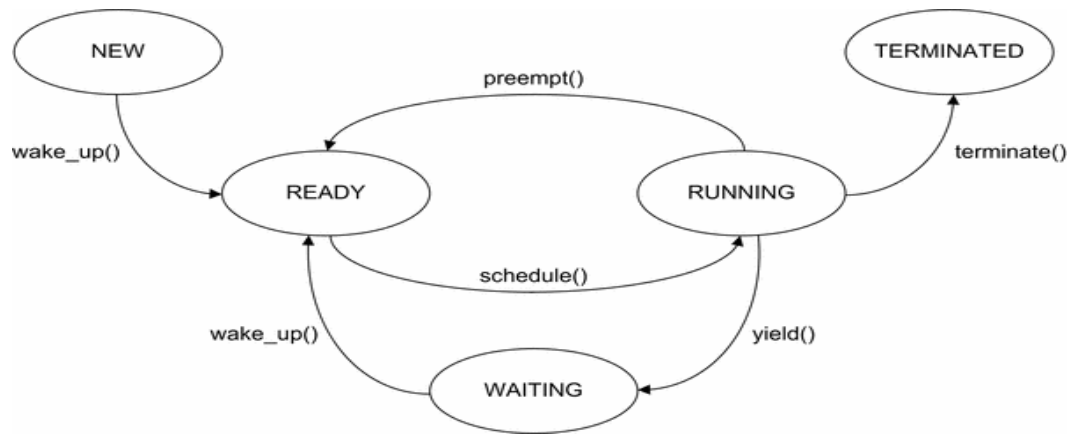


Figure 1.7: State of Processes

- **New state:** Initially process will be in New state. It means process is being created.
- **Ready state:** Once the process is created it will be moved on to ready state. In the ready state there will be multiple number of process.
- **Running state:** One of the process will be selected from the ready state and dispatched on to the running state. When the process in the running state it occupied the CPU, and executing the instruction of the process and performing CPU time. In the running state one process at any point of the time.
- **Waiting:** If the running process required any input output then it will come to wait state. In the wait state there will be multiple number of process. It means multiple process will perform input output operation simultaneously.
- **Terminate:** Terminate the process after its execution is completed.

Process Scheduling: Mechanism by which every process gets its turn to execute in a manner so that user can feel that all its program is running is called Process scheduling.

MEMORY MANAGEMENT:

The operating System performs the function of memory management by allocating main memory to all process in such a manner so that none of the process run out of memory. There various method by which OS allocate memory to all process. Followings are the methods of memory allocation

- Contiguous memory allocation of fixed partition.
- Contiguous memory allocation of variable partition.
- Non-Contiguous memory allocation or paging.

Contiguous memory allocation of fixed partition: OS divides the memory into several fixed size blocks. OS makes available each block of memory to process and process occupies entire block. If size of process is larger than block size than OS allocate more than one block if available in continuity. In

Contiguous memory allocation OS does not part the process.

Since in this method process occupies entire block and if size of process smaller than block size than remaining space in block remains unoccupied by any process. So therefore, in entire memory there are various unoccupied memory spaces in between occupied space. It is called Internal Fragmentation.

Contiguous memory allocation of variable partition: OS allocate memory space as per size of process. In this Memory is not partitioned in several fixed size blocks. In this also there are chances of Fragmentation which is called External Fragmentation.

Compaction: Mechanism used to reduce or eliminate fragmentation is called compaction. In compaction, occupied memory spaces are moved in one side to create large size of free space.

File Management: Files are visible aspect of operating systems which represents the information stored in memory in organized manner. The file management system of an OS is responsible for maintaining the file system and performing different following different operations on files

- Creation of file or directory.
- Deleting of file or directory.
- Searching of file or directory.
- Renaming of file or directory.
- Updating of file or directory.
- Organizing files and subdirectories in directory structure.

TYPES OF OPERATING SYSTEMS:

There are many types of operating systems depending on applications for which they are used.

- **Batch Processing Operating Systems:** Such type of OS was developed in year 1950. In this system each program to be executed treated as job. All jobs sequentially arranged in a queue for execution. All jobs are executed in sequence one after another without or little manual intervention. The main purpose of such type of is to minimize the human intervention in processing of jobs and to improve utilization of computer systems. In batch processing operating system the CPU is allocated to process till its completion.
- **Multiprogramming Operating Systems:** It is also known as multitasking operating systems. It supports execution and running of multiple program (process) at the same time on the CPU. Processes are allocated to CPU for some specific amount of time for its execution and this switching of processes to CPU is so quickly that it gives impression of running all the processes concurrently (at the same time). For example, on multitasking OS the user can simultaneously work on word processor, playing songs, brows Internet etc. The examples of multitasking OS are Windows XP, Windows 7, Linux etc.
- **Real-Time Operating Systems (RTOS):** RT OS are designed to handle real-time applications and activities. For example, withdrawing of money form ATM, Operation of different functions of an aircraft, telecommunication systems etc. Such applications require very quick response time in real-time without external interruption. Real-time OS has capability to handle such application which can response in real-time, because they can process information and data immediately or within the stipulated time (deadline). Examples: OS-9, IBM's OS/390, RTLinux etc.

- **Network Operating Systems (NOS) :** A NOS is a computer operating system that is designed to support workstation (Server) and personal computer(Client) that are connected on Local Area Network (LAN). NOS allows the client to share the resource such as file, printers etc. connected in LAN. Windows NT, windows server 2003 are example of network operating systems.
- **Embedded Operating Systems:** Embedded OS are specially designed for electronic devices and installed(Embedded) in the device for which its designed. Such OS perform the computational task on such devices. Personal digital assistant, traffic control systems, automatics washing machine are device which perform its functions due to embedded operating systems. Palm OS, Minix3 , Android are examples of embedded operating systems.

INPUT DEVICES:

The input device takes the raw data from the user and sent them to computer for processing. Keyboard, mouse, scanner, joysticks, microphones, webcams are examples are input devices.

OUTPUT DEVICES:

The output device takes the output generated by computer and present those outputs to user. Monitor, printer are examples of output devices.

COMPUTER APPLICATIONS:

- **e-Business:** e-business is a term which is used for business or commercial transaction that includes sharing information across the internet using ICT and computers. E-business elements like Selling or buying of products, on-line banking, Payments by cards, on-line stock trading etc. become very handy due to computers.
- **Bio-Informatics:** Field of Biology and Medicines together considered as Bio-informatics. Computer is playing very important role in this field for statistical study on collection and storage of Biological and genetic data to arrive at require solution. DNA mapping, medicinal research, pattern recognitions are some areas of Bi-informatics where computer become very important tool.
- **Health Care:** Various sophisticated medical equipment like Ultrasonography machine, CT scan, X-rays, Eye testing machine use computers for their smooth and accurate operations. Not only theses Doctors use computers to get suggestions on complicated case from their counterpart at abroad.
- **Remote Sensing and GIS:** Remote sensing is a technique of acquiring information about an object or phenomenon without making physical contact with the it. Computer and its computation capabilities is used in various field of remote sensing like geography, land surveying and Earth Science etc. in which computer collect, organized and analyzed data for further processing. Marine navigation and air traffics management are some are some examples where computers are used along with remote sensing mechanism. GIS (Geographical Information systems) in which computer gathers location specific data and present them in various meaningful form. GIS system fitted in Car is very useful in locating its real time position.
- **Meteorology and Climatology:** Computers are very useful for collecting, storing and processing

of atmospheric and weather-related data to forecasts atmosphere and weather conditions for short and long period. Computer displays results using graphics and animations for accurate forecasts.

- **Computer Gaming:** Computer creates virtual environments with graphical and animation support for gaming. User can play game on stand alone PC or Network connected PC on these virtual field, vehicle etc.
- **Multimedia and Animation:** Computer support various Multimedia and animation elements for representation of music, video, sound, text, images etc.

MS WORD (MICROSOFT WORD):

Microsoft Office Word is used to create and edit personal and business documents, such as letters, reports, invoices, e-mails, and books. Documents created in MS word are saved with the .docx or .doc extension. Microsoft Word is used to

- To create business documents with various graphic elements, including images, chart and diagrams.
- To create letters and headers for personal and professional purposes.
- To design different documents such as resumes or invitation cards, etc.

MS POWERPOINT:

Microsoft PowerPoint is an office application developed by Microsoft for windows operating system for creation of attractive and professional presentation. Microsoft PowerPoint supports integration with text, size, graphics, images and multimedia content to create effective presentation. File created in MS PowerPoint are saved with the .pptx or .ppt extension.

MS EXCEL:

MS Excel is an office application developed by Microsoft to manage and analyze various types of Data. Microsoft Excel is a spreadsheet program that is used to record and analyses numerical data. Spreadsheet as a collection of columns and rows that form a table. We all deal with numbers in one way or the other. We all have daily expenses which we pay for from the monthly income that we earn. For one to spend wisely, they will need to know their income vs. expenditure. Microsoft Excel comes in handy when we want to record, analyze and store such numeric data. File created in MS PowerPoint are saved with the .xlsx or .xls extension.