Unit-1

High Level Language,Low Level Language and Middle Level Language

High Level Language： High level language is abbreviated as **HLL**. High level languages are similar to the human language. Unlike low level languages, high level languages are programmers friendly, easy to code, debug and maintain.

High level language provides higher level of abstraction from machine language. They do not interact directly with the hardware. Rather, they focus more on the complex arithmetic operations, optimal program efficiency and easiness in coding.

Low level programming uses machine friendly language. Programmers writes code either in binary or assembly language. Writing programs in binary is complex and cumbersome process. Hence, to make programming more programmers friendly. Programs in high level language is written using English statements.

High level programs require compilers/interpreters to translate source code to machine language. We can compile the source code written in high level language to multiple machine languages. Thus, they are machine independent language.

Today almost all programs are developed using a high level programming language. We can develop a variety of applications using high level language. They are used to develop desktop applications, websites, system software's, utility software's and many more.

Advantages of High Level Language

- High level languages are programmer friendly. They are easy to write, debug and maintain.
- It provide higher level of abstraction from machine languages.
- It is machine independent language.
- Easy to learn.
- Less error prone, easy to find and debug errors.
- High level programming results in better programming productivity.

Disadvantages of High Level Language

- It takes additional translation times to translate the source to machine code.
- High level programs are comparatively slower than low level programs.
- Compared to low level programs, they are generally less memory efficient.
- Cannot communicate directly with the hardware.

Low Level Language： Low level language abbreviated as **LLL**, are languages close to the machine level instruction set. They provide less or no abstraction from the hardware. A low-level programming language interacts directly with the registers and memory. Since, instructions written in low level languages are machine dependent. Programs developed using low level languages are machine dependent and are not portable.

Low level language does not require any compiler or interpreter to translate the source to machine code. An assembler may translate the source code written in low level language to machine code.

Programs written in low level languages are fast and memory efficient. However, it is nightmare for programmers to write, debug and maintain low-level programs. They are mostly used to develop operating systems, device drivers, databases and applications that requires direct hardware access.

Low level languages are further classified in two more categories – Machine language and assembly language.

Machine Language - Machine language is closest language to the hardware. It consists set of instructions that are executed directly by the computer. These instructions are a sequence of binary bits. Each instruction performs a very specific and small task. Instructions written in machine language are machine dependent and varies from computer to computer.

Example: SUB AX, BX = **00001011 00000001 00100010** is an instruction set to subtract values of two registers **AX** and **BX**.

In the starting days of programming, program were only written in machine language. Each and every programs were written as a sequence of binaries.

A Programmer must have additional knowledge about the architecture of the particular machine, before programming in machine language. Developing programs using machine language is tedious job. Since, it is very difficult to remember sequence of binaries for different computer architectures. Therefore, nowadays it is not much in practice.

Assembly Language -Assembly language is an improvement over machine language. Similar to machine language, assembly language also interacts directly with the hardware. Instead of using raw binary sequence to represent an instruction set, assembly language uses **mnemonics**.

Mnemonics are short abbreviated English words used to specify a computer instruction. Each instruction in binary has a specific mnemonic. They are architecture dependent and there is a list of separate mnemonics for different computer architectures.

Examples of mnemonics are – ADD, MOV, SUB etc.

Mnemonics gave relief to the programmers from remembering binary sequence for specific instructions. As English words like **ADD, MOV, SUB** are easy to remember, than binary sequence 10001011. However, programmer still have to remember various mnemonics for different computer architectures.

Assembly language uses a special program called **assembler**. Assembler translates mnemonics to specific machine code.

Assembly language is still in use. It is used for developing operating systems, device drivers, compilers and other programs that requires direct hardware access.

Advantages of Low Level Languages

- Programs developed using low level languages are fast and memory efficient.
- Programmers can utilize processor and memory in better way using a low level language.

- There is no need of any compiler or interpreters to translate the source to machine code. Thus, cuts the compilation and interpretation time.
- Low level languages provide direct manipulation of computer registers and storage.
- It can directly communicate with hardware devices.

Disadvantages of Low Level Languages

- Programs developed using low level languages are machine dependent and are not portable.
- It is difficult to develop, debug and maintain.
- Low level programs are more error prone.
- Low level programming usually results in poor programming productivity.
- Programmer must have additional knowledge of the computer architecture of particular machine, for programming in low level language.

Middle Level Language : The middle-level language lies in between the low level and high-level language.It interacts with the abstraction layer of a computer system. It serves as the bridge between the raw hardware and programming layer of the computer system.

The middle-level language is an output of any programming language, which is known as source code. The source code is written in a high-level language. This kind of middle-level language is designed to improve the translated code before the processor executes it.

The middle-level language is also known as the intermediate programming language and pseudo-language.

C language is the middle-level language

C language is the middle-level language due to its features which are given below:

1) Fast and Efficient

2) Rich library functions

3) Portable

4) Modularity

5) Easy to extend

By using the C language, the user is capable of doing the system programming for writing operating system as well as application programming.

Compiler,Assembler and Interpreter

Compiler : The language processor that reads the complete source program written in high level language as a whole in one go and translates it into an equivalent program in machine language is called as a Compiler.
Example: C, C++

In a compiler, the source code is translated to object code successfully if it is free of errors. The compiler specifies the errors at the end of compilation with line numbers when there are any errors in the source code. The errors must be removed before the compiler can successfully recompile the source code again.

Assembler : The Assembler is used to translate the program written in Assembly language into machine code. The source program is a input of assembler that contains assembly language instructions. The output generated by assembler is the object code or machine code understandable by the computer.

Interpreter : The translation of single statement of source program into machine code is done by language processor and executes it immediately before moving on to the next line is called an interpreter. If there is an error in the statement, the interpreter terminates its translating process at that statement and displays an error message. The interpreter moves on to the next line for execution only after removal of the error. An Interpreter directly executes instructions written in a programming or scripting language without previously converting them to an object code or machine code.
Example: Perl, Python and Matlab.

Difference between Compiler and Interpreter

Compiler	Interpreter
A compiler is a program which coverts the entire source code of a programming language into executable machine code for a CPU.	interpreter takes a source program and runs it line by line, translating each line as it comes to it.
Compiler takes large amount of time to analyze the entire source code but the overall execution time of the program is comparatively faster.	Interpreter takes less amount of time to analyze the source code but the overall execution time of the program is slower.
Compiler generates the error message only after scanning the whole program, so debugging is comparatively hard as the error can be present any where in the program.	Its Debugging is easier as it continues translating the program until the error is met
Generates intermediate object code.	No intermediate object code is generated.
Examples: C, C++, Java	Examples: Python, Perl

Main Memory

Main memory is close to the CPU on the computer motherboard, enabling the CPU to read data from primary memory very quickly indeed. It is used to store data that the CPU needs imminently so that it does not have to wait for it to be delivered

There are two key types of primary or main memory:

- RAM, or random access memory
- ROM, or read-only memory

1) RAM

RAM stands for random access memory, and the name suggest that data stored in random access memory can be accessed in any random order.

The most important things to understand about RAM are that RAM memory is very fast, it can be written to as well as read, it is volatile (so all data stored in RAM memory is lost when it loses power) and, finally, it is very expensive compared to all types of secondary memory in terms of cost per gigabyte. It is because of the relative high cost of RAM compared to secondary memory types that most computer systems use both primary and secondary memory.

Data that is required for imminent processing is moved to RAM where it can be accessed and modified very quickly, so that the CPU is not kept waiting. When the data is no longer required it is shunted out to slower but cheaper secondary memory, and the RAM space that has been freed up is filled with the next chunk of data that is about to be used.

Types of RAM

- **DRAM**: DRAM stands for Dynamic RAM, and it is the most common type of RAM used in computers. The oldest type is known as single data rate (SDR) DRAM, but newer computers use faster dual data rate (DDR) DRAM. DDR comes in several versions including DDR2 , DDR3, and DDR4, which offer better performance and are more energy efficient than DDR. However different versions are incompatible, so it is not possible to mix DDR2 with DDR3 DRAM in a computer system. DRAM consists of a transistor and a capacitor in each cell.
- **SRAM**: SRAM stands for Static RAM, and it is a particular type of RAM which is faster than DRAM, but more expensive and bulker, having six transistors in each cell. For those reasons SRAM is generally only used as a data cache within a CPU itself or as RAM in very high-end server systems. A small SRAM cache of the most imminently-needed data can result in significant speed improvements in a system

The key differences between DRAM and SRAM is that SRAM is faster than DRAM - perhaps two to three times faster - but more expensive and bulkier. SRAM is usually available in megabytes, while DRAM is purchased in gigabytes.

DRAM uses more energy than SRAM because it constantly needs to be refreshed to maintain data integrity, while SRAM - though volatile – does not need constant refreshing when it is powered up.

2) ROM

ROM stands for read-only memory, and the name suggest that while data can be read from this type of computer memory, data cannot normally be written to it. It is a very fast type of computer memory which is usually installed close to the CPU on the motherboard.

ROM is a type of non-volatile memory, which means that the data stored in ROM persists in the memory even when it receives no power – for example when the computer is turned off. In that sense it is similar to secondary memory, which is used for long term storage.

When a computer is turned on, the CPU can begin reading information stored in ROM without the need for drivers or other complex software to help it communicate. The ROM usually contains "bootstrap code" which is the basic set of instructions a computer needs to carry out to

become aware of the operating system stored in secondary memory, and to load parts of the operating system into primary memory so that it can start up and become ready to use.

ROM is also used in simpler electronic devices to store firmware which runs as soon as the device is switched on.

Types of ROM

ROM is available in several different types

- **PROM (Programmable read-only memory)** – It can be programmed by user. Once programmed, the data and instructions in it cannot be changed.
- **EPROM (Erasable Programmable read only memory)** – It can be reprogrammed. To erase data from it, expose it to ultra violet light. To reprogram it, erase all the previous data.
- **EEPROM (Electrically erasable programmable read only memory)** – The data can be erased by applying electric field, no need of ultra violet light. We can erase only portions of the chip.

Differences between RAM and ROM

ROM:

- Non-volatile
- Fast to read
- Usually used in small quantities
- Cannot be written to quickly
- Used to store boot instructions or firmware
- Relatively expensive per megabyte stored compared to RAM

RAM:

- Volatile
- Fast to read and write
- Used as system memory to store data (including program code) that the CPU needs to process imminently
- Relatively cheap per megabyte stored compared to ROM, but relatively expensive compared to secondary memory

Cache Memory

Cache memory is a special very high-speed memory that acts as a buffer between RAM and the CPU. It holds frequently requested data and instructions so that they are immediately available to the CPU when needed.It is costlier than main memory or disk memory but economical than CPU registers.

Cache memory is used to reduce the average time to access data from the Main memory. The cache is a smaller and faster memory which stores copies of the data from frequently used main

memory locations. There are various different independent caches in a CPU, which store instructions and data.

Functions of Cache Memory:

The basic purpose of cache memory is to store program instructions that are frequently re-referenced by software during operation. Fast access to these instructions increases the overall speed of the software program.

The main function of cache memory is to speed up the working mechanism of computer.

Unit -I

Input Device

Input device is a device through which data and instruction are entered into computer system. An input devices converts the data and instructions into binary form that computer can understand. This transformation is performed by "Input interface".

The data entered through input device can be some text, some graphical image or symbol, sound etc, depending on the form of the raw data the various input devices are available.

Some of the commonly input devices used are:-

1. Keyboard
2. Mouse
3. Joy stick
4. Track ball
5. Touch screen
6. Light Pen
7. Digitizer
8. Scanner
9. Speech Recognition Devices

1.Keyboard

Keyboard is an input device for entering data and instructions into a computer. Data is entered into the computer by pressing set of keys available with this device

Keyboard keys are arranged in 6 groups such as:

1. Alphanumeric keys: - The alphanumeric keys are the collection of alphabets A-Z, numerals from 0-9 and punctuation marks that are arranged the same way on almost every keyboard.

2. Numeric keys: - It is usually located on right side of keyboard and appears like a non-scientific calculator with ten digits (0-9) and arithmetic operators.

3. Function keys: - The Function keys numbered from F1 to F12 are usually arranged in a first row at top of keyboard. Each function key performs different function depending upon the current application being run by user.

4. Cursor movement keys: - These keys allows user to change the position of the cursor on the screen. Cursor movement keys move cursor up, down, left and right.

5. Special purpose keys: - These keys perform special function i.e. insert, delete, print screen.

6. Modifier keys: - These keys are used in conjunction with other keys. Modifier keys include keys such as Alt (Alternate), Shift and Ctrl (Control).

2. Mouse

Mouse is a pointing device that controls the position of the cursor on a computer screen without using keyboard. It is called pointing device because it is used to point and select option on screen. There are two or more depression switched on the top of mouse.

Types of Mouse: -

1) Mechanical mouse

It has rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within mouse detect the direction the ball is rolling and move the screen pointer accordingly.

2) Optical mouse

It uses a laser to detect the mouse's movement. It respond more quickly and precisely than mechanical mouse.

Three simple techniques to use mouse: -

1) Clicking: - To click on something with the mouse means, to move the pointer to the item on the screen and to press and release the mouse button once.

2) Double clicking: - To double click on item means, to move the pointer to the item on the screen and to press and release the mouse button twice with quick succession.

3) Dragging: - To drag an item, user position the mouse cursor over the item, the press the mouse button and hold it down as you move mouse.

3. Joy stick

It is also a pointing device which is used to move cursor position on a monitor screen. It consists of a lever which moves in all directions and controls the movement of pointer. Lever is having spherical ball at its base. When the lever steers the cursor moved in the respective direction. Potentiometers are used to sense the movements. On most of joystick a button at top is provided to select the option.

E.g. It is commonly used with computer games, flight simulators and for controlling robots.

4. Track ball

Track ball is pointing device that works like an upside down mouse. The only difference is that the ball in case of the track ball is placed on the top along with the button of the trackball. The movement of cursor is controlled by movement of ball by the fingers.

Trackball is most commonly used in notebook or laptop instead of a mouse.

5. Touch Screen

Touch Screen is the most simple and easiest to learn of all input devices. It is also a pointing device by which users touch areas of the screen with their fingers to issue commands. Touch screen enables the users to choose from available options by simply touching with their fingers the desired icon or menu displayed on the screen.

E.g. A common application of touch screen is ATM's installed in banks.

6. Light Pen

Light is pointing device which is used to select a displayed menu item or draw pictures on the monitor screen. It is connected by a cable to the display device. The light pen consists of a light sensing element (photo diode) at the tip of pen and a cable through which the signal is

transmitted. When the screen touched with the tip of pen, pen gets activated light spots are sensed and a signal sent to the system indicating the position.
E.g. Used for corrections in architectural designs.

7. Speech recognition system

These devices are used to recognize the voice and translate it into the text using speech recognition system. Speech recognition software is loaded into the machine which gathers sound waves remove unwanted noise and compare the incoming signal against a pattern stored in memory. If sound is similar or almost similar then the voice is translated into text otherwise it is ignored.

Speech recognition system equipped with the following components:
a) Computer system with sound card
b) Speech Recognition software
c) Microphone

8) Scanner

"A scanner is an input device which translates paper documents into an electronic format, which can be stored in a computer."

Input documents may be typed text, pictures, graphics or handwritten material. Scanner is helpful in preserving paper documents in electronic format.

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Output Device

An output device is an electromechanical device which accepts data from a computer and translates them into a human acceptable form.

Output generated by output device classified into two types:

1) Soft-copy output – Output which is not produced on a paper is known as soft-copy output. They are temporary in nature.

2) Hard-copy output – Output which is produced on a paper is known as hard-copy output. They are permanent in nature.

Following is list of most commonly used output device.

1) Monitor
2) Printer
3) Plotter
4) Speaker

1) Monitor

Monitor is an output device which is used for producing soft-copy output. It is also known as VDU i.e. Visual Display Unit. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the no. of the pixels.

On the basis of **volume** monitor is of two types-

a) Cathode-Ray Tube (CRT)

CRT's Screen display is made up of small picture elements called pixels. The smaller the pixels the better the image clarity or resolution. CRT is the large bulky sized monitor. It has high power requirement so it is not appropriate for portable devices.

A monochrome CRT contains single electron gun which emits beam of electrons. These electrons are attached towards positive phosphorous screen. When an electron strikes the screen it glows and emits light. A small area in which an electron strikes is known as pixel. To display a screen all the pixel are strike by electrons. Accelerating anode varies the speed of the electron and deflecting system changes the path of the electron.

In short

A heated cathode emits a high-speed electron beam onto phosphor-coated glass screen. Glass screen glows when they are struck by electron beam.

Advantages of CRT Monitors

1. It has better brightness.
2. It is cheaper in cost.
3. It is more durable.
4. It has better graphics and larger viewing angle (~180)

Disadvantages of CRT monitors

1. It bulky and large in size. It is large in size so occupies more space.
2. More power consumption.
3. It is not portable.

b) Flat- Panel Display

Flat panel monitors are thinner and lighter and commonly used with portable computer systems.

Following are Flat-Panel display:

1. Light emitting diode

LED contains multiple small bulbs. The contents are displayed by turning the bulbs "on" and "off". Initially it was used only for simple digital displays like in calculator, digital watch, etc. At present it is also used in television, desktop PC, laptop, etc.

Advantages of LED

1. It is light in weight so, it can be used in portable devices.
2. It requires less power.
3. It is small in size.
4. Its viewing angle is larger compared to LCD.

Disadvantages of LED

1. It has low brightness but is better than LCD and plasma.
2. It is expensive compared to CRT.
3. It is difficult to maintain.

2. Liquid crystal display

LCD contains liquid crystals in between two plates of the screen. The plates are made by either glass or plastic. The front plate is transparent and the back plate is reflective. Liquid crystals are charged electronically to display the content.

Advantages of LCD

1. It is small in size.
2. It is light in weight.
3. It has low power requirements so, can be used in portable devices.
4. It is cheaper than LED

Disadvantages of LCD

1. It has low brightness.
2. It is expensive compared to CRT.
3. It requires viewing angle of almost 90.

Types of monitor on the basis of color display are:

1. **Monochrome monitor**

It is a single colored monitor. It can display only text and images of a single color against a contrasting background. The first monitor displayed text and images of light green color against black background.

2. **Gray scale monitor**

It can display 256 different variations of black and white color. It can also display video. The first television set was gray scale.

3. **Color monitor**

It can display 16-42 million colors. It uses 3 basic colors Red, Blue and Green. All the other colors are the combination of these colors. Color monitor is also known as RGB monitor.

2. Printers

Printers are the most popular output devices. They produce hard-copy output.

Printers are broadly classified into two categories:

a) Impact printer: -

Impact printers are those printers that print the characters by striking hammers or pins against ribbon onto paper. Impact printers are noisy printers.

Characteristics of Impact Printers are following

- Less expensive
- Impact printers are very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce a pattern

b) Non-impact Printers

The printers that print the characters without striking against the ribbon and onto the paper are called Non-impact Printers.

Characteristics of Non-impact Printers

- Faster than impact printers.
- They are not noisy.
- High quality.
- Support many fonts and different character size.

Printers can be further classified into the different categories:-

a) Character Printer

i. Dot Matrix Printer (Impact printer)
ii. Daisy wheel Printer (Impact printer)
iii. Inkjet printer (Non-impact printer)

b) Line Printer

i. Drum printer (Impact printer)
ii. Chain printer (Impact printer)

c) Page printer

i. Laser printer (Non-impact printer)

1) Character printer prints only one character at a time. This types of printer is described as follows-

a) Dot matrix

Dot matrix is an impact printer and it prints one character at a time in the form of dots. Its speed is usually ranges from 30 to 550 characters per second (cps). Dot matrix is the cheapest and the noisiest printer and has a low print quality. It was 1st introduced by Centronics in 1970.

How it works

1. In this printer an inked ribbon between paper and the print head. The print head moves across the paper and goes on printing the information.
2. Uses tiny pins to hit an ink ribbon and the paper. 9 to 24 vertical column pins are contained in a rectangular print head.
3. When print head moves across the paper, pins are activated to form a dotted character image. When pins get activated they strike on paper along with ribbon. These printers can produce carbon copies along with the originals.

Advantages

1. Less-expensive.
2. Low per page cost.
3. Energy efficient.
4. Multipage forms can be printed on this printer.

Disadvantages:

1. Noisy
2. Low resolution
3. Limited fonts flexibility
4. Poor quality graphics output.

b. Daisy wheel printer

A daisy wheel printer is basically an impact printer consisting of a wheel and attached extensions on which molded metal characters are mounted. A daisy wheel printer produces letter quality print and it can't produce graphics output. It speed is around 90 cps.

How it works

1. In Daisy wheel printer each petal of wheel has a character embossed on it.
2. A hammer presses the wheel against a ribbon which in turn makes an ink stain on the paper
3. A motor spins the wheel rapidly and when the desired character spins to the correct position, a print hammer strikes it to produce the output.

Advantages

1. Quality output is produced
2. The font of character can be easily changed
3. More reliable than DMP.

Disadvantages

1. Slower than DMP.
2. Produce noise while printing.
3. More expensive than DMP.

c. Inkjet printer

It is a non-impact printer producing a high quality print. Multipage forms cannot be printed by these printers. Its speed ranges from 40 to 300 characters per second with a resolution of from 300 dpi to 1200 dpi.

How it works

1. Print head having four ink cartridges moves.
2. Software instructs where to apply dots of ink, which color and what quantity to use.
3. Electrical pulses are sent to the resistors behind each nozzle.
4. Vapor bubbles of ink are formed by resistors and the ink is forced to the paper through nozzles.
5. A matrix of dots forms characters and pictures.

Advantages

1. High quality of printing.
2. More reliable.
3. Energy efficient.

Disadvantages

1. Expensive as cost per page is high.
2. Slow as compare to laser printer.

b) Line printers

Line printers are the impact printers and are used for producing high volume paper output. These printers print the complete line at a time so that's why they are called line printers. They are faster printers having speed in the range of 300 to 2500 lines per minute.

Types of line printers

a. Drum printers

Drum printers print one line at time. It consists of a solid cylindrical drum with character embossed on its surface in the form of circular bands. Each band contains numerals, alphabets and special characters.

In addition to drum a set of hammer mounted in front of drum in manner that an inked ribbon and paper can be placed between hammers and the drum. It is very fast and also expensive. It speed ranges from 300 to 2000 lines per minute.

How it works

1. The drum rotates rapidly and one revolution is required to print one line.
2. Character at print position is printed by activating the appropriate hammer, when character embossed on the band at print position passes below it.

Advantages

1. They can be used to produce multiple copies by using carbon paper.
2. It is very fast.

Disadvantages

1. Expensive
2. Noisy while operation.
3. Cannot produce different sizes of print and graphics.

b. Chain printer

Chain/band printers are line printers which print one line at a time. It consists of a metallic chain on which all the characters of the character set supported by printer is embossed. A charcter set may have 48, 64, or 96 characters. Its speed ranges from 400 to 3000 line per minute.

How it works

Chain rotates rapidly and a character at print position is printed by activating the appropriate hammer, which is embossed on the chain pass below it.

Advantages

1. Fast than drum printers
2. Chain or chain printer can be easily changed. This allows the use of different font with same printer.

Disadvantage

1. It does not have ability to print graphics such as charts and graphs.
2. Slower as compare to laser printer.

3) Page printer

Page printer is a very high speed non impact printer and prints the entire page at a time. The quality of these printers is the best quality but there cost is much higher.

Laser printer

Laser printers are page printers which print one page at a time. The main components of laser printers are a laser beam source, multi-sided mirror, a drum and a toner. Laser printer produces very high quality output. Its print speed ranges from 4 to 12 pages per minute in case of low speed laser printer and 500 to 1000 pages per minute in case of high speed laser printer. It has resolution 600 dpi.

How it works

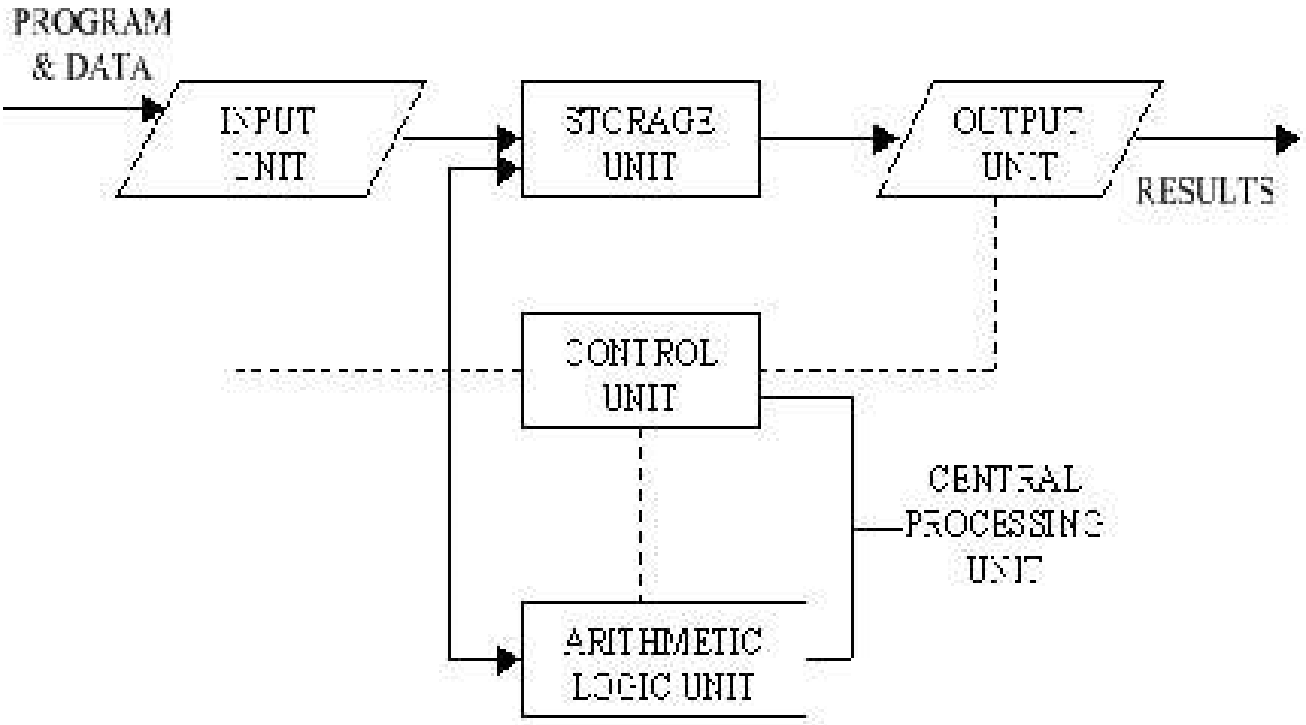
1. Paper is fed and the drum rotates.
2. A laser beam conveys information from the computer to a rotating mirror and thus an image is created on the drum.
3. The charges on the drum are ionized and the toner sticks to the drum.
4. Toner is transferred from drum to paper.
5. Heat is applied to fuse the toner on the paper.

Unit -1

Block Diagram of Computer

A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately. A computer performs basically five major computer operations or functions. These are

1) it accepts data or instructions by way of input,
2) it stores data,
3) it can process data as required by the user,
4) it gives results in the form of output, and
5) it controls all operations inside a computer.



1. Input unit : This is the process of entering data and programs in to the computer system. Since computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. Storage unit : The process of saving data and instructions permanently is known as storage unit . Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

3. Output unit : This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

4. Central Processing Unit (CPU) : The ALU and the CU of a computer system are jointly known as the central processing unit. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.The CPU further uses these components-

a) Arithmetic and Logic Unit

After you enter data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

b) Control Unit

The next component of cpu is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. control unit is responsible for co ordinating various operations using time signal. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output.

Hardware,Software

Hardware: Hardware refers to the physical elements of a computer. This is also sometime called the machinery or the equipment of the computerWithout the creation of hardware to perform tasks directed by software via the central processing unit, software would be useless.

Examples of hardware in a computer are the keyboard, the monitor, the mouse and the central processing unit.

Software: Software, commonly known as programs, consists of all the instructions that tell the hardware how to perform a task. These instructions come from a software developer in the form that will be accepted by the *platform* that they are based on.

For example, a program that is designed for the Windows operating system will only work for that specific operating system. Compatibility of software will vary as the design of the software and the operating system differ.

Software is capable of performing many tasks, as opposed to hardware which can only perform mechanical tasks that they are designed for. Software provides the means for accomplishing many different tasks with the same basic hardware.

computer systems divide software systems into two major classes

System Software: It helps run the computer hardware and computer system itself. System software includes operating systems, device drivers, diagnostic tools and more. System software is almost always pre-installed on your computer.

Application Software: It allows users to accomplish one or more tasks. It includes word processing, web browsing and almost any other task for which you might install software.

Software is generally created (written) in a high-level programming language, one that is readable by people. These high-level instructions are converted into "machine language" instructions, represented in binary code, before the hardware can "run the code". When you install software, it is generally already in this machine language, binary form.

External Storage Device

An external storage device, also referred to as auxiliary storage and secondary storage, is a device that contains all the addressable data storage that is not inside a computer's main storage or memory. An external storage device can be removable or non-removable, temporary or permanent, and accessible over a wired or wireless network.

External storage enables users to store data separately from a computer's main or primary storage and memory at a relatively low cost. It increases storage capacity without having to open up a system.

External storage is often used to store information that's accessed less frequently by applications running on a desktop, laptop, server or mobile device, such as an Android or iOS smartphone or tablet.

Another common use case for an external storage device is to transport data between on-site and off-site computer systems.

Types of External Storage

1. CD :

Compact Discs (CDs) are one of the oldest forms of external memory.It was made initially to replace cassette tapes until it grew and led to several types of CDs being made. The differences between each type lie in the read and write restrictions for users.

- **CD Read-Only Memory (CD-ROM) —** This type of CD doesn't allow users to erase nor write over whatever is in the disc.
- **CD-Recordable (CD-R) —** A CD like this gives users the ability to write on the CD only once but has an unlimited number of reads available.
- **CD Re-Writable (CD-RW) —** With a CD like this, you can erase and write over it for up to 1000 times.

2. DVD :

Digital Versatile Discs (DVDs) are much like CDs in that it also uses laser light to store and retrieve data. This particular way of storing or retrieving data is characteristic of optical storage devices.

Although a CD and a DVD are similar in many ways, they're also different in just as many aspects too. One difference is their storage capacity.

In comparison to CDs, DVDs have much *higher* storage capacity. .

Usually, people use DVDs to store movies and videos, while CDs are more commonly used to store music.

3. Floppy Disk :

A floppy disk is a magnetic storage medium for computer systems. The floppy disk is composed of a thin, flexible magnetic disk sealed in a square plastic carrier. In order to read and write data from a floppy disk, a computer system must have a floppy disk drive (FDD). A floppy disk is also referred to simply as a floppy. Since the early days of personal computing, floppy disks

were widely used to distribute software, transfer files, and create back-up copies of data. When hard drives were still very expensive, floppy disks were also used to store the operating system of a computer.

A number of different types of floppy disks have been developed. The size of the floppy got smaller, and the storage capacity increased. However, in the 1990s, other media, including hard disk drives, optical drives started to replace floppy disks as the primary storage medium.

The first floppy disks that came on the market were 8 inches (200 mm) in diameter. The disk was protected by a flexible plastic jacket. An 8-inch disk back in the late 1970s could store about 1 MB of data. This was quickly followed by a smaller version of the same design, the 5.25-inch (133 mm) floppy, which could store about the same amount of information using higher-density media and recording techniques.

In the early 1980s, the 3.5-inch (90 mm) floppy, or micro floppy, came on the market, and this type became the dominant storage medium for personal computers for many years. Each of these floppy disks required a different type of floppy disk drive. These were typically built into the computer case itself.

Floppy disks were quite vulnerable. The disk medium was very sensitive to dust, moisture, and heat. The flexible plastic carrier was also not very sturdy. The hard plastic case of the 3.5-inch floppy presented a substantial improvement in this respect. The most common format of this floppy became the double-sided, high-density 1.44 MB disk drive.

3.USB flash Drives :

A USB flash drive -- also known as a USB stick, USB thumb drive or pen drive -- is a plug-and-play portable storage.

USB flash drives are often used for storage, data back-up and transfer of computer files. Compared with floppy disks or CDs, they are smaller, faster, have significantly more capacity, and are more durable due to a lack of moving parts.

It consists of a small printed circuit board carrying the circuit elements and a USB connector, insulated electrically and protected inside a plastic, metal, or rubberized case, which can be carried in a pocket or on a key chain. The USB connector may be protected by a removable cap or by retracting into the body of the drive.

Most flash drives use a standard type-A USB connection allowing connection with a port on a personal computer, but drives for other interfaces also exist. USB flash drives draw power from the computer via the USB connection. Some devices combine the functionality of a portable media player with USB flash storage; they require a battery only when used to play music on the go.