MODULE 1

INTRODUCTION TO COMPUTERS

The term computer is derived from the word *compute*. A computer is an electronic device that takes data and instructions as an input from the user, processes data, and provides useful information known as output. This cycle of operation of a computer is known as the Input-Process-Output cycle shown in figure. The electronic device is known as hardware and the set of instructions is known as software.

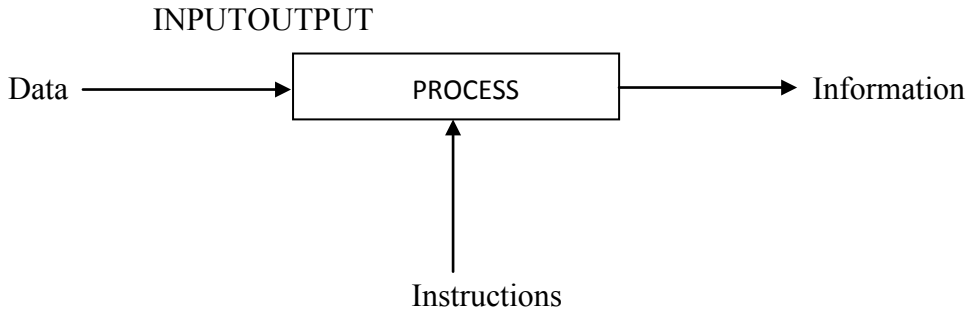


Fig: Input _Process-Output Concept

COMPUTER SYSTEM CHARACTERISTICS

Computer is fast and accurate electronic system that is designed to accept and store input data, process them and produce output results using the instructions of a stored program.

1) Speed: Computer executes one instruction at a time. Most instructions are carried out in less than a millionth of a second.
2) Accuracy: Since the circuits in a computer have electronic parts, which far do not have wear and tear, the instructions are carried out without any mistakes.
3) Vast Storage Media: In a computerized system a very large amount of data can be stored.

Modern computers possess certain characteristics and abilities

- Perform complex and repetitive calculations rapidly and accurately
- Store large amount of data and information for subsequent manipulations
- Compare items and make decisions
- Provide information to the user in many different forms
- Automatically correct or modify the parameters of a system under control
- Draw and print graphs
- Receive and display audio and video

GENERATIONS OF COMPUTERS

The different computing devices developed over the years can be categorized into several generations. Each generation of computer is the result of a technological development, which changed the way computers used to operate. Computers can be categorized into five generations:

- First generation(1940-1956)
- Second generation(1956-1963)
- Third generation(1964-1971)
- Fourth generation(1971-Till Date)
- Fifth generation(1980s…)

First –Generation Computers

In this generation of computers, *vacuum tubes* were used to build the circuitry for the computers and magnetic drum was used for the memory of the computer. A vacuum tube was a device made up of glass and used filaments to generate electrons. It was used to amplify the electronic signals.

These computers used to perform calculation in milliseconds. The size of these computers was very large, and a single computer was used to cover the space of an entire room. Since the size of the computers was very large, they used to consume a great deal of electricity and generated a large amount of heat. To avoid malfunctioning from overheating, the rooms where these computers were placed had to be air-conditioned.

They used machine language to perform operations and were capable of performing one operation at a time. The first generation computers are ENIAC, EDVAC and UNIVAC. These computers were used for scientific calculations.

Second-Generation Computers

In the second generation of computers, *transistors* were used instead of vacuum tubes. They are faster and more reliable than vacuum tubes. In addition the size of transistors was smaller than vacuum tubes and they generate less heat as compared to vacuum tubes.

They used assembly language instead of machine language .The use of assembly language helped the programmer to specify instructions in the form of words. The main characteristic of second generation computers was that they used the stored program concept, i.e. the instructions were stored in the memory of the computer. These computers use magnetic tapes and magnetic disks as external storage devices. IBM 1620, PDP8 and CDC1604 are examples of second generation computers.

Third-Generation Computers

They were characterized by the development of the *integrated circuit* (IC). An IC is a silicon chip that embeds an electronic circuit, which comprises several components, such as transistors. The use of ICs had increased the speed and efficiency of the computers to a significant extent. Third generation computers include IBM 370, PDP11 and CDC7600 etc.

Fourth-Generation Computers

Fourth generation computers use *Large Scale Integration* (LSI) circuits and *Very Large Scale Integration* (VLSI) circuits in the construction of computing components. LSI and VLSI circuits were further integrated on a single silicon chip, termed as microprocessor, containing control logic and memory. The Intel 4004 chip was the first microprocessor for the computers of this generation. The major change in the fourth generation of computers was seen in the replacement of magnetic core memories by semiconductor memories.

For enabling connection and communication among multiple computers at one time they use two types of high speed computer networking. The first one is the *Local Area Network* (LAN), where multiple computers in a local area are connected and allowed to communicate among them. The second type of networking is the *Wide Area Network* (WAN), which facilitates connection and communication of hundreds of computers located across multiple locations. Fourth generation of computers used high-level programming languages. They have large primary and secondary storage memory. Examples are IBM 4300 and ICL 2900.

Fifth-Generation Computers

Fifth generation of computers is characterized by the *Ultra Large Scale Integration* technology, which is more powerful as well as faster than the microprocessors used by the computers of the fourth generation. The PCs in the fifth generation have become portable, which are much smaller than the fourth generation PCs. There are some computing devices of the fifth generation still in the development phase, which are based on artificial intelligence.

BLOCK DIAGRAM OF COMPUTER

A Computer has four main components

1) Central Processing Unit(CPU)
2) Memory
3) Input device
4) Output Device

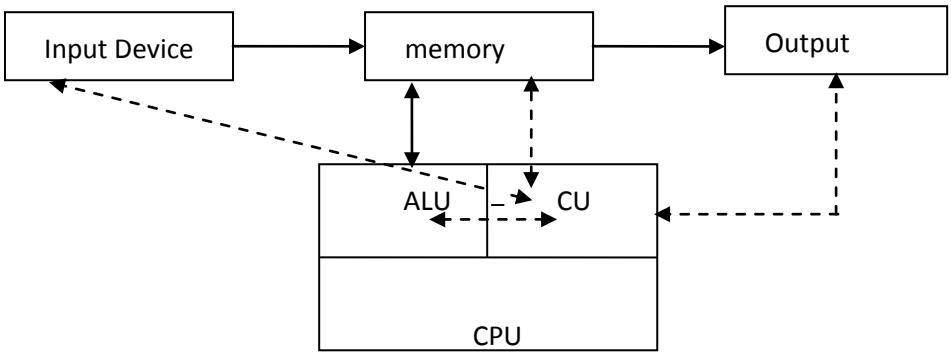


Fig:-Block Diagram Of Computer

Central Processing Unit(CPU)

The CPU acts as the computer brain. CPU is responsible for the overall working of all components of the computer. It consists of two parts: Arithmetic and Logic Unit (ALU) and Control Unit (CU) .The ALU performs arithmetic operations and conducts the comparison of information for logical decisions. The control unit is responsible for sending / receiving the control signals from / to all components. The dotted lines in the above diagram represent the communication of control signal, whereas the solid lines denote the transfer of data. Under the control of CU, the data comes from input device(s) to memory, it is processed in ALU and the result is stored back in the memory. The processed results are displayed with the help of an output device.

MEMORY

The memory unit of the computer is used to store data, instructions for processing data, intermediate results for processing and the final processed information. The memory of the computer of two types: Primary Memory and Secondary Memory.

Primary Memory

Primary memory is faster in speed, less in size (normally a few megabytes) and costlier. It consists of ROM (Read Only Memory), RAM (Random Access Memory).

ROM – In ROM, the information is burnt (pre-recorded) into the ROM chip at manufacturing time. It stores data and instructions, even when the computer is turned off. It is the permanent memory of the computer where the contents cannot be modified by an end user. ROM is called *non-volatile* memory because it never loses its contents. ROM holds instructions that the computer needs to operate. ROM stores critical programs such as the program that boots the computer.

1) Programmable Read Only Memory - PROM
   PROM is a memory on which data can be written only once. A variation of the PROM chip is that it is not burnt at the manufacturing time but can be programmed. PROM is also a non-volatile memory.

2) Erasable Programmable Read Only Memory – EPROM
   In EPROM, the information can be erased and reprogrammed. EPROM is non-volatile memory. An EPROM differs from a PROM in that a PROM can be written to only once and cannot be erased. But an ultraviolet light is used to erase the contents of the EPROM.

3) Electrically Erasable Programmable Read Only Memory - EEPROM
   EEPROM is a recently developed type of memory. This is equivalent to EPROM, but does not require ultraviolet light to erase its content. It can be erased by exposing it to an

electrical charge. Itis also non-volatile in nature. EEPROM is not as fast as RAM or other types of ROM. A flash memory is a special type of EEPROM that can be erased and reprogrammed.

RAM- It contains all types of intermediate and temporary data to be used by the CPU. In fact, CPU can work / process only that data which is present in the RAM. Any data present in the secondary memory needs to be first brought to RAM and only then can it be used by the CPU. Since data can be both written to and read from this memory it is called Read/Write memory. RAM is *volatile,* meaning that it loses its contents when the computer is turn off or if there is a power failure.

Secondary Memory

Secondary memory is usually a very large amount of memory (in gigabytes), which is comparatively cheaper and slower than primary memory, but is permanent in nature. Thus, anything stored in secondary memory remains available even if the computer is switched off.

INPUT-OUTPUT DEVICES

Input devices

Input devices accept data and instructions from the user or from another computer system. The most common input devices are

- Keyboard:-Which accepts letters, numbers and commands from the user. A standard keyboard includes alphanumeric keys(Number keys and Alphabet keys), function keys(F1-F12), modifier keys(Shift and Control keys), cursor movement keys(up, down, left and right keys), space bar, escape key, numeric key pad(for numbers and mathematical operators), and some special keys (Page Up, Page Down, Home, Insert, Delete and End).

- Mouse:-The mouse allows the user to select elements on the screen, such as tools and icons. It is also known as a pointing device because it helps to change the position of the pointer or cursor on the screen. The mouse consists of two buttons, a wheel at the top and a ball at the bottom of the mouse. When the ball moves, the cursor on the screen moves in the direction in which the ball rotates. The left button of the mouse is used to select an element and the right button, when clicked, displays the special options. The wheel is used for scrolling purpose.

- Scanner:-A scanner converts documents and images as the digitized images understandable by the computer system.
- Joystick:-It consists of a small, vertical level mounted on a base that is used to steer the screen cursor around.

- Microphone:-It is used to input the voice or music as data.

- Optical Character Reader (OCR):-In OCR the optical character recognition techniques permit the direct reading of any printed character. These readers examine each character as if it were made up of a collection of minute spots ones the whole character has been scanned, the pattern detected is

matched against a set of patterns stored in the computer. Whichever pattern it matches, or nearly matches, is considered to be the character read.

Patterns which cannot be identified are rejected. OCR readers can read at the rate of up to 2400 characters per second.

Output devices

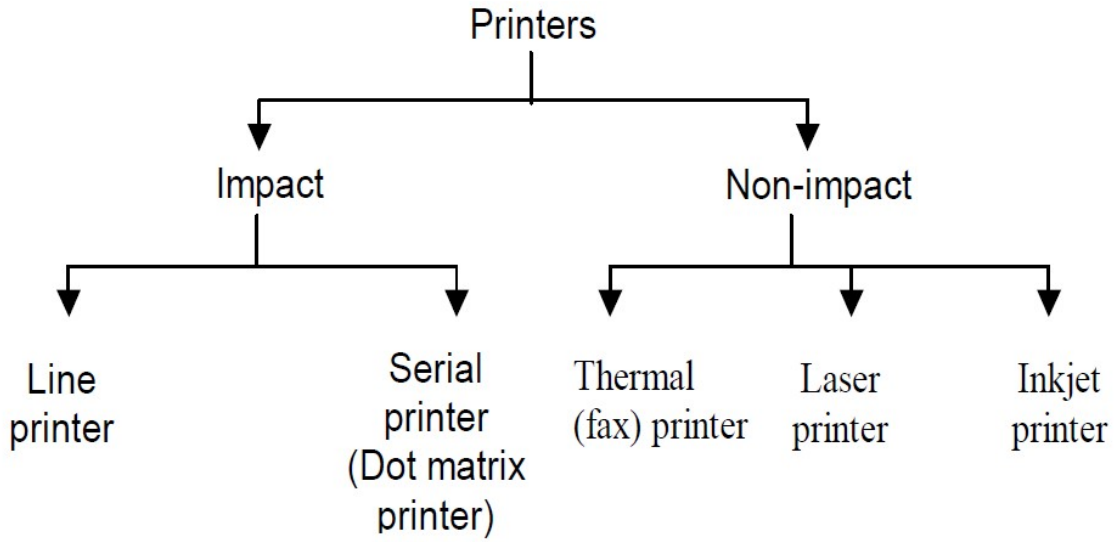
Output devices return processed data to the user or to another computer system. The most commonly used output devices are

- Monitor:-A monitor is the most commonly used output device that produces visual displays generated by the computer. The display device is used for visual presentation of textual and graphical information. The monitors can be classified as Cathode Ray Tube (CRT) monitors or Liquid Crystal Display (LCD) monitors. The CRT monitors are large, occupy more space in the computer, whereas LCD monitors are thin, light weighted and occupy lesser space.

  A monitor can be characterized by its monitor size and resolution. The monitor size is the length of the screen that is measured diagonally. The resolution of a screen is expressed as the number of picture elements or pixels of the screen. The resolution is also called the dot pitch.

- Printer:-Printer is an output device that prints text or images on paper or other media (like transparencies). By printing you create what is known as a „hard copy". There are different kinds of printers, which vary in their speed and print quality. The two main types of printers are impact printers and non-impact printers.

Impact printers include all printers that print by striking an ink ribbon. Impact printers use a print head containing a number of metal pins which strike an inked ribbon placed between the print head and the



Types of Printers

paper. Line printers, dot matrix printers are some of the impact printers.

In non-impact printers the printing heads do not strike the paper. Non-impact printers include laser printers, inkjet printers and thermal printers.

Line Printer

Line printers are high-speed printers capable of printing an entire line at a time. A line printer can print 150 lines to 3000 lines per minute. The limitations of line printer are they can print only one font, they cannot print graphics, the print quality is low and they are noisy to operate. But it can print large volume of text data very fast compared to the other printers.

Dot Matrix Printer

The most popular serial printer is the dot matrix printer. It prints one line of 8 or 14 points at a time, with print head moving across a line. They are similar to typewriters. They are normally slow. The printing speed is around 300 characters per second.

Thermal Printer

Thermal printers are printers that produce images by pushing electrically heated pins against special heat-sensitive paper. They are inexpensive and used widely in fax machines and calculators. Thermal printer paper tends to darken over time due to exposure to sunlight and heat. So the printed matters on the paper fade after a week or two. It also produces a poor quality print.

Laser Printers

Laser printers use a laser beam and dry powdered ink to produce a fine dot matrix pattern. It can produce very good quality of graphic images. One of the chief characteristics of laser printers is their resolution – how many dots per inch (dpi) they lay down. The available resolutions range from 300 dpi at the low end to around1200 dpi at the high end.

Inkjet Printers

Inkjet printers work by spraying ionizing ink at a sheet of paper. Magnetized plates in the ink's path direct the ink onto the paper in the described shape.

- Speakers:-The speaker is a electromechanical transducer that converts an electrical signal into sound. They are attached to computer as output devices, to provide audio output, such as warning sounds and internet audios. We can have built in speakers or attached speakers in a computer to warn end users with error audio messages and alerts. The audio drivers need to be installed in the computer to produce the audio output. The computer speakers vary widely in terms of quality and price.
- Plotters:-It is an output device that is connected to a computer to print large documents, such as engineering or constructional drawings.

SECONDARY STORAGE DEVICES

The computer may need to store data, programs etc. in a computer readable medium. This is called the secondary storage. Secondary storage is also called backup storage. Secondary storage can be used to transmit data to another computer either immediately or a later time. This provides a mechanism for storing a large amount of data for a long period of time. Some of the commonly used storage devices are hard disks, magnetic tapes, floppy disks and CD-ROM.

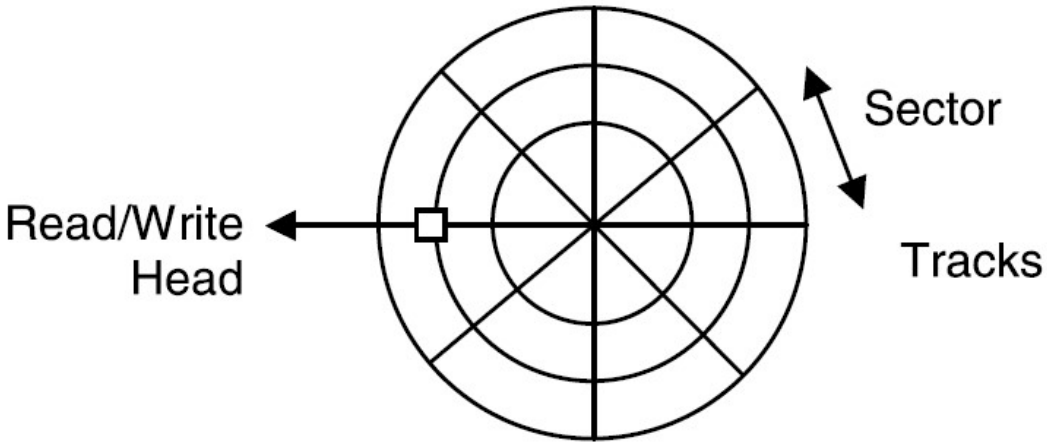
To understand the physical mechanism of secondary storage devices one must have knowledge of magnetism, electronics and electro mechanical systems. The average time required to reach a storage

location and obtain its contents is called its *access time*. In electro mechanical devices with moving parts such as disks and tapes, the access time consists of a seek time required to position the read write head to a location and transfer time required to transfer the data to or from the device.

- Magnetic Storage

1) Magnetic tape:-Magnetic tape memories are similar to the commonly used audio tape recorders. The tape medium on which data is recorded is sealed in a cartridge. The method of recording data is magnetic surface recording using a magnetic recording head. Magnetic tape is a serial access medium and so data cannot be randomly located. This characteristic has prompted its use in the regular backing up of hard disks.

2) Magnetic hard Disk:- Hard disk is a magnetic disk on which you can store computer data. The hard disk is a direct-access storage medium. This means you can store and retrieve data randomly. A disk is a round, flat object that spins around its centre. Read/Write heads are used to read data from the disk or write data on to the disk. Magnetic disks are smooth metal plates coated on both sides with a thin film of magnetic material. A set of such magnetic plates are fixed to spindle one below



A track subdivided into sectors

the other to make up a disk pack. The disk pack is sealed and mounted on a disk drive.

Data is arranged as a series of concentric rings. Each ring (called a track) is subdivided into a number of sectors, each sector holding a specific number of data elements (bytes or characters).The smallest unit that can be written to or read from the disk is a sector. The storage capacity of a hard disk can be Gigabytes (GB),i.e. thousands of Megabytes of information.

3) Floppy Disk :-

The floppy drive uses a thin circular disk for data storage. It is a soft magnetic disk. It is a thin magnetic-coated disk contained in a flexible or semi-rigid protective jacket. The disk rotates at 360rpm. A read/write head makes physical contact with the disk surface. Data

is recorded as a series of tracks subdivided into sectors. The floppy disks are usually 3.5" in size. However, older floppy disks may be in use; these would be 5.25" in size or even 8" in size. A 3.5" floppy disk can hold 1.44 MB of data. Disk drives for floppy disks are called floppy drives. Floppy disks are slower to access than hard disks and have less storage capacity. Itis less expensive and is portable. It can be accessed randomly.

- Optical Storage

Optical disks are a storage medium from which data is read and to which it is written by lasers. The optical disk is a random access storage medium; information can be easily read from any point on the disk. CD-ROM stands for Compact Disk - Read Only Memory. It is now possible to have CD-ROMs where tracks of information can be written onto them by the user. These are called read/write CD-ROMs and these are becoming a popular and cheap method for storage.

PROCESSOR CONCEPTS EVOLUTION AND COMPARATIVE STUDY OF PROCESSORS

Intel Processors

Intel is historically the leading provider of chips for PCs. In 1971, Intel invented the microprocessor –the so called computer on a chip-with the 4004 model. This invention led to the first microcomputers that began appearing in 1975. In 1981, IBM released the first IBM PC, which was based on an Intel microprocessor.

Current Intel Processors

Model	Primary Use	Clock Speed	Number of Transistors
Itanium 2	Server	1.3GHz & up	410 Million
Pentium 4	PC	1.4GHz & up	42-55 Million
Pentium III Xenon	Server/Workstation	700MHz & up	42-55Million
Pentium III	PC	650 MHz & up	28-44Million
Celeron	Budget PC	500 MHz & up	28-44Million

AMD Processors

In1998, Advanced Micro Devices (AMD) emerged as a primary competitor to Intel's dominance in the IBM-Compatible PC market. With the release of K6 and Athlon processor series, AMD proved that it could compete feature for feature with many of Intel's best-selling product

AMD Processors Used In Today's Personal Computers

Model	Clock Speed	Number of Transistors
Athlon FX 64	2.2 GHz & up	105.9 Million
Athlon XP	2.2 GHz & up	54.3 Million
Opteron for servers	1.4 GHz & up	106 Million
Athlon	1.0 GHz & up	37 Million
Duron	600 MHz & up	25 Million

Freescale Processors

Freescale Semiconductor, Inc. is a subsidiary of Motorola, Inc. Freescale offered two processor architectures that were used in Macintosh computers. The first is known as the 680x0 family and the other is

PowerPC developed by Freescale, Apple and IBM. Freescale's MPC74xx processors can be found in Apple's G4 computers.

IBM Processors

In addition to working with Apple and Freescale on the PowerPC line, IBM makes high – performance Mainframe and workstation CPU"s. In 2003, IBM partnered with Apple and released the G5.

Comparative Study

Mainly we compare the processors using their clock speed. But when comparing processors, many factors are also come into play. They are

- Size of cache
- Number of registers
- Word size
- Speed of Front side bus

CPU"s Performance Specifications			
Specification	**AMD Athlon 64 FX**	**Intel Pentium IV**	**PowerMac G5**
Number of registers	16	16	80
Word size	64 bits	32 bits	64 bits
Front Side or system	1.6 GHz	800 MHz	1 GHz

Bus speed			
L1 cache	128 KB	nana	
L2 cache	1024 KB	512	512

TYPES OF PROGRAMMING LANGUAGES

The operations of computer are controlled by a set of instructions called a computer program. These instructions are written to tell the computer:

1) What operation to perform
2) Where to locate data
3) How to represent results
4) When to make certain decisions

The communication between two parties, whether they are machines or human beings, always needs a common language or terminology. The language used in the communication of computer instructions is known as the programming language. The computer has its own language and any communication with the computer must be in its language or translated into this language.

There are many different languages that can be used to program a computer. They can be divided into three main categories.

- Machine Language (Low Level Language)
- Assembly (Symbolic) Language
- High level language

Machine Language

As computers are made of two-state electronic devices, they can understand only pulse and no-pulse (1 & 0) conditions. Therefore, all instructions and data should be written using binary codes 1 and 0. The binary code is called the *machine code or machine language.*

Machine languages are most fundamental of languages. Using a machine language, a programmer creates instructions in the form of machine code (0"s and 1"s) that a computer can follow. Very few computer programs are actually written in machine language, however, for two significant reasons: First, because machine language is very cumbersome to work with and Second, because every different types of computer has its own unique instruction set. Thus, a machine language program written for one type of computer cannot be run in another type of computer without significant alterations. Machine language is the only language a computer is capable of understanding. It does not need any translator program (A translator is a program which converts one programming language in to another).Machine languages are usually referred to as the *first generation* languages.

Advantage

The only advantage is that program of machine language run very fast because no translation program is required for the CPU.

Disadvantages

1. It is very difficult to program in machine language. The programmer has to know details of hardware to write program.
2. Machine language is hardware dependent.
3. The programmer has to remember a lot of codes to write a program, which results in program errors.
4. It is difficult to debug the program.

Assembly Language

The first step in the evolution of programming languages was the development of what is known as assembly language. Assembly languages have the same structure and set of commands as machine languages, but they enable a programmer to use names (Mnemonics) instead of numbers (0"s and 1"s). An assembly language program written for one type of CPU won't run on another. The assembly language is referred to as the second generation programming language. It is also considered as low level language because they are very close to machine languages.
During execution, the assembly language program is converted into the machine code with the help of an assembler. Assembler is a translator program.

Advantages:

1. Assembly Language is easier to understand and saves a lot of time and effort.
2. It is easier to correct errors and modify program instructions.
3. Assembly Language has the same efficiency of execution as the machine level language

Disadvantages:

Assembly language is machine dependent. A program written for one computer might not run in other computers with different hardware configuration

High Level Language

High level languages were developed to make programming easier. These languages are called high level languages because their syntax is more like human language than either assembly or machine language code. Programs written in a high level language must be translated into machine language by a compiler or interpreter.

Compiler is a computer program that translates the source code written in high level language in to the corresponding low level language. This translation process is called compilation. The entire high level program is converted into the executable machine code. Compiled languages include COBOL, FORTRAN, C, C++, etc. The interpreter is a translation program that coverts each high level program statement into the corresponding machine code. Instead of the entire program, one statement at a time is translated and executed immediately. The commonly used interpreted languages are BASIC and PERL.

Although, interpreters are easier to create compared to compilers, the compiled languages can be executed more efficiently *and are faster. Advantages:*

1) Higher-level languages have a major advantage over machine and assembly languages that higher-level languages are easy to learn and use. It is because that they are similar to the languages used by us in our day-to-day life.
2) The programs can easily be debugged and are machine independent.

INSIDE A PC

- **Central processing unit (CPU)** - The microprocessor "brain" of the computer system is called the central processing unit. It's a chip that holds a complete computational engine. It uses assembly language as its native language. Everything that a computer does is overseen by the CPU.

- **Memory** - This is very fast storage used to hold data. It has to be fast because it connects directly to the microprocessor. There are several specific types of memory in a computer:

  Random-access memory (RAM) - Used to temporarily store information with which the computer is currently working

  Read-only memory (ROM) - A permanent type of memory storage used by the computer for important data that doesn't change

  Basic input/output system (BIOS) - A type of ROM that is used by the computer to establish basic communication when the computer is first powered on

  Caching - The storing of frequently used data in extremely fast RAM that connects directly to the CPU

  Virtual memory- Space on a hard disk used to temporarily store data and swap it in and out of RAM as needed

  Flash memory - a solid state storage device, Flash memory requires no moving parts and retains data even after the computer powers off

- **Motherboard** - This is the main circuit board to which all of the other internal components connect. The CPU and memory are usually on the motherboard. Other systems may be found directly on the motherboard or connected to it through a secondary connection. For example, a sound card can be built into the motherboard or connected through an expansion slot.

- **Power supply**- An electrical transformer regulates the electricity used by the computer.

- **Hard disk** - This is large-capacity permanent storage used to hold information such as programs and documents. Traditional hard drives contain moving parts -- the drive has platters on which it stores data. The drive spins the platters to record and read data. But some newer hard drives are flash-based with no moving parts. These drives are called solid-state drives.

- **Operating system** - This is the basic software that allows the user to interface with the computer.

- **Integrated Drive Electronics (IDE) Controller** - This is the primary interface for the hard drive, CD-ROM and floppy disk drive.

- **Accelerated Graphics Port (AGP)** - This is a very high-speed connection used by the graphics card to interface with the computer.

- **Sound card**- This is used by the computer to record and play audio by converting analog sound into digital information and back again.

- **Graphics card** - This translates image data from the computer into a format that can be displayed by the monitor. Some graphics cards have their own powerful processing units (called a GPU -- graphics processing unit). The GPU can handle operations that normally would require the CPU.

- **Ports** - In computer hardware terms, a port is an interface that allows a computer to communicate with peripheral equipment.

- **Real-time clock** - Every PC has a clock containing a vibrating crystal. By referring to this clock, all the components in a computer can synchronize properly.

- **Complementary Metal-oxide Semiconductor** - The CMOS and CMOS battery allow a computer to store information even when the computer powers down. The battery provides uninterrupted power.

- **Fans, heat sinks and cooling systems** - The components in a computer generate heat. As heat rises, performance can suffer. Cooling systems keep computers from overheating.

LATESTTRENDS AND TECHNOLOGIES OF STORAGE,MEMORY,PROCESSOR,PRINTING etc.

STORAGE

Removable High-Capacity Magnetic Disk

Removable High-Capacity Disk and drives combine the speed and capacity of a hard disk with portability of a diskette. There are basically two types of removable high-capacity magnetic disks:

High-Capacity Floppy Disks

Many computer makers now offer built in high-capacity floppy disk drives in addition to a standard diskette drive. We can easily add a high capacity floppy disk drive to a system that doesn‟t already have one. The most commonly used high capacity floppy disk system is the Zip drive and disks. Zip disks come in capacities ranging from 100 MB to 750 MB.

- Hot-Swappable Hard Disks (Removable Hard disks)

These disks are sometimes used on high-end workstations or servers that require large amounts of storage. They allow the user to remove (swapout) a hard disk and insert (swap in) another while the computer is still running (hot). The removable box includes the disk, drive and read/write heads in a sealed container.

Recordable Optical Technologies

The latest innovations in optical technologies allow home users to create their own DVDs, filled with audio and video, music or computer data. Some popular "writable" CD and DVD (Digital Video Disk) technologies are:

- CD-Recordable (CD-R):- A CD-R drive allows to create data or audio discs that can be read by most CD-ROM drivers. After information has been written to part of the special recordable disk, that information cannot be changed.

- CD-ReWritable (CD-RW):- Using a CD-RW drive, we can write data on to special CD-RW discs, then overwrite it with new data. Most CD-RW discs cannot store audio data.

- DVD-Recordable (DVD-R):- A DVD-R system record data on to a special recordable digital video disc, using a special drive. Once we record data on to a DVD-R disc, we cannot change it.
- DVD-RAM:- DVD-RAM allow us to record, erase and re-record data on a special disc. DVD-RAM drives can read DVDs, DVD-R discs, CD-R disc, CD-RW disc and standard CDs.

Solid-State Storage Devices

Solid-State Storage is neither magnetic nor optical. Instead it relies on ICs to hold data. According to the memory circuits it used they are volatile or non-volatile. Solid-State Storage devices have a big advantage over standard storage devices: speed. This is because Solid-State devices have no moving parts and because they already store data electronically.

- Flash Memory

  It is a special type of memory chip that combines the best features of RAM and ROM. Flash memory lets a user or programmer to access data randomly and also it is non-volatile. It is commonly used in digital cameras and multimedia players (MP3 players).

- Smart Cards

  Smart cards contain a small chip that stores data, using a special device, called smart card reader, the user can read data from the card, add new data or revise existing data. Some smart cards, called intelligent smart cards, also contain their own tiny microprocessor, and they function like a computer.

- Solid-State disk (SSD)

  This device uses very fast memory chips, such as Synchronized Dynamic RAM (SDRAM), to store data. SDRAM is much faster than standard RAM. Large-scale SSD systems can store a terabyte or more of data. The biggest drawback of RAM-based SSDs is volatility. For this reason, many SSD systems feature built-in battery backups and a set of hard disk. If power fails or a circuit goes back, the system can still use backup data stored on its hard disks.

PRINTING

High Quality Printers

Although most offices and homes use ink jet or laser printers, other types of printers are used for special purposes. High Quality Printers are often used by publishers and small print shops to create high-quality output, especially colour output. Different types are

Dye-Sublimation Printers

Desktop publishers and graphic artists get realistic quality and colour for photo images using dye-sublimation (dye-sub) printers. In dye sublimation technology, a ribbon containing panels of colour is moved across a focused heat source capable of subtle temperature variations. The heated dyes evaporate from the ribbon and diffuse on specially coated paper or another material, where they form areas of different colours. The variations in colour are related to the intensity of the heat applied. Dye-sub printers create extremely sharp images, but they are slow and costly.

Photo Printers

The photo printers can create images that look nearly as good as a photograph printed using traditional methods. Many photo printers use ink jet technology, but a few use dye-sublimation technology. Photo printers work slowly; some can take two to four minutes to create a printout.
One advantage of the newest photo printers is that they do not need a computer. These photo printers feature slots for memory cards used by many digital cameras. Instead of connecting the printer to the computer, the user can simply remove the memory card from the camera and plug it into the printer. Some photo printers can connect directly to a camera by a cable or even by an infrared connection.

Thermal-Wax Printers

Thermal-Wax Printers are used primarily for presentation graphics. They create bold colours and have a low per- page cost for printouts with heavy colour requirements, such as posters or book covers. Thermal-Wax Printers operate with a ribbon coated with panels of coloured wax that melts and adheres to plain paper as coloured dots when passed over a focused heat source.

CONCEPT OF PROGRAM AND DATA

Data

Data consist of individual facts or pieces of information. A computers primary job is to process these tiny pieces of data in various ways, converting them into useful information. All digital computers, regardless of their size, are used to transmit, store and manipulate information (i.e., data). Several different types of data can be processed by a computer. These include *numeric data*, *character data* (names, addresses, etc.), *graphic data* (charts, drawings, photographs, etc.), and *sound* (music, speech patterns, etc.).The two most common types are numeric data and character data. Scientific and technical applications are concerned primarily with numeric data, whereas business applications usually require processing of both numeric and character data.

Program

To processes a particular set of data, the computer must be given an appropriate set of instructions called a *program*. These instructions are entered into the computer and then stored in a portion of the computer's memory. A computer can process information in accordance with the program put into it. A stored program can be executed at any time.

SYSTEM SOFTWARE

Software refers to the set of computer programs, procedures that describe the programs and how they are to be used.

Computer software is normally classified into two broad categories.

- System Software
- Application Software

System Software

System software may be defined as a set of one or more programs designed to control the operations of computer system. System Software are general purpose programs designed for performing tasks such as controlling all operations required to move data into and out of the computer. It also monitors the use of various hardware like memory, CPU etc. System software acts as an interface between hardware and application software. System software allows application packages to be run on the computer with less time and effort. It is not possible to run application software without system software. Examples of system software are Operating System (OS), Assembler, Compiler and Debugger.

There are three basic types of system software.

- An *operating system* tells the computer how to use its own components. It is essential for any computer, because it acts as a interpreter between the hardware, application programs and the user.
- A *network operating system* allows computers to communicate and share data across a network while controlling network operations and overseeing a network's security.
- A *utility* is a program that makes the computer system easier to use or performs highly specialized functions. Utilities are used to manage disks, troubleshoot hardware problems and perform other tasks that the operating system itself may not be able to do.

BIOS (Basic Input Output System)

When a computer is turned on, it must know how to start. ROM contains a set of start-up instructions called the *basic input output system*(BIOS) for a computer. In addition to booting the machine, BIOS contains another set of routines, which ensure that the system is functioning properly and all expected hardware devices are present. This routine is called *PowerOnSelf Test* (POST).Having done this, it reads from the disk a small portion of OS known as boot and loads it into the main memory. This boot program then "pulls" the rest of the OS from the disk and stores it in the main memory. This is known as booting the system. Other programs contained in BIOS are:

- System configuration analysis
- Time-of-day
- I/O support programs for:- keyboard, disk, floppy, printer, display

OPERATING SYSTEM

Definition

An Operating System (OS) is a system software that helps the users to operate the computer and manage its resources. The primary purpose of the OS is to act as an interface between the computer and the user. OS manages all the resources of the computer, i.e. CPU, Memory and Input-Output devices. In Order to manage and optimize the usage of the resources, OS uses some predefined techniques and facilitates the efficient working of the computer. Operating System also helps in executing other softwares on the computer. MS-DOS, Windows 98, Windows 2000, Windows XP, Linux are some commonly used operating systems.

Functions of Operating System

- Displays the user interface (on- screen elements with which user can interact).
- Loads programs into the computer's memory.
- Manages the way information stored on and retrieved from disks.
- Coordinates how programs work with the computer's hardware and other software.

MS DOS

MS DOS stands for Microsoft Disk Operating System. In MS DOS there is a command line user interface, which is known as MS DOS prompt. In the MS DOS prompt or the command prompt, the user needs to type various commands to perform the operations in MS DOS operating system.

WINDOWS

MS Windows stands for Microsoft Windows operating system, which was introduced by Microsoft Corporation in the year 1985. It was brought in as an add-on to MS DOS operating system due to the growing interest of users in GUIs. Windows is a GUI based operating system. First version of Windows is Windows 3.1 released in 1992 by Microsoft. Some of the popular versions of Windows operating systems include:- Windows 95,Windows 98,Windows 2000,Windows Millennium (Windows Me), Windows XP, Widows Vista, Windows NT.

LINUX

Linux is a freely available version of the UNIX operating system. Developed by a worldwide cooperative of programmers in 1990s, Linux is a feature-rich, 32-bit, multiuser, multiprocessor operating system that runs on virtually any hardware platform.

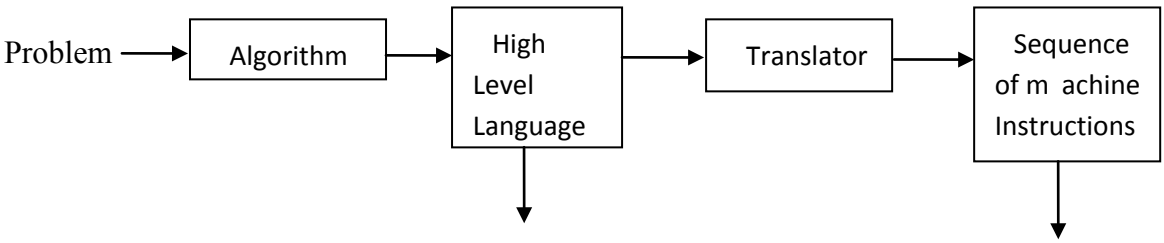
- Linux operating system is reliable, stable, and very powerful
- Linux comes with a **complete development environment**, including compilers, toolkits,and scripting languages
- Linux comes with **networking** facilities, allowing you to share hardware
- Linux utilizes your memory, CPU, and other hardware to the fullest
- A wide variety of **commercial software** is also available
- Linux is very easily **upgradeable**
- Supports **multiple processors** as standard
- True **multitasking**. So many applications, all at once

COMPILERS AND ASSEMBLERS

COMPILER

It is a program that translates the instructions of higher-level languagesto machine language. It is called compiler because it compilesevery program instruction given in higher-level languages intomachine language. Thus compiler is a program translator like assemblerbut more sophisticated. It scans the entire program firstand then translates it into machine code.The program written by the programmer in higher-level language iscalled source program. After this program is converted to machinelanguage by the compiler it is called object program.

A compiler can translate only those source programs, which havebeen written, in that language for which the compiler is meant for.For example, FORTRAN compiler will not compile source code writtenin COBOL language.Object program generated by compiler is machine dependent. Itmeans programs compiled for one type of machine will not run inanother type. Therefore every type of machine must have its personalcompiler for a particular language. Machine independence isachieved by using standard higher-level language on different machinesand converting them for use on specific machines through acompiler.

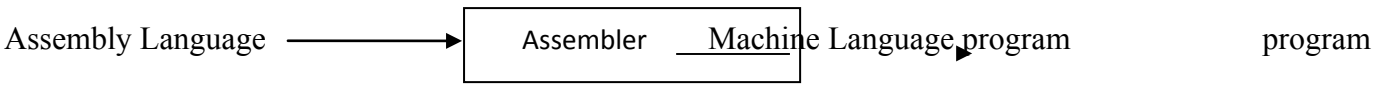


source program

Object program in Machine Language

ASSEMBLER

An assembler is a computer program that translates assembly language statements (Mnemonics) into machine language codes. The assembler takes each of the assembly language statement from the source code and generate the corresponding bit stream using 0‟s and 1‟s.The output of the assembler in the form of sequence of 0‟s and 1‟s is called *object code* or *machine code.*This machine code is finally executed to obtain the result.



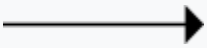
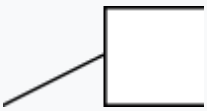
BASIC ELEMENTS OF A PROGRAMMING LANGUAGE

FLOW CHARTS

A Flow Chart depicts pictorially the sequence in which instructions are carried out in an algorithm. Flow charts are used not only as aids in developing algorithms but also to document algorithms.

For easy visual recognition a standard convention is used in drawing flow charts.

In this standard convention

ANSI/ISO Shape	Name	Description
	Flowline (Arrowhead)[15]	Shows the process's order of operation. That means the flow of data from one point to other
	Terminal[14]	Indicates the beginning and ending of a program or sub-process. Represented as a stadium, oval or rounded (fillet) rectangle. They usually contain the word "Start" or "End", or another phrase signalling the start or end of a process, such as "submit inquiry" or "receive product".
	Process[15]	Represents a set of operations that changes value, form, or location of data. Represented as a rectangle.
	Decision[15]	Shows a conditional operation that determines which one of the two paths the program will take. The operation is commonly a yes/no question or true/false test. Represented as a diamond (rhombus).[15]
	Input/Output[15]	Indicates the process of inputting and outputting data, as in entering data or displaying results. Represented as a parallelogram.
	Annotation[14] (Comment)[15]	Indicating additional information about a step in the program. Represented as an open rectangle with a dashed or solid line connecting it to the corresponding symbol in the flowchart.
	Predefined Process	Shows named process which is defined elsewhere. Represented as a rectangle with double-struck vertical edges.
	On-page Connector	Pairs of labelled connectors replace long or confusing lines on a flowchart page. Represented by a small circle with a letter inside.

	Off-page Connector	A labelled connector for use when the target is on another page. Represented as a home plate-shaped pentagon.

ALGORITHM

Definition

An algorithm is a precise specification of a finite sequence of instructions to be carried out in order to solve a given problem. Each instruction tells what task is to be performed.

Properties of Algorithm

An algorithm has the following five properties:

1) A number of quantities are provided to an algorithm initially before the algorithm begins. These quantities are the *inputs* which are processed by the algorithm.
2) The *processing rules* specified in the algorithm must be precise, unambiguous and lead to a specific action. In other words the instruction must not be vague. It should be possible to carry out the given instruction. An instruction which can be carried out is called an *effective* instruction.
3) Each *instruction* must be sufficiently *basic* such that it can, in principle, be carried out in a finite time by a person with paper and pencil.
4) The total time to carry out all the steps in the algorithm must be finite. An algorithm may contain instructions to repetitively carry out a group of instructions. This requirement implies that the number of repetitions must be finite. 5) An algorithm must have one or more *output.*

For Developing Algorithm the following conventions are used:

1) Each algorithm will be logically enclosed by two statements START and STOP.
2) To accept data from user, the INPUT or READ statements are to be used.
3) To display any user message or the content in a variable, PRINT statement will be used. Note that the message will be enclosed within quotes.
4) The arithmetic operators that will be used in the expressions are
   „=“ Assignment (the left-hand side of “=“ should always be a single variable)
   „+“ Addition „-“ Subtraction
   „*“ Multiplication „/“ Division
5) In propositions, the commonly used relational operators will include
   „>“ Greater than „<=“ Less than or equal to
   „<“ Less than „=“ Equality
   „>=“Greater than or equal to „!=“ Non-equality 6) The most commonly used logical operators will be
   „AND“ Conjunction

„OR“ Disjunction

„NOT“ Negation

DEVELOPMENT OF ALGORITHMS FOR SIMPLE PROBLEMS

1) Write the algorithm for finding the sum of any two numbers.

Solution) Let the two numbers be A and B and let their sum be equal to C. Then, the desired algorithm is given as follows:

Step 1: Start

Step 2: Print “Enter two numbers”

Step 3: Input A, B

Step 4: C=A+B

Step 5: Print C

Step 6: Stop

2) Construct the algorithm for interchanging (Swapping) the numeric values of two variables.

Solution) Let the two variables be A and B. Consider C to be a third variable that is used to store the value of one of the variables during the process of interchanging the values. The desired algorithm is given as follows:

Step 1: Start

Step 2: Print “Enter the values of A & B”

Step 3: Input A, B

Step 4: C=A

Step 5: A=B

Step 6: B=C

Step 7: Print A, B

Step 8: Stop

3) Write an algorithm that compares two numbers and prints either the message identifying the greater number or the message stating that both numbers are equal.

Solution) Here, two variables, A and B, are assumed to represent the two numbers that are being compared. The desired algorithm is given as follows:

Step 1: Start

Step 2: Print “Enter two numbers”

Step 3: Input A, B

Step 4: If A>B Then

Print “A is greater than B”

Step 5: If B>A Then

Print “B is greater than A”

Step 6: If A=B Then

Print “Both are equal

Step 7: Stop

4) Write an algorithm to check whether a number given by the user is odd or even.

Solution) Let the number to be checked be represented by N. The number N is divided by 2 to give an integer quotient, denoted by Q. If the remainder, designated as R, is Zero, N is even; otherwise N is odd. The desired algorithm is given as follows:

Step 1: Start

Step 2: Print “Enter the number”

Step 3: Input N

Step 4: Q=N/2 (Integer division)

Step 5: R=N-Q*2

Step 6: If R=0 Then Print “ N is Even

Step 7: If R!=0 Then

Print “ N is Odd “

Step 8: Stop

5) Print the largest number among three numbers

Solution) Let the three numbers be represented by A, B, and C. The desired algorithm is

Step 1: Start

Step 2: Print “Enter the three numbers”

Step 3: Input A, B, C

Step 4: If A > B Then

If A > C Then

Print A

Else

Print C

Else If B > C Then

Print B

Else

Print C

Step 5: Stop

6) Construct an algorithm for incrementing the value of a variable that starts with an initial value of 1 and stops when the value becomes 5.

Solution) This problem illustrates the use of iteration or loop construct. Let the variable be represented by C. The algorithm for the problem is:-

Step 1: Start

Step 2: C = 1

Step 3: Print C

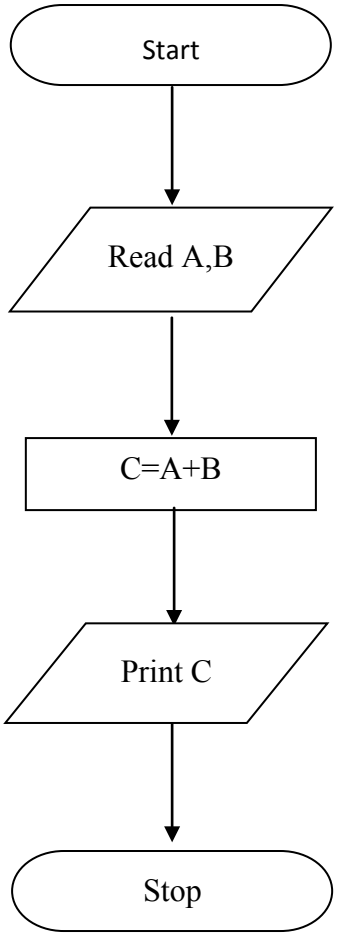
Step 4: C = C+1

Step 5: If C <= 5 Then Go To Step 3

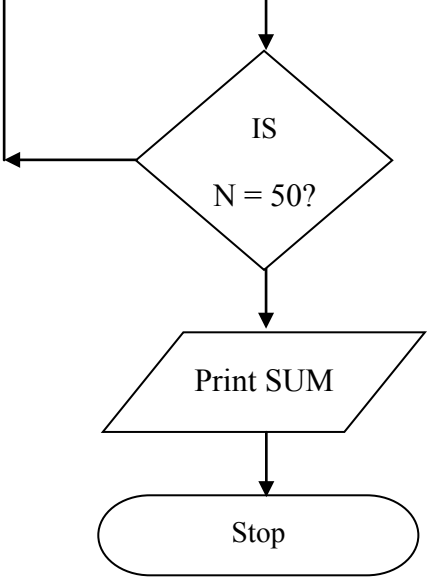
Step 6: Stop

DEVELOPMENT OF FLOWCHARTS FOR SIMPLE PROBLEMS

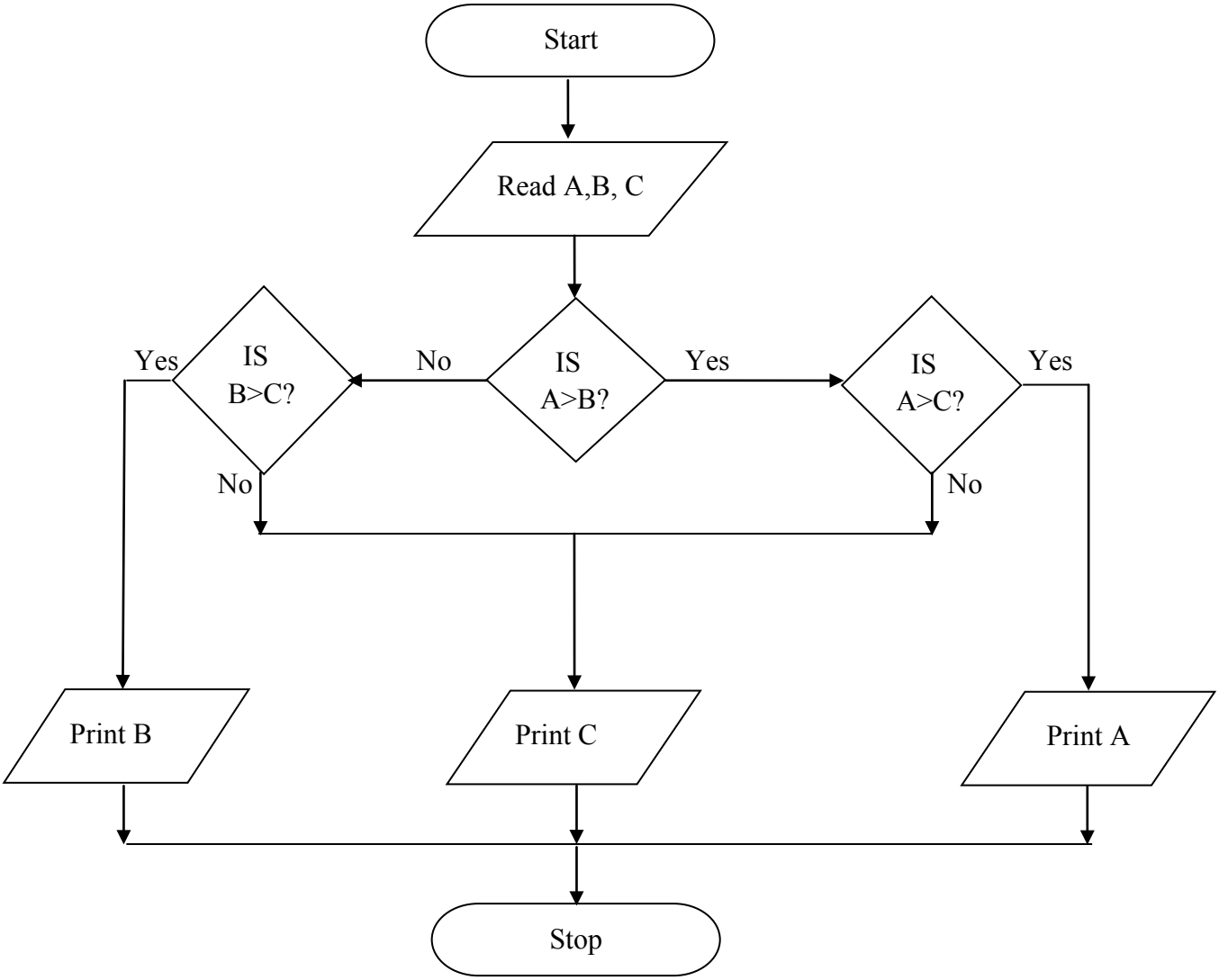
1) Draw a Flow Chart for finding the sum of any two numbers.



2) Draw a Flow Chart to find the sum of the first 50 natural numbers.



3) Draw a Flow Chart to find the largest of three numbers A, B, C


Start
Read A,B, C
IS
A>B?
Yes
No
IS
B>C?
Yes
No
IS
A>C?
Yes
No
Print B
Print C
Print A
Stop