CHAPTER 1

INTRODUCTION

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Contents:

1. Introduction to Computer
2. Brief History of Computing
3. Generation of computer
4. Types of Computer
5. Components of Computer System
6. Software and its types
7. Programming languages
8. Language translators
9. Traditional and structured programming concept

1. Introduction to Computer

- The term computer is derived from the Latin term '**computa**

- this means to calculate or programmable machine.

- What is a computer?
  - An electronic device
  - Accepts data and instructions as input,
  - Process the data
  - Provides meaningful result.
  - Stores the data/result as needed.

- Basic Principle: IPOS

- Input-Process-Output-Storage

Primary operations in Computer

- **INPUT** : entering data into the computer
- **PROCESSING** : performing operations on the data
- **OUTPUT** : Presenting the result
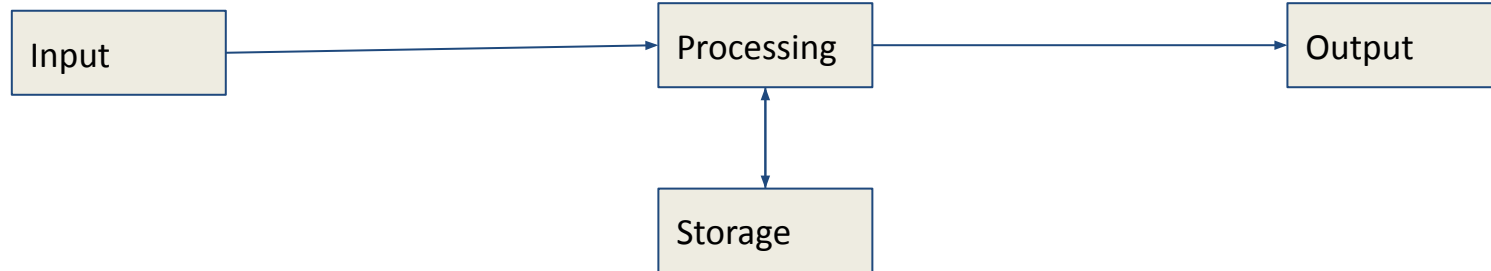- **STORAGE** : saving the data/result for future use

Primary operations in Computer

Order Slip:
Chicken Momo - 1
Veg. Chowmin - 1
Milk Coffee - 2
French Fries - 1
Mushroom Pizza -1

Cashier adds the order into the system.

Data is processed and total is calculated.

New Road, Pokhara, Kaski

Table - 06

Check #:   888129   Pax(s): 01
Date   :   04/15/2022   09:18
Cashier: Neetu Gurung

|		
1	Chicken Momo	Rs 150.00
1	Veg Chowmin	Rs 140.00
2	Milk Coffee	Rs 240.00
1	French Fries	Rs 180.00
1	Mushroom Pizza	Rs 460.00

Subtotal :   Rs 1170.00
Tax   Rs 120

Total :   Rs 1290.00

Take home a bag of meatballs and 2 pkgs. of cream sauce for only Rs 999
Made from an authentic recipe!

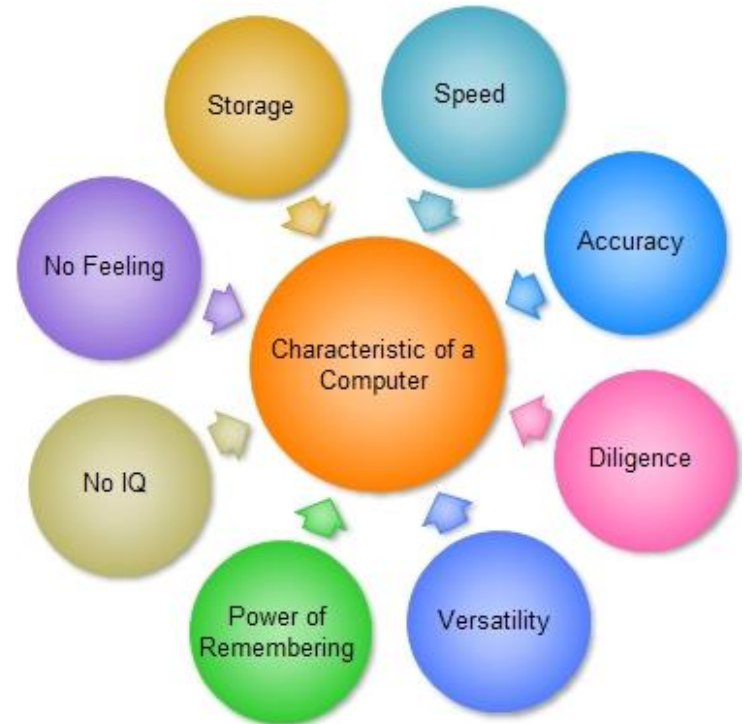Input → Processing → Output

Processing ↕ Storage

Characteristics of a Computer

1. **Speed:** Computer can work very fast. It takes only few seconds for calculations compared to human.

2. **Accuracy :** The degree of accuracy of computer is very high.

3. **Diligence :** A computer is free from tiredness, lack of concentration, fatigue, etc.

4. **Versatility:** It means the capacity to perform completely different type of work.
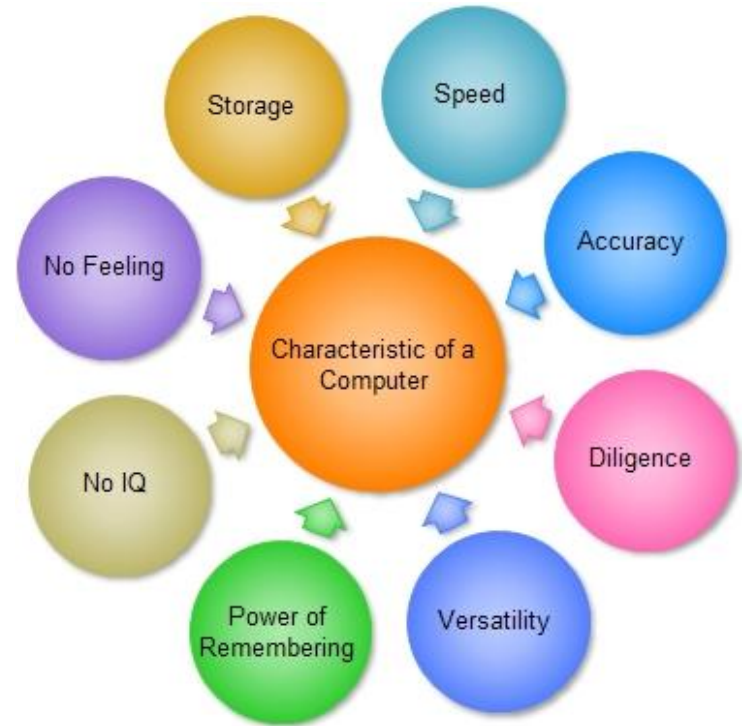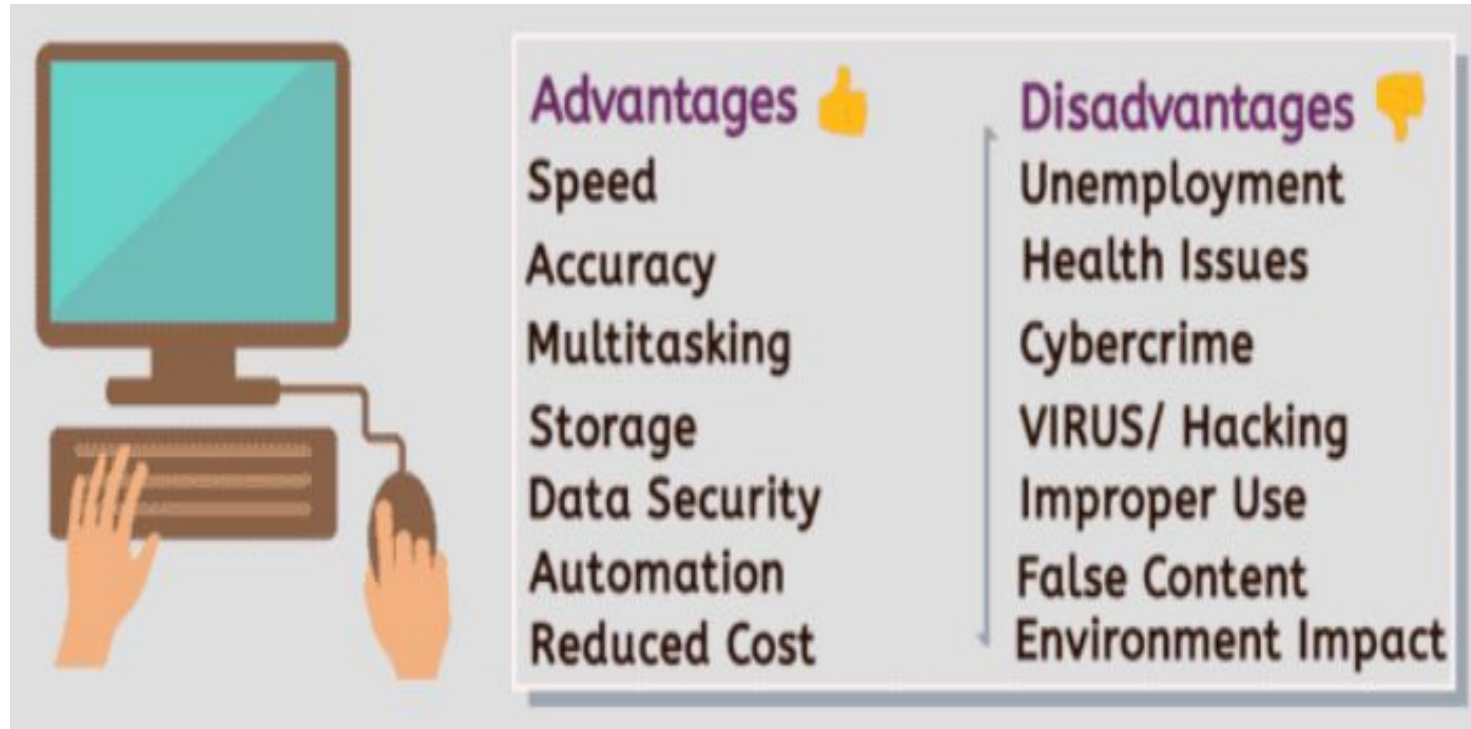
Characteristics of a Computer

5. **Power or Remembering**: Computer has the power of storing any amount of information or data.

6. **No IQ :** It cannot do any work without instruction from the user. Computer cannot take its own decision.

7. **No feeling :** Computer has no feeling or emotions, tase, knowledge and experience.

8. **Storage:** It can store a large amount of data.

Advantages and Disadvantages of Computer

Advantages 👍
Speed
Accuracy
Multitasking
Storage
Data Security
Automation
Reduced Cost

Disadvantages 👎
Unemployment
Health Issues
Cybercrime
VIRUS/ Hacking
Improper Use
False Content
Environment Impact

Scope of Computer

Computer is playing very important role in every field of life.

- Education
- Health and medicine
- Science
- Business
- Recreation and Entertainment
- Government
- Engineering
- An many more..

Components of computer System

1. **Hardware:** Hardware components are the electronic or mechanical instruments, like keyboard, monitor, printer etc.
2. **Software:** Software is a set of programs (computer instructions), which helps the user to do a set of specific tasks.
   Computer hardware should follow set of instructions supplied to it as software to work.
3. **Data:** Data is essentially the raw facts and figures that we input in the computer
4. **User:** The people interacting with the computer system are also an element of it. They are the ultimate "users" of the computer systems.

Block Diagram of Computer
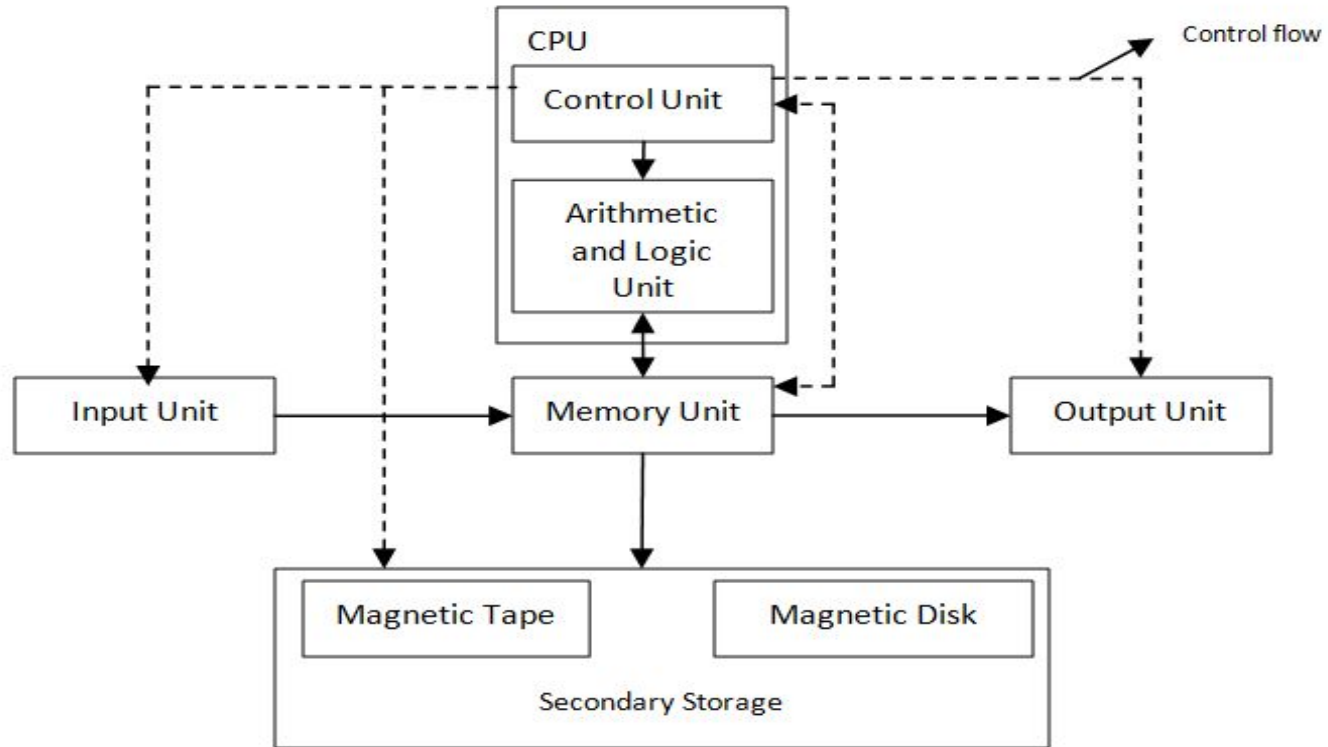
1. Input Unit

- Input unit is a unit that accepts any input device.

- The input device is used to input data into the computer system.

- Examples of input devices are: keyboard, mouse, joystick, scanner, microphone, digitizer, etc.

- Major functions of input unit:

  - It converts inputted data into binary codes.
 - It sends data to main memory of computer.
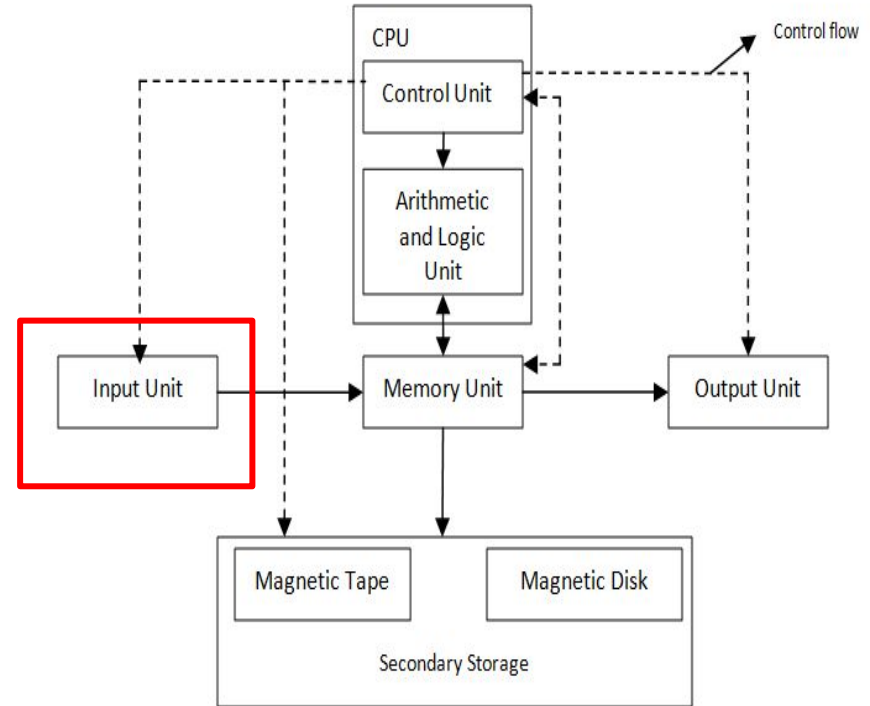
2. Central Processing Unit

- also called the brain of a computer
- It is an electronic circuitry that carries out the instruction given by a computer program.
- Major functions of CPU are:
    - It controls all the parts and software and data flow of computer.
    - It performs all operations.
    - It accepts data from input device.
    - It sends information to output device.
    - Executing programs stored in memory
    - It stores data either temporarily or on permanent basis.
    - It performs arithmetical and logical operations.
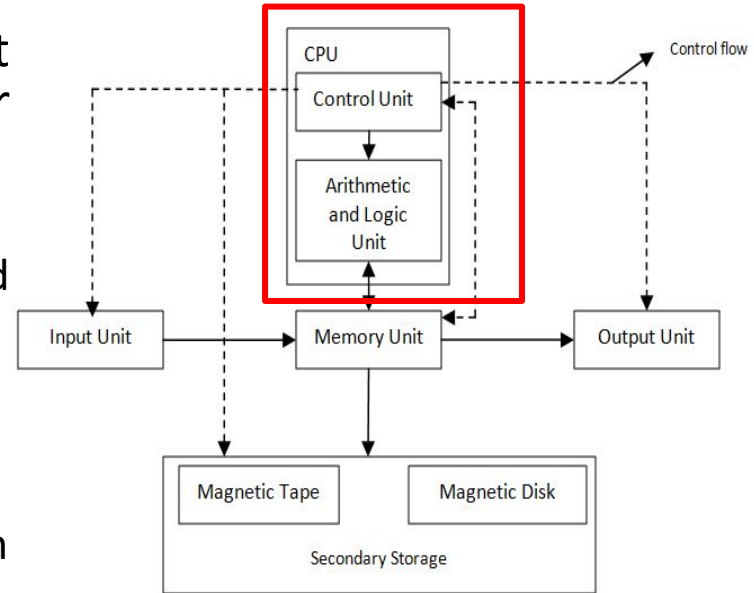
2. Central Processing Unit

- Two sub-parts:
  - Control Unit (CU)
  - Arithmetic and Logic Unit (ALU)
- The control unit manages the various components of the computer.
- The ALU performs simple arithmetic and logical operations.
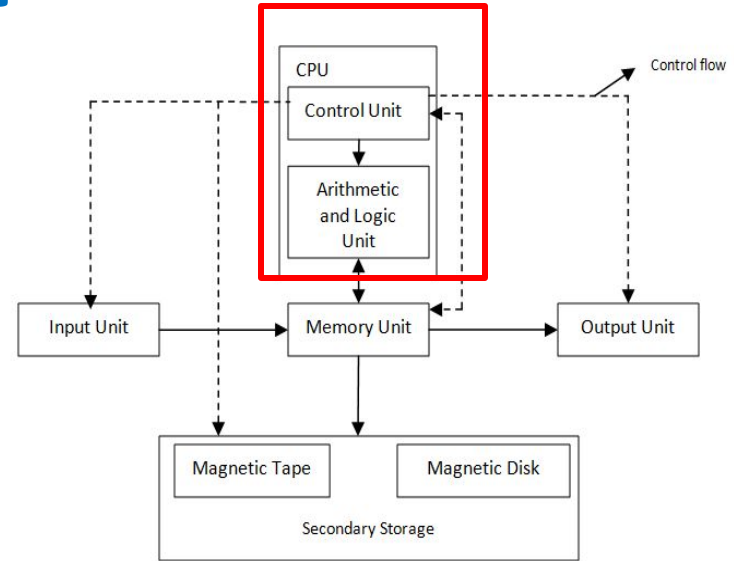
# 3. Output Unit

- Output unit is a unit that consists of a number of output device.

- An output device is used to show the result of processing.

- Examples of output devices are: Monitor, Speaker, Plotter, etc.

- Major functions of Output unit are:

  - It accepts data or information sends from main memory of computer
  - It converts binary coded information into HLL or inputted languages.
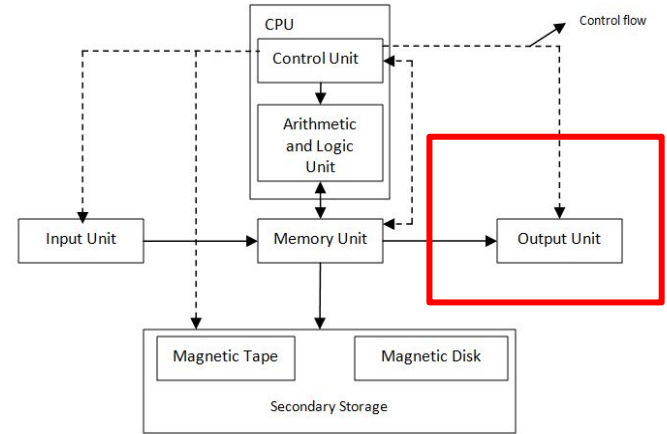
4. Memory Unit

- Major functions of storage unit are:
  - ⬜ All data and instructions are stored here before and after processing.
  - ⬜ Intermediate results of processing are also stored here.
- Memory unit are of two types:
  - ⬜ Primary Memory

    Primary memory is computer memory that a processor or computer accesses first or directly
  - ⬜ Secondary Memory

    Secondary memory stores data and programs permanently.
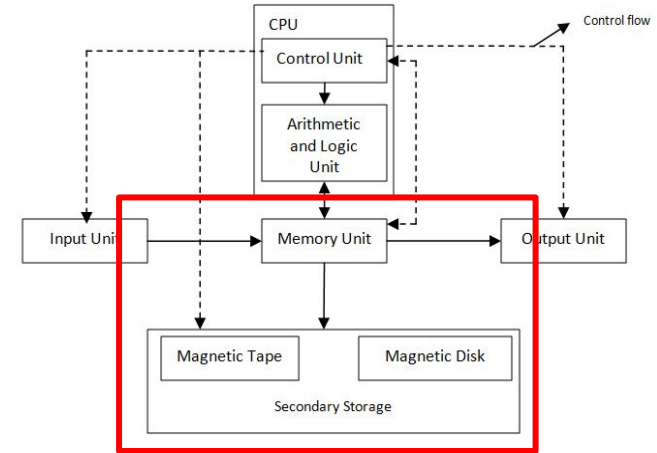
RAM Vs ROM

RAM	ROM
1. Read and Write Memory	1. Read Only Memory.
1. It is a volatile memory.	2. It is non-volatile in nature.
2. Data is stored temporarily.	3. Data is stored permanently.
3. Cost is comparatively higher.	4. Cost is comparatively cheaper.
4. Physically, the size of RAM chip is larger than ROM chip.	5. Physically, the size of ROM chip is smaller than RAM chip.

4. Brief History of Computing

1.   Mechanical Era

2.   Electro-mechanical Era
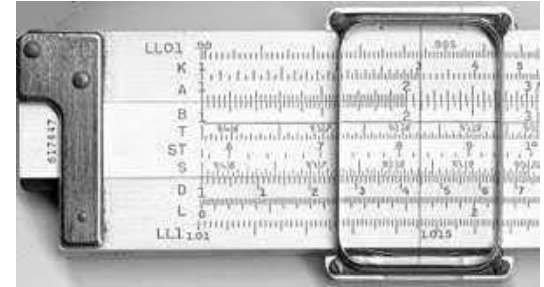
3.   Electronic Era

1. Mechanical Era

- The computers were developed using mechanical parts like as wheel, lever, gears and shaft, etc.

- E.g.: Abacus, Napier's bone, Slide rule, Pascaline, Stepped Reckoner, Jacquard's Loom, Difference Engine, Analytical Engine, Tabulating Machine, etc.

Computers in Mechanical Era

Napier's Bone

Slide Rule
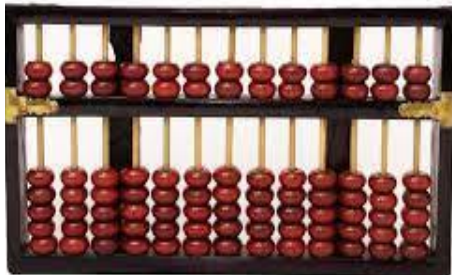
Abacus

Pascaline
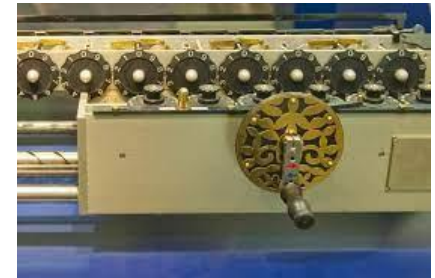
Stepped Reckoner

Computers in Mechanical Era

Analytical Engine

Tabulating Machine

Jacquard's Loom
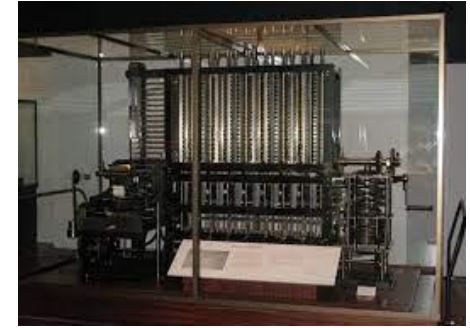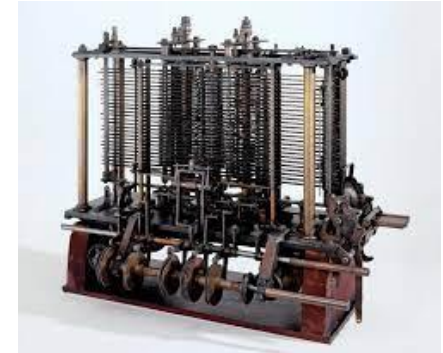
Difference Engine

2. Electro-mechanical Era

- electricity was used in computer devices and they were partly programmable

- Some of the parts of these computers consist of mechanical parts too.

- MARK-I developed by Howard Aiken was the first electro-mechanical computer.

- Example: mark - I, ABC, Zuse, etc.

Computers in Electro-mechanical Era

Mark-I Computer

**Atanasoff Berry
Computer (ABC)**

3. Electronic Era

- electronic circuit elements replaced mechanical devices.

- Calculations were purely digital and only done with electronic circuits.

- This computer was faster than earlier computer as it used vacuum tubes instead of mechanical switches and relays.

- Examples: ENIAC, COLOSSUS, EDVAC, EDSAC, UNIAC, etc.

Computer in Electronic Era

Electronic Discrete Variable Automatic Computer (EDVAC)

Electronic Numerical Integrator and Computer (ENIAC)

3. Generations of Computer

- The term generation indicates the type of technology used in the computer construction.

- Generation here represents the time period.

- There are five generations of computer.
  - First Generation (1942-1955)
  - Second Generation (1955- 1964)
  - Third Generation (1964-1975)
  - Fourth Generation (Since 1975)
  - Fifth Generation (Since 1980)

First Generation

Second Generation

Third Generation

Fourth Generation

Fifth Generation

1. First Generation

- **Main electronic component** – vacuum tube
- **Main memory** – magnetic drums and magnetic tapes
- **Programming language** – machine language
- **Power** – consume a lot of electricity and generate a lot of heat.
- **Speed and size** – very slow and very large in size (often taking up entire room).
- **Input/output devices** – punched cards and paper tape.
- **Examples** – ENIAC, UNIVAC1, IBM 650, IBM 701, etc.
- **Quantity** – there were about 100 different vacuum tube computers produced between 1942 and1963

2. Second Generation

- **Main electronic component** – transistor

- **Memory** – magnetic core and magnetic tape / disk

- **Programming language** – assembly language

- **Power and size** – low power consumption, generated less heat, and smaller in size (in comparison with the first generation computers).

- **Speed** – improvement of speed and reliability (in comparison with the first generation computers).

- **Input/output devices** – punched cards and magnetic tape.

- **Examples –** IBM 1401, IBM 7090 and 7094, UNIVAC 1107, etc.

3. Third Generation

- **Main electronic component** – integrated circuits (ICs)
- **Memory** – large magnetic core, magnetic tape / disk
- **Programming language** – high level language (FORTRAN, BASIC, Pascal, COBOL, C, etc.)
- **Size** – smaller, cheaper, and more efficient than second generation computers (they were called minicomputers).
- **Speed** – improvement of speed and reliability (in comparison with the second generation computers).
- **Input / output devices** – magnetic tape, keyboard, monitor, printer, etc.
- **Examples** – IBM 360, IBM 370, PDP-11, UNIVAC 1108, etc.
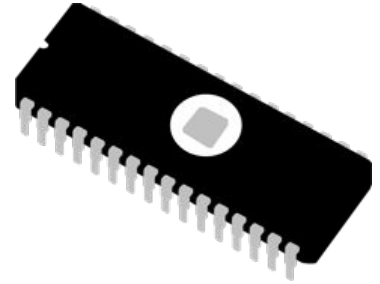
4. Fourth Generation

- **Main electronic component** – very large-scale integration (VLSI) and microprocessor.
  - VLSI– thousands of transistors on a single microchip.

- **Memory** – semiconductor memory (such as RAM, ROM, etc.

- **Programming language** – high level language (Python, C#, Java, JavaScript, Rust, Kotlin, etc.).

- **Size** – smaller, cheaper and more efficient than third generation computers.

- **Speed** – improvement of speed, accuracy, and reliability (in comparison with the third generation computers).

- **Input / output devices** – keyboard, pointing devices, optical scanning, monitor, printer, etc.

- **Network** – a group of two or more computer systems linked together.

- **Examples –** IBM PC, STAR 1000, APPLE II, Apple Macintosh, etc.

5. Fifth Generation

- **Main electronic component:** based on artificial intelligence, uses the Ultra Large-Scale Integration (ULSI) technology and parallel processing method.
  - **ULSI** – millions of transistors on a single microchip
  - **Parallel processing method** – use two or more microprocessors to run tasks simultaneously.
- **Language** – understand natural language (human language).
- **Power** – consume less power and generate less heat.
- **Speed** – remarkable improvement of speed, accuracy and reliability (in comparison with the fourth generation computers).
- **Size** – portable and small in size, and have a huge storage capacity.
- **Input / output device** – keyboard, monitor, mouse, trackpad (or touchpad), touchscreen, pen, speech input (recognise voice / speech), light scanner, printer, etc.
- **Example –** desktops, laptops, tablets, smartphones, etc.
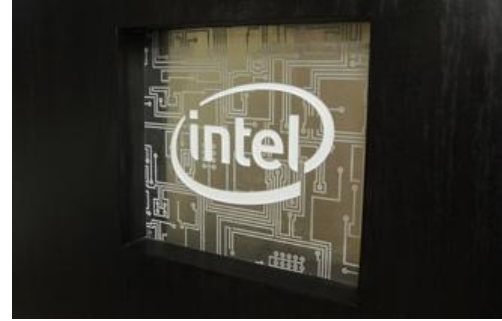
4. Types of Computer

On the basis of Operation	On the basis of Size
• Analog • Digital • Hybrid	• Super • Mainframe • Mini • Micro

i) Analog Computers

- can process analog quantities (continuous data)
- They are designed to accept physical quantities (such as temperature, pressure, speed, frequency, etc) and record them as reading along a continuous scale.
- They are basically single purpose computers.
- The disadvantages of analog computers are that they are not versatile and they are not very accurate
- Eg: Thermometer, speedometer, analog watch, etc

ii) Digital Computers

- The computer which accepts discrete data (discontinuous data) is known as digital computers.

- Basically, a digital computer counts digits, which represent numbers or characters.

- They are most widely used computers.

- They are used in the preparation of reports, tabulation, graphics, etc. in business, accounting, engineering and other fields.

- Eg: Personal computers, PDA, digital watch, etc.

iii) Hybrid Computers

- The data processing device which uses both analog and discrete data representation is known as hybrid computer.

- Hybrid computers can perform the tasks of both analog and digital computers.

- They can transfer data from analog to digital and vice-versa. They are used in scientific research, industrial application, airplanes, etc.

- Eg: Computers used in jet plane, medical computing devices, etc.

Types of Computer

	On the basis of Size
	• Super • Mainframe • Mini • Micro

i) Super Computer

- Supercomputers are the fastest and the most expensive machines.

- They have high processing speed compared to other computers.

- Some of the faster supercomputers can perform trillions of calculations per second.

- Supercomputers are built by interconnecting thousands of processors that can work in parallel.

- Supercomputers are used for highly calculation intensive tasks, such as, weather forecasting, climate research (global warming), molecular research, biological research, nuclear research and aircraft design.

- Eg: Cray Y-MP/C 90, ANURAG, CDC-205, etc

ii) Mainframe Computers

- Mainframe computers are large and powerful machines below super computers.

- They are like big file servers, enabling multiple users from nearby and remote locations to access resources at the same time.

- These systems can handle massive amounts of data going in and out simultaneously.

- They support a large number of terminals, and hence used in LAN, MAN and WAN.

- Some examples of mainframes are CDC 6600 and IBM ES000 series.

ii) Mini Computers

- Minicomputers are digital computers, generally used in multi-user systems.

- They have high processing speed and high storage capacity than the microcomputers.

- But they are comparatively smaller and less expensive and less powerful than the Mainframes.

- They are used for real-time applications in industries, research centers, etc.

- PDP 11, IBM (8000 series) are some of the widely used minicomputers.

iv) Micro Computers

- Microcomputers are small, low-cost and single-user digital computer.

- They consist of CPU, input unit, output unit, storage unit and the software.

- Although microcomputers are stand-alone machines, they can be connected together to create a network of computers that can serve more than one user.

- IBM PC based on Pentium microprocessor and Apple Macintosh are some examples of microcomputers.

- Microcomputers include desktop computers, notebook computers or laptop, tablet computer, handheld computer, smart phones and notebook

5. Software

Introduction

5. Software

- A single instruction given to the computer to perform a single job is called 'command'.

- Collection of such commands in logical and sequential order is called a 'program'.

- When we collect such programs for performing a specific task, then such set of computer programs is called 'computer software'.

- Software is a collection of instructions that enable the user to interact with a computer.

- Software are such type of programs which instruct the computer what to do? when to do? and how to do? any task.

- Without software, most computers would be useless.

Types of software
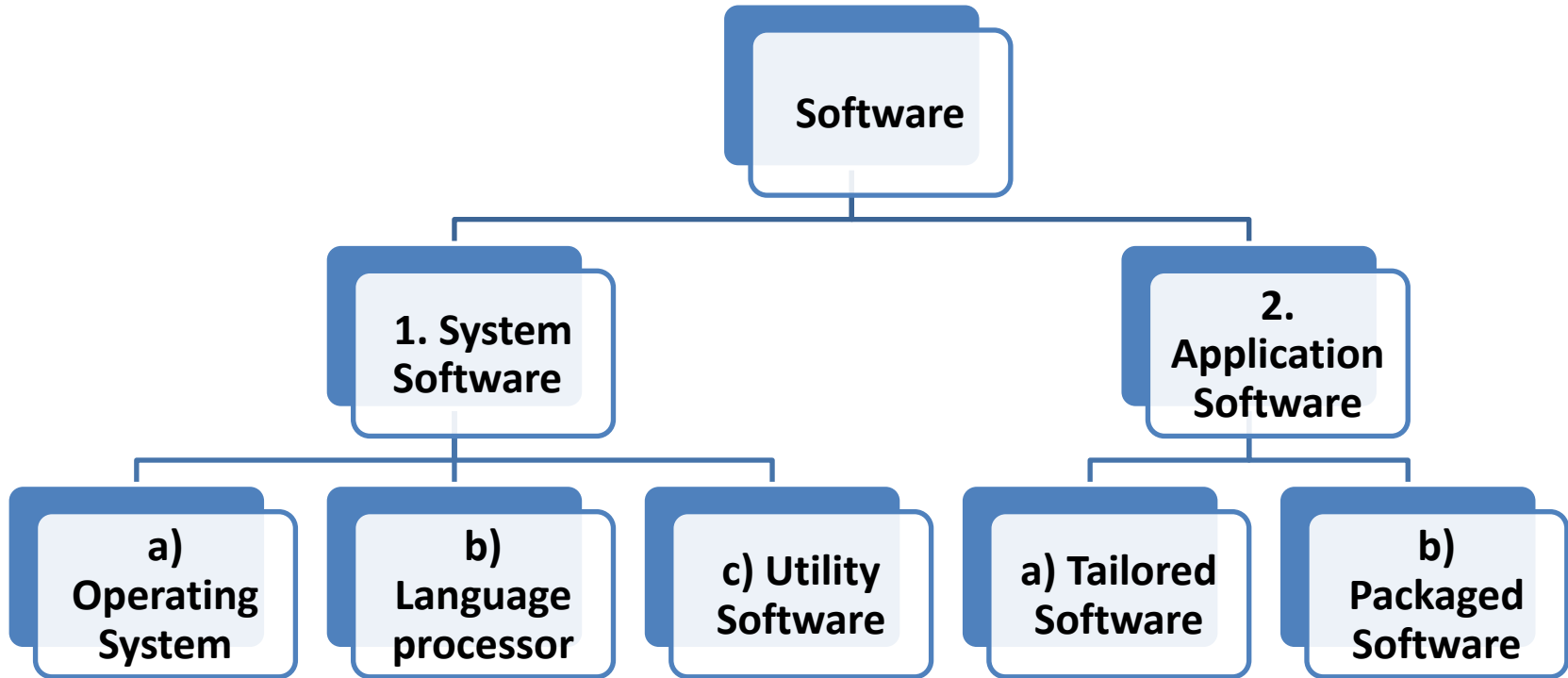
1. System Software

- The software which is used to control and coordinate the computer hardware and software is called system software.

- These are specially built for computer hardware.

- Types:
    a)   Operating System Software
    b)   Language Translator
    c)   Utility Software

a) Operating System

- These softwares manage the resource and control the overall operations of the computer system.

- Operating system provides the interface between the application software/user and hardware.

- The primary purpose of this software is to keep the system operating in an efficient manner while allowing the users access to the system.

- Examples: Windows XP, Vista, Seven, Linux, UNIX, MAC OSX, MAC Lion etc.

# a) Operating System

- The basic functions of OS are:

a) Booting of computer

b) File management

c) Resource management

d) Process management

e) Schedule management

f) Memory management

g) IO management

b) Language Processor Software

- They are those softwares that translate the programs written in other languages to the machine level program.

- Eg: Assembler, Interpreter, Compiler, etc.
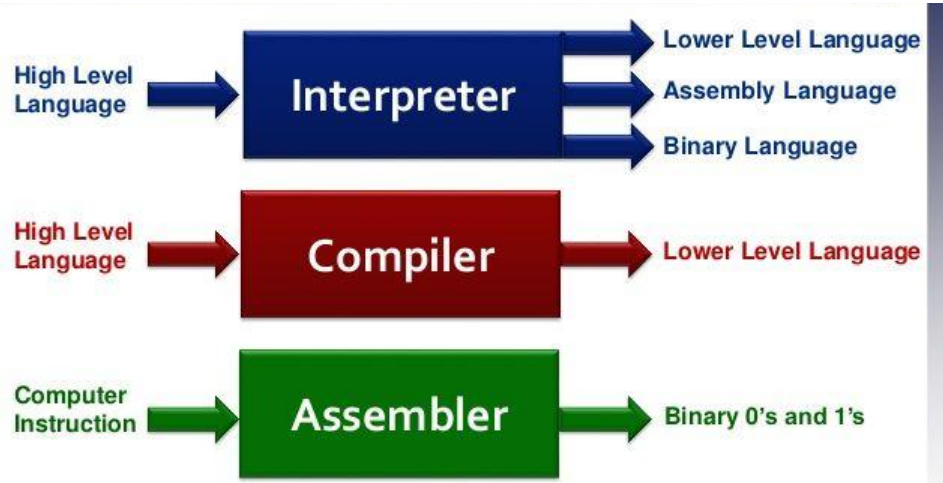
Assembler

- An assembler translates the program written in assembly level language into its equivalent machine level language.
- It takes the basic commands and operations from assembly (mnemonic) code and converts them into binary cod
- A program written by a programmer in assembly language is called a source program.
- When source program is converted to machine code it is called object program.

Interpreter

- An interpreter is a language translator which is used for translating high level language code into machine language code.
- It takes one statement of a high-level language and translates it into machine instruction and executes it immediately.
- Interpreters do not create any object program.

Compiler

- A compiler is a language translator that converts the whole instructions of a high-level language into machine language at once.
- Compilers are large programs which reside permanently in the secondary storage.
- When the translation of the program is done, they are copied into the main memory of the computer

c) Utility Software

- Utility softwares are the useful programs that help in the operation of the computer, and help in smooth operation.

- Utility software is the supporting software which is used to perform specific tasks related to the maintenance of the computer system.

- Some of the utility software are included in Operating System Software, some are available as a separate utility in the market.

- Utility programs are also called as service programs.

- The examples of utility software are Norton utilities, PC tools, WinZip, Partition magic, Backup Utility, Disk Defragmenter and so on.

- They are used in virus scanning, disk repairing, system backup, etc.

2. Application Software

- Application software is a set of one or more programs which are designed to do a specific task.
- It is made to fulfill the user's demand.
- Application is also called as application package.
- For example:
  - a payroll package produces pay slips as the output,
  - word processing jobs are done by word processing software (MS-word) and
  - School Management System processes examination results and produces mark sheets.

a) Packaged Software

- Packaged software is the software that is ready-made and available for sale, lease or license to the general public.
- They are designed to meet the common requirements of people.
- Eg: MS-office package, Adobe package, etc.

b) Customized software

- Custom software (also known as bespoke software or tailored software) is software that is specially developed for some specific organization or other user.

- It is made due to the specific requirement of the user.

- For example, school management system, payroll package, mark sheet preparation and so on.

6. Programming languages

- A programming language is a **computer language** that is used by **programmers (developers) to communicate with computers**.

- It is a set of instructions written in any specific language (C, C++, Java, Python) to perform a specific task.

- A programming language is mainly used to **develop desktop applications, websites, and mobile applications**.

Types of Programming Languages
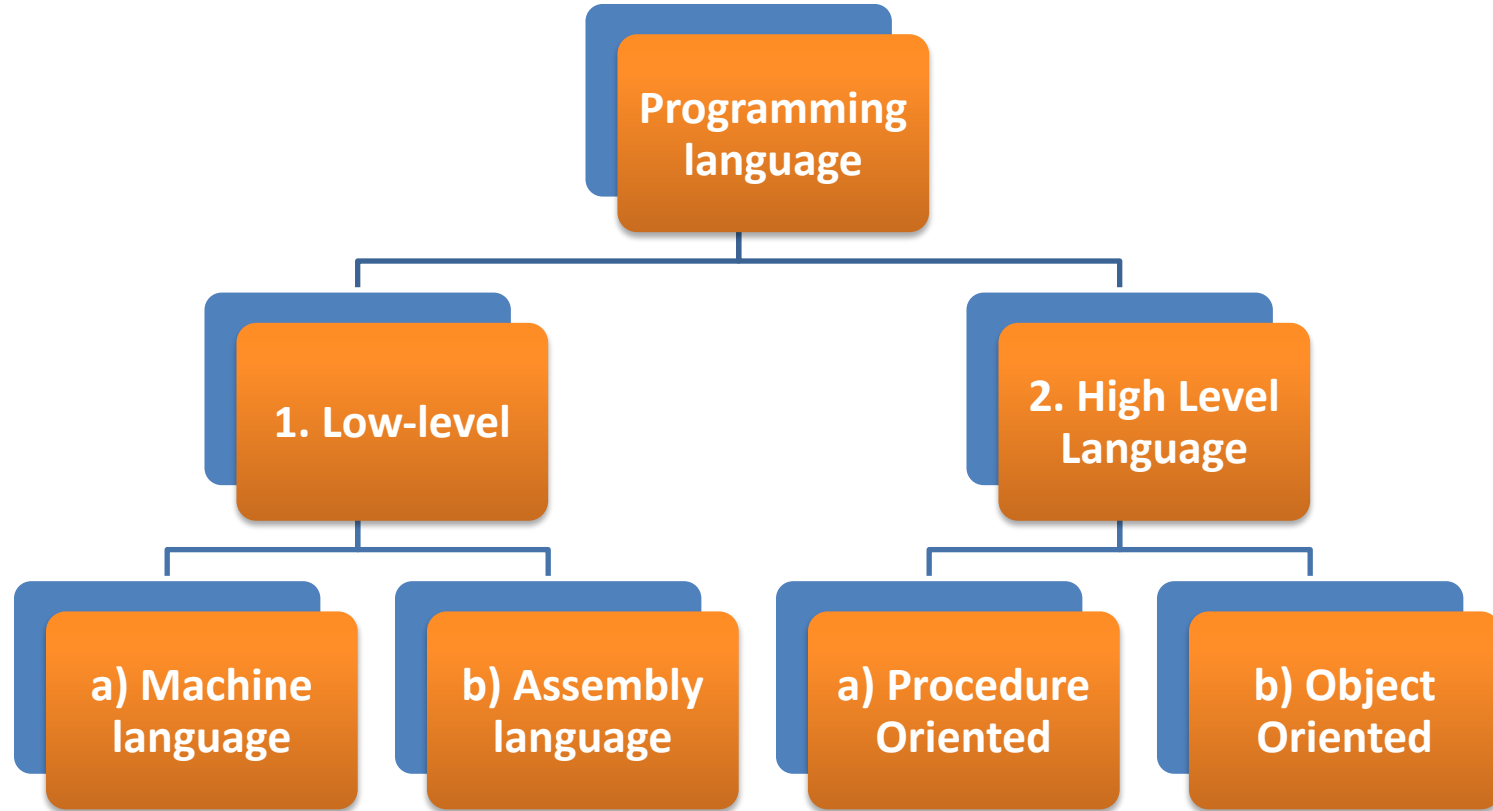
1. Low Level Language (LLL)

- Low-level languages are programming languages which are much closer to the computer or hardware.

- Two types:
  1. Machine language
  2. Assembly language

a) Machine Language

- Machine languages are the lowest level programming languages.
- A computer understands the programs written only in the machine language.
- Machine code consists entirely of 0's and 1's of the binary system which are also called bits.
- **Example:** SUB AX, BX = **00001011 00000001 00100010** is an instruction set to subtract values of two registers **AX** and **BX**.

Advantages:

- Program execution is faster and memory efficient.
- No need of language translators.

Disadvantages:

- hardware dependent: The machine code may be different from machine to machine
- Writing programs in machine language is very tedious, time consuming, difficult to find bugs in longer programs.

b) Assembly language

- To overcome the difficulties of programming in machine language, assembly languages were developed.
- An assembly language contains the same instruction as a machine language.
- But each instruction and variable have a symbol instead of being just numbers.
- And these symbols are called mnemonics.
- For e.g., if 78 is the number to command "Add two numbers", ADD could be used to replace it.

Advantages:

- After developing assembly language, it was easier to program using symbols instead of numbers.

Disadvantages:

- Required Assembler
- They are also machine-dependent.

2. High Level Language

- The programming languages which are closer to the human languages are High Level Language.
- HLL were developed to make programs easier.
- Most of the HLL are English-like language.
- They use familiar English words, special symbols and mathematical symbols in their syntax.
- Therefore, HLL are easier to read, write, understand and program.
- Each HLL has their own set of grammar and rules to represent a set of instructions.
- Programming languages such as C, C++, Java, etc. are some examples of HLL.
- Like an assembly language programs, programs written in HLL also need to be translated into machine language. This can be done either by a compiler or an interpreter.

a) Procedure Oriented Language

- Procedural Oriented Programming (POP) language is derived from structured programming and based upon the procedure call concept.

- It divides a program into small procedures called **routines or functions**.

- The advantage of POP language is that it helps programmers to easily track the program flow and code can be reused in different parts of the program.

- **Example:** C, FORTRAN, Basic, Pascal, etc.

b) Object Oriented Language

- Object-Oriented Programming (OOP) language is **based upon the objects**. In this **programming language, programs are divided into small parts called objects**.

- It is used to implement real-world entities like inheritance, polymorphism, abstraction, etc in the program to makes the program reusable, efficient, and easy-to-use.

- The main advantage of object-oriented programming is that OOP is faster and easier to execute, maintain, modify, as well as debug.

- **Example:** C++, Java, Python, C#, etc.

8. Structural programming

- **Structured programming** is a programming paradigm aimed at improving the clarity, quality, and development time of a computer program.
- It makes extensive use of the structured control flow constructs of selection (if/then/else) and repetition (while and for), block structures, and subroutines rather than using jump statements.
- The structured program consists of well structured and separated modules.
- But the entry and exit in a Structured program is a single-time event.
- It means that the program uses single-entry and single-exit elements.
- Therefore a structured program is well maintained, neat and clean program.

8. Structural programming

- **Structured Programming Approach**, as the word suggests, can be defined as a programming approach in which the program is made as a single structure.

- It means that the code will execute the instruction by instruction one after the other.

- It doesn't support the possibility of jumping from one instruction to some other with the help of any statement like GOTO, etc.

- Therefore, the instructions in this approach will be executed in a serial and structured manner.

- The languages that support Structured programming approach are: C, C++, Java, C#..etc

8. Structural programming

- On the contrary, in the Assembly languages like Microprocessor 8085, etc, the statements do not get executed in a structured manner.

- It allows jump statements like GOTO. So the program flow might be random.

- The structured program mainly consists of three types of elements:
  - Selection Statements
  - Sequence Statements
  - Iteration Statements

8. Structural programming

- The structured program consists of well structured and separated modules.

- But the entry and exit in a Structured program is a single-time event.

- It means that the program uses single-entry and single-exit elements.

- Therefore a structured program is well maintained, neat and clean program.

- This is the reason why the Structured Programming Approach is well accepted in the programming world.

8. Structural programming

Advantages of Structured Programming Approach:

- Easier to read and understand

- User Friendly

- Easier to Maintain

- Mainly problem based instead of being machine based

- Development is easier as it requires less effort and time

- Easier to Debug

- Machine-Independent, mostly.

8. Structural programming

Disadvantages of Structured Programming Approach:

- Since it is Machine-Independent, So it takes time to convert into machine code.

- The converted machine code is not the same as for assembly language.

- The program depends upon changeable factors like data-types. Therefore it needs to be updated with the need on the go.

- Usually the development in this approach takes longer time as it is language-dependent. Whereas in the case of assembly language, the development takes lesser time as it is fixed for the machine.

End of chapter 1