

# FUNDAMENTAL OF COMPUTERS & EMERGING TECHNOLOGIES (KCA – 101)

## Unit – I

- **Introduction to Computer:** Computer is an advanced electronic device that takes raw data as an input from the user and processes it under the control of a set of instructions (called program), produces a result (output), and saves it for future use.
- A computer is an electronic data processing device, which accepts and stores data input, processes the data input, and generates the output in a required format.

# Functionalities of a Computer

- If we look at it in a very broad sense, any digital computer carries out the following five functions –
- **Step 1** – Takes data as input.
- **Step 2** – Stores the data/instructions in its memory and uses them as required.
- **Step 3** – Processes the data and converts it into useful information.
- **Step 4** – Generates the output.
- **Step 5** – Controls all the above four steps.

# Computer

Input



Process



Output

# Advantages of Computers

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

- **Accuracy:**

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

- **Storage Capability:**

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

- **Diligence:**

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

- **Versatility:**

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

- **Reliability:**

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

- **Automation:**

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



## • **Reduction in Paper Work and Cost:**

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up the process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.
- Though the initial investment for installing a computer is high, it substantially reduces the cost of each of its transaction.

# Disadvantages of Computers

- **No I.Q. :**
- A computer is a machine that has no intelligence to perform any task.
- Each instruction has to be given to the computer.
- A computer cannot take any decision on its own.
- **Dependency:**
- It functions as per the user's instruction, thus it is fully dependent on humans.
- **Environment:**
- The operating environment of the computer should be dust free and suitable.

- **No Feeling:**
- Computers have no feelings or emotions.
- It cannot make judgment based on feeling, taste, experience, and knowledge unlike humans.

# Computer Hardware

- Hardware represents the physical and tangible components of a computer, i.e. the components that can be seen and touched.
- Examples of Hardware are the following –
- **Input devices** – keyboard, mouse, etc.
- **Output devices** – printer, monitor, etc.
- **Secondary storage devices** – Hard disk, CD, DVD, etc.
- **Internal components** – CPU, motherboard, RAM, etc.



# Computer Software

- Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.
- There are two types of software –
- System Software
- Application Software

# System Software

- The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.
- Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.



# Application Software

- Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.
- Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

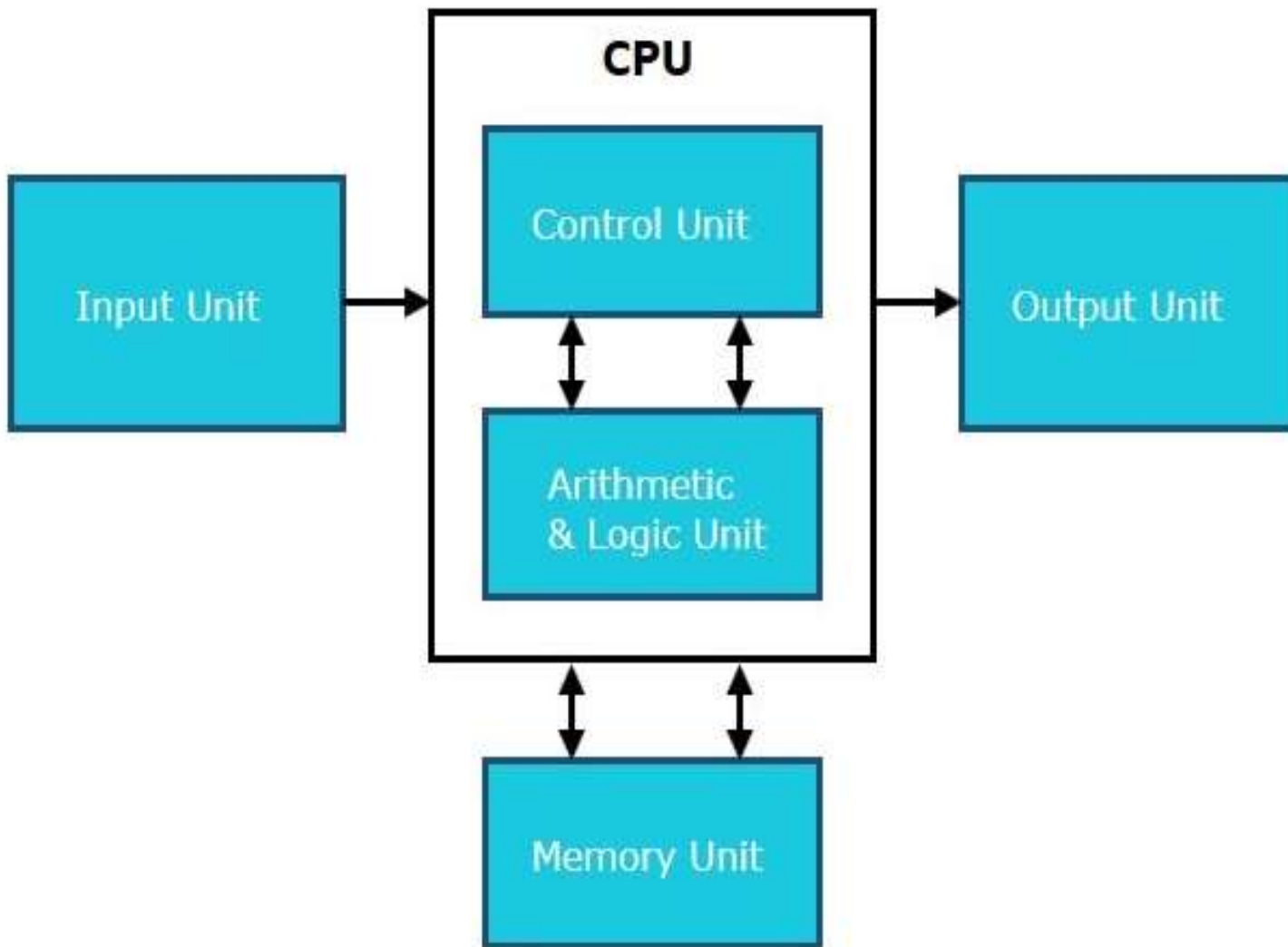


- Examples of Application software are the following –
- Payroll Software
- Student Record Software
- Inventory Management Software
- Income Tax Software
- Railways Reservation Software
- Microsoft Office Suite Software
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint

# Components:

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

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



- **Input Unit:**

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

- **CPU (Central Processing Unit):**

- CPU is considered as the brain of the computer. CPU performs all types of data processing operations. It stores data, intermediate results, and instructions (program). It controls the operation of all parts of the computer.
- CPU itself has the following three components –
  - ALU (Arithmetic Logic Unit)
  - Memory Unit
  - Control Unit

- **Output Unit:**

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

- **Computer – Memory:**

- A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one.

- For example, if the computer has 64k words, then this memory unit has  $64 * 1024 = 65536$  memory locations. The address of these locations varies from 0 to 65535.
- **Memory is primarily of three types –**
- **Cache Memory**
- **Primary Memory/Main Memory**
- **Secondary Memory**

- **Cache Memory:**

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

- **Advantages:**

- The advantages of cache memory are as follows –
- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.

- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.
- **Disadvantages:**
- The disadvantages of cache memory are as follows –
- Cache memory has limited capacity.
- It is very expensive.



- **Primary Memory (Main Memory):**

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

- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.
- **Secondary Memory:**
- This type of memory is also known as external memory or non-volatile. It is slower than the main memory. These are used for storing data/information permanently. CPU directly does not access these memories, instead they are accessed via input-output routines. The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.

## • **Characteristics of Secondary Memory:**

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

# Computer Languages:

- There are mainly three different languages with the help of which we can develop computer programs. And they are
- Machine Level language
- Assembly Level Language and
- High-Level Language
- **Machine Level Language:**
- The computer can understand only the language of Digital Electronics. Digital Electronics deals with the presence and absence of voltages. Within the computer there are two logics can play their role. These logics are –

- **Positive Logic** – Here presence of voltage will be denoted by 1 and absence of voltage will be denoted by 0
- **Negative Logic** – Here presence of voltage will be denoted by 0 and absence of voltage will be denoted by 1
- **Assembly Level Language:** It is a language of an encoding of machine code that makes simpler and readable.

- **High Level Language:**

- High level language is the next development in the evolution of computer languages. Examples of some high-level languages are given below
- PROLOG (for “PROgramming LOGic”)
- FORTRAN (for ‘FORmula TRANslation’)
- LISP (for “LISt Processing”)
- Pascal (named after the French scientist Blaise Pascal).
- Each high level language will have its own syntax and keywords. The meaning of the word syntax is grammar.
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# Concept of Compiler

- A compiler is a special program that translates a programming language's source code into machine code, byte code or another programming language. The source code is typically written in a high-level, human-readable language such as Java or C++.

# Interpreter

- **The program is interpreted/translated one line at a time.** One line of code is scanned, and errors encountered are shown. Usually, interpreter is slow, and hence takes more time to execute the object code. It is not preferred due to its slow speed.



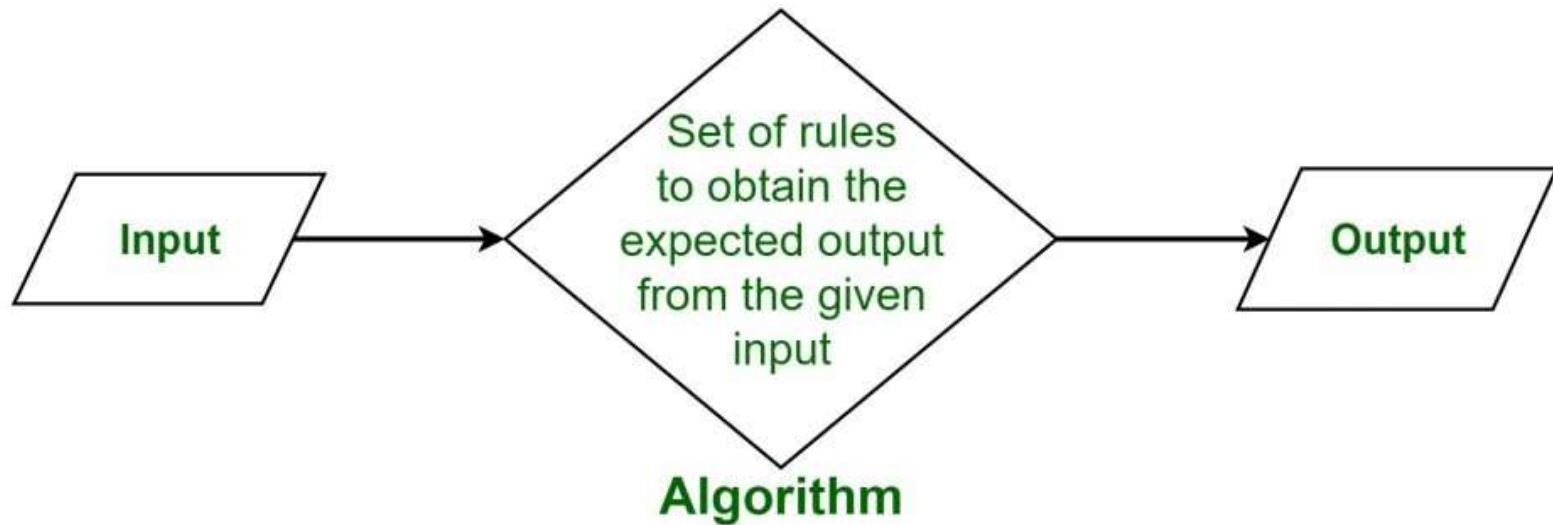
# Assembler

An assembler translates assembly language programs into machine code. The output of an assembler is called an object file, which contains a combination of machine instructions as well as the data required to place these instructions in memory.

# Problem solving concept:

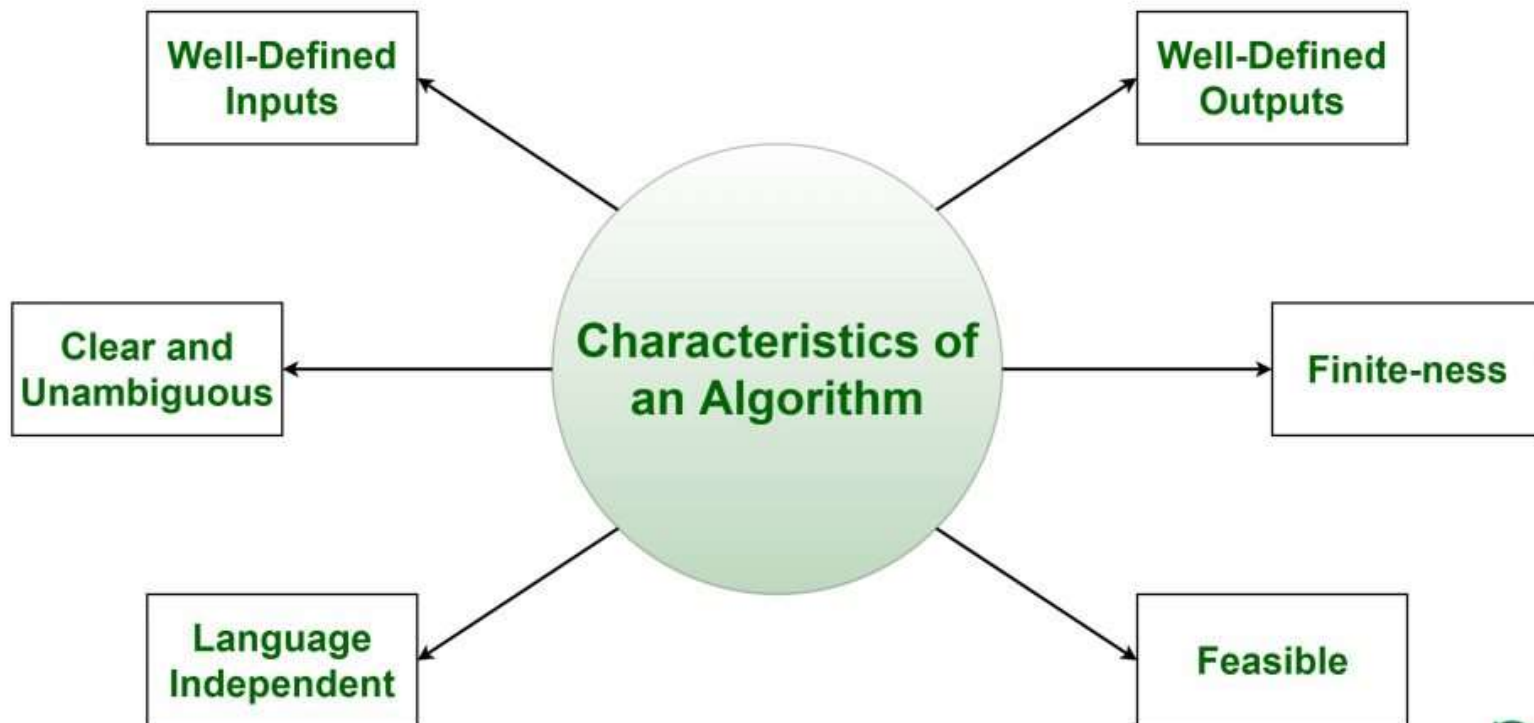
- **Algorithms:** An algorithm is a procedure used for solving a problem or performing a computation. Algorithms act as an exact list of instructions that conduct specified actions step by step in either hardware- or software-based routines.

## What is Algorithm?



# Characteristics of an Algorithm

## Characteristics of an Algorithm



# Limitations

- There are two categories of problems that an algorithm cannot solve.
- **Undecidable Problems:** These problems are the theoretically impossible to solve — by any algorithm. The halting problem is a decision problem (with a yes or no answer) that is undecidable. A computer cannot tell if it is in an infinite loop or it will at some point stop!
- **Intractable Problems:** These problems are theoretically impossible to solve in a reasonable time — i.e., there are known algorithmic solutions, but the algorithms are too inefficient/slow to solve the problem when the number of inputs grows large.

# Conditions in pseudo-code

- An IF statement starts with a condition which is tested. If the condition evaluates as TRUE then the THEN code block will be run. If the condition evaluates as false then the ELSE block will run. In the following example "Hello" will be printed if  $x = 1$ , otherwise "Good night" will be printed.

# Loops in pseudo code

- There are 3 main types of loops in pseudo code, **Do loops**, **While loops**, and **For loops**. Loops are also known as iteration, meaning the repetition of a block of code.
- **For Loops in Pseudo code:**
- For Loops (also known as definite or count-controlled iteration) are the perfect way to iterate through a list or an array. They are much easier than they look, and they are very simple once you start playing with them.
- **For loops** are used when you know how many times you want to repeat a certain block of code. This is known as **definite iteration**. This can be very helpful with outputs and inputs in the program!

# While Loops in Pseudo code

- While Loops are very easy to get the hang of! Also known as indefinite iteration, they are used in almost every program
- We use **While loops** when we do not know how many times we will run through the code; this can be very helpful when we want to loop some code until a certain event happens. Say we were making a searching algorithm, we would want the loop to continue until we found the thing we were looking for, so we would use a **while loop**!



# Do While Loops in Pseudo code

- Do While loops are very helpful for iterating whilst waiting for a condition to become true. This is another example of indefinite iteration.
- **Do While loops** are used when it is once again **indefinite iteration**. This means that while we do not know how many times to loop something, we can just use a Do While loop. This can be very helpful when used with functions and procedures as while the condition is false, the function will run.