CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY,
KANPUR
UGC Category I University

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instructor

mputer Fundamental and
nerging Technology

oduction to Computer

Lecture Number 1

Shivneet Tripathi
Computer Application

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY,
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ntroduction to Computer Fundamentals

Introduction to computer

Objective of computer fundamental

Definition and Types of computer

Advantages of computer

Application of computer

Computer Hardware and Software

ntroduction to computer Fundamentals

Computer fundamentals blend computer science and digital literacy to help st
evelop confidence in technology operations. These skills can be applied in everyd
y helping them to choose technology and use it effectively, troubleshoot c
echnologies, and transfer that knowledge to explore emerging technologies.

Computer fundamentals refers to the basics of using digital devices such as comp
mart phones and tablets. "Computer" used to only refer to the basics of using a com
nd associated devices; however, it has since expanded to include most frequently
igital devices. "Fundamentals" refers to basics, or the general skills someone s
now to be able to use and navigate these devices.

Objective

dentifying computer components such as the processor, keyboard, mouse, mo
peakers and printer.

escribing how internal and external parts of computing devices work together.
dentifying successful troubleshooting strategies for common hardware and sof
ssues.
nderstanding transferrable functions between different types of software.
ifferentiating between software types and common use cases.
pplying computer fundamentals knowledge to other technology, including r
evices.

Definition of Computer

computer is an electronic device which takes input from the user, processes it and gives the ou
er user's requirement.

**computer is a programmable electronic device that takes data, perform instructed arithme
gical operations, and gives the output.**

o the main tasks of performed by the computer are:

nput
rocess
utput

computer is a marvel of modern technology, a device that has revolutionized nearly every as
uman life. At its core, a computer is a complex machine designed to process data in various form
umbers and text to images and videos, with remarkable speed and precision. In this comprel
xploration, we'll delve into the inner workings of a computer, its components, its history, and its pr
npact on society.

Functional components of a Computer

f we look at it in a very broad sense, any digital computer carries ou

llowing five functions -

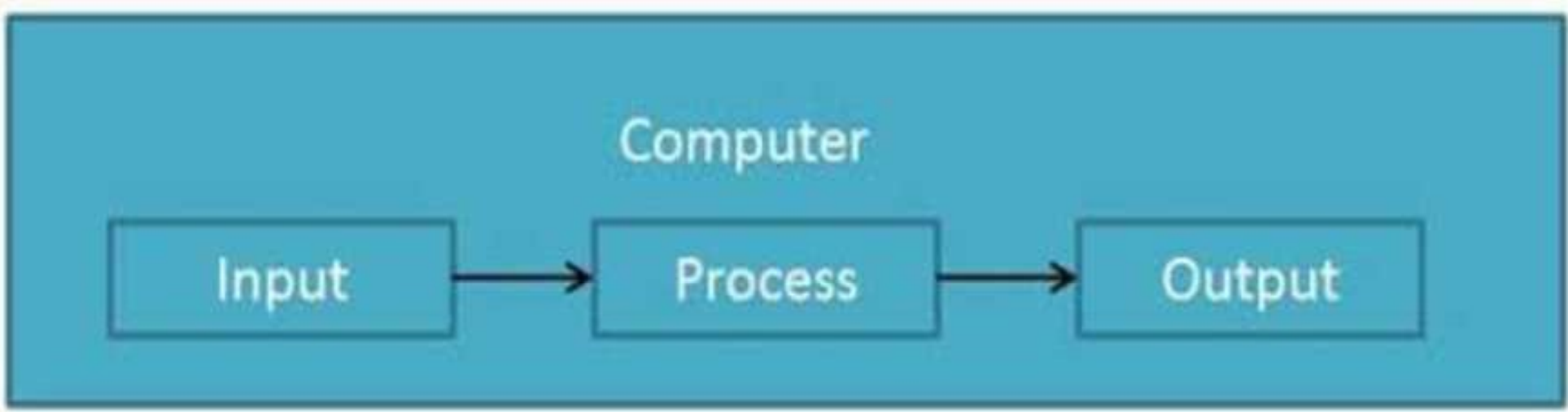
tep 1 - Takes data as input.

tep 2 - Stores the data/instructions in its memory and uses them as require

tep 3 - Processes the data and converts it into useful information.

tep 4 - Generates the output.

tep 5 - Controls all the above four steps.



Input Unit

- The input unit consists of input devices that are attached to the computer.
- These devices take input and convert it into binary language that the com

nderstands.

- Some of the common input devices are keyboard, mouse, joystick, scanner etc.

Central Processing Unit(CPU)

- **Once the information is entered into the computer by the input device processor processes it.**
- **The CPU is called the brain of the computer because it is the control centre c omputer.**
- **As the CPU is located on a small chip, it is also called the Microprocesso**

Central Processing Unit(CPU)

he CPU has three main components which are responsible for different functi

rithmetic Logic Unit (ALU),

ontrol Unit (CU) &

Memory registers.

Arithmetic Logic Unit(ALU)

- The ALU, as its name suggests performs mathematical calculations and ogical decisions. Arithmetic calculations include addition, subtra nultiplication and division.
- Logical decisions involve comparison of two data items to see which c arger or smaller or equal.

Control Unit(CU)

- The Control unit coordinates and controls the data flow in and out of
nd also controls all the operations of ALU, memory registers and also input/o
nits.
- It is also responsible for carrying out all the instructions stored in the program.

Memory Registers

- A register is a temporary unit of memory in the CPU.

- These receive data/information and then this data/information is held in th
er the requirement.

Output Unit

- The output unit consists of output devices that are attached with the computer.
- It converts the binary data coming from CPU to human understandable from. The
- common output devices are monitor, printer, plotter etc.

Types of Computer

- The computers can be classified based on the techno being used as:

- Digital Computers
- Analog Computers &
- Hybrid Computers

Digital Computers

- Binary digits are easily expressed in a digital computer by the presenc
r absence (0) of current or voltage.
- It computes by counting and adding operations.
- The digital computers are used in industrial, business and scie
pplications.
- They are quite suitable for large volume data processing.

XAMPLES:

- IBM PC, HP, LENOVO, DELL, ...etc
- Apple Macintosh
- Calculators
- Digital watches etc

Analog Computers

- An Analog computer works on continuously changeable aspects of ph
henomenon such as fluid pressure, mechanical motion and electrical quantities.
- These computers measure changes in continuous physical quantities say curren
oltage.
- These computers are used to process data generated by ongoing physical process
- A thermometer is an example of an analog computer since it measures the cha
ercury level continuously.
- Although the accuracy of an analog computer is less as compared to digital comp
et it is used to process data generated by changing physical quantities especially
he response to change is fast.

Analog Computers

- Most present day Analog computers are well suited to simulating systems. A sim
elps to conduct experiments repeatedly in real time environment.
- Some of the common examples are simulations in aircrafts, nuclear power p
ydraulic and electronic networks.

xamples

- Thermometer.
- Analog clock.
- Speedometer.
- Tire pressure gauge.

Hybrid Computers

- These use both analog and digital technology.
- It has the speed of analog computer and the accuracy of a c
omputer.
- It may accept digital or analog signals but an extensive conversion of
rom digital to analog and analog to digital has to be done.
- Hybrid Computers are used as a cost effective means for con
imulations.
- Examples: Computer used in hospitals to measure the heartbeat o
atient. Devices used in petrol pump.

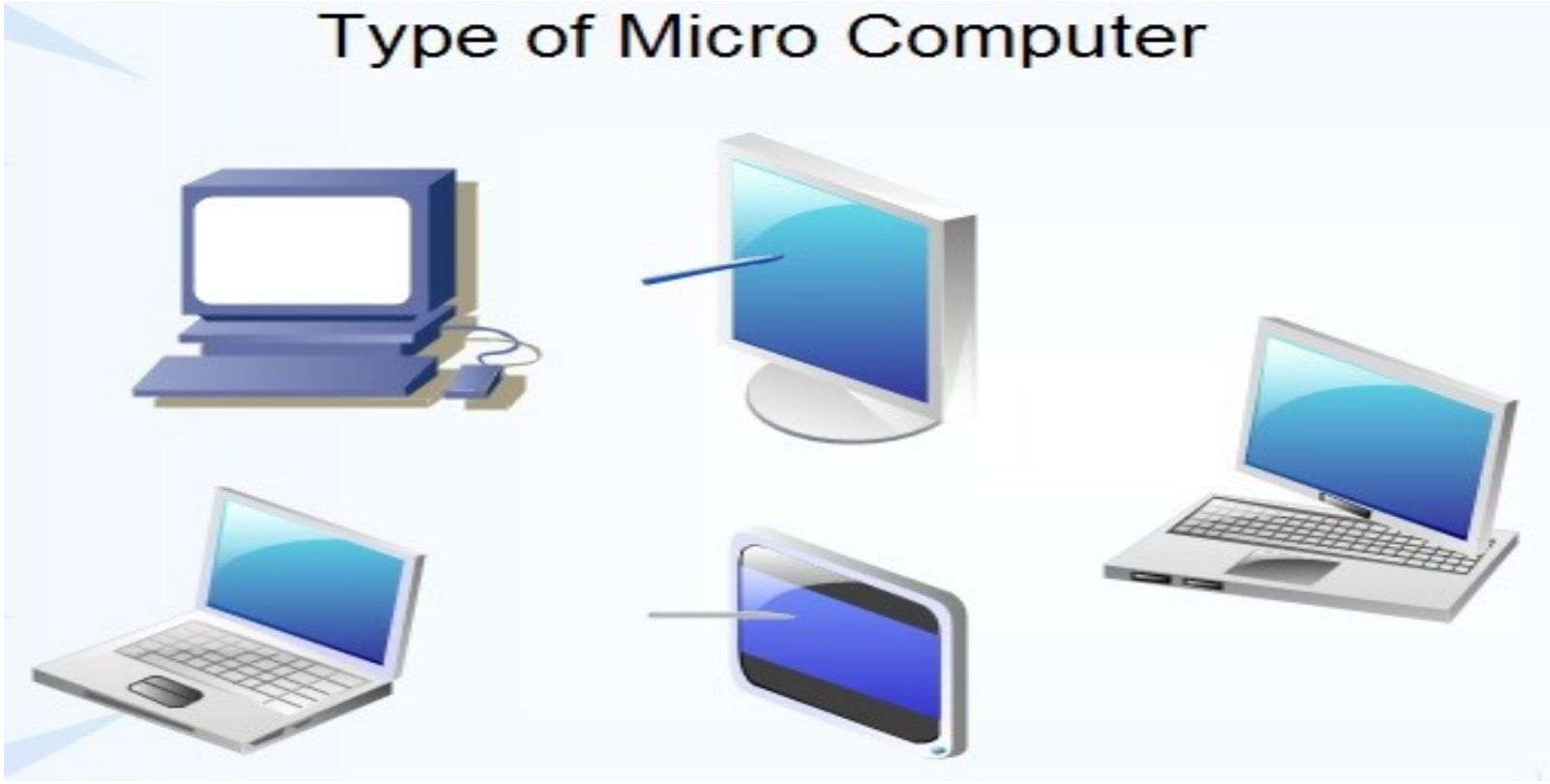
Classification of Digital Computers

- The various types of digital computers are :
- Micro Computers
- Mini Computers
- Main Frames
- Super Computers

Micro Computers

- These are also known as Personal Computers. These type of c
omputer uses a microprocessor (a CPU on a single chip) and include
esktops and laptops.
- These computers can work on small volume of data, are very versatil
an handle variety of applications. These computers are being used as
tations, CAD, multimedia and advertising applications.
- Small portable computers such as PDAs (Personal Digital Assistants
ablets with wireless computing technology are increasingly beco
opular.

Micro Computers



Mini Computers

- **These are mainly used in an organization where compu**

nstalled in various departments are interconnected. T

omputers are useful for small business organizations.

Examples

- Honeywell-Bull DPS 6/DPS 6000 series.
- IBM midrange computers.
- Interdata 7/32 and 8/32.
- Varian 620 100 series.

Mainframe Computers

- These computers are large and very powerful computers with very high m
apacity.
- These can process huge databases such as census at extremely fast rate. The
uitable for big organizations, banks, industries etc. and can support hundreds of
imultaneously on the network.
- istory of IBM mainframes, 1952–present Market name 700/7000 series
- zEnterprise System (z196, zEC12, z13, z14)
- ArchitectureSystem/360
- System/370
- S/370-XA

Super Computers

- These are fastest and very expensive computers.
- They can execute billions of instructions per second.
- These are multiprocessor, parallel systems suitable for specialized complex sci
pplications involving huge amounts of mathematical applications such as we
precasting.
- The main difference between a supercomputer and a mainframe is t
upercomputer executes fewer programs as fast as possible whereas a main
xecutes many programs concurrently.

Advantages of Computers

ollowing are certain advantages of computers.

ligh 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 ev

the picosecond.

- It can perform millions of calculations in a few seconds as compared to

who will spend many months to perform the same task.

Advantages of Computers

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
  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.

Advantages of Computers

Diligence

- Unlike human beings, a computer is free from monotony, tiredness, and 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 field

Advantages of Computers

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. Onc computer receives a program i.e., the program is stored in the com memory, then the program and instruction can control the program exec without human interaction.

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Computer Hardware and Software

computer consists of both hardware and software and both are equally importan
he working of the computer system.

The electronic components of a computer system that we can see and touch are
ardware.

Software is a general term used for computer programs that control the operati
he computer.

Computer Hardware and Software

- A program is a sequence of instructions that perform a particular task. A
rograms form a software.

- It is the software which gives hardware its capability.

- Hardware is of no use without software and software cannot be used w
ardware.

Computer Hardware and Software

oftware can be broadly are categorized as:

- System Software
- Application Software
- Utility Software

Computer Hardware and Software

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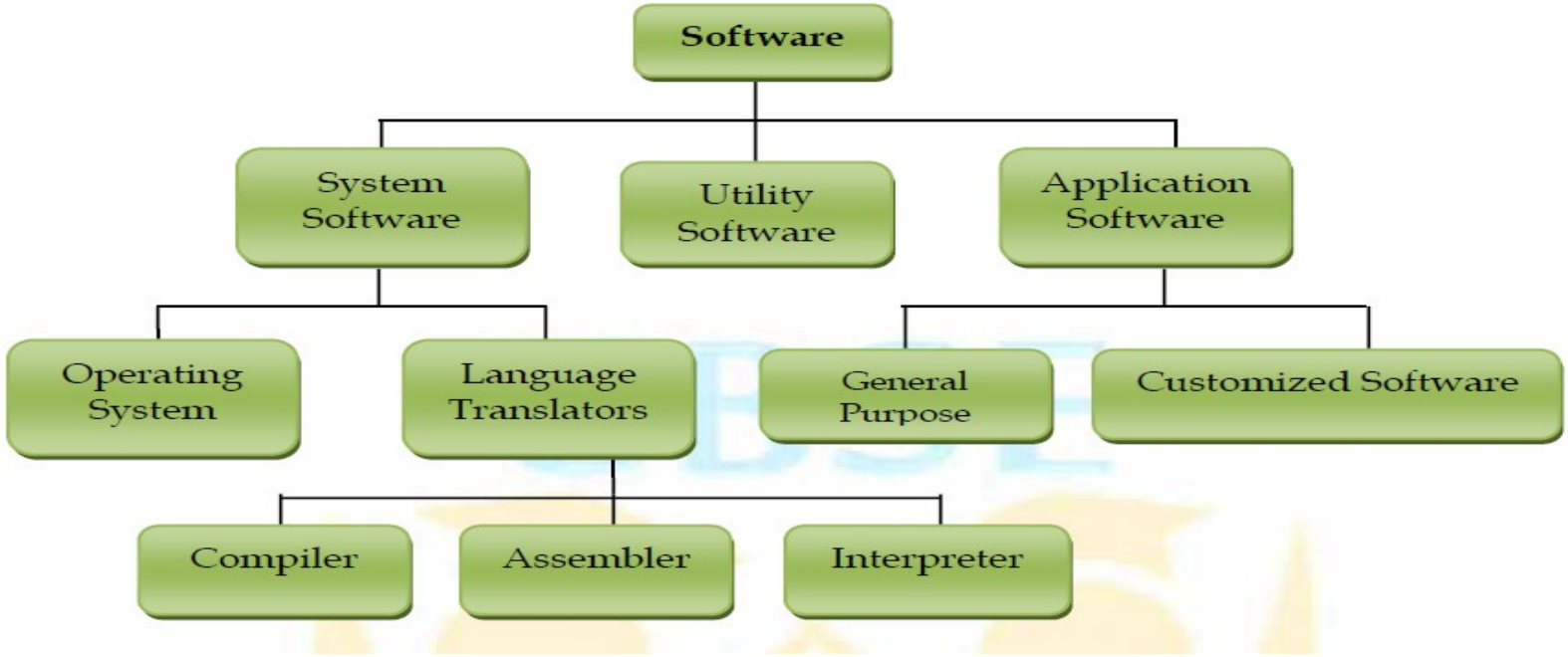


System Software

ystem Software is the software that is directly related to coordinating com
perations and performs tasks associated with controlling and utilizing com
ardware. These programs assist in running application programs and are desig
ontrol the operation of a computer system.
ystem software directs the computer what to do, when to do and how to do. S
oftware can be further categorized into:-

- Operating System
- Language Translators

Operating System

- An Operating system is the most important system software.

- It is a set of programs that control and supervise the hardware of a computer an rovide services to application software, programmers and users. Ex :-
- Some of the popular operating systems used in personal computers are Windows, Unix, Linux, Solaris, etc.

Application Software

- An application software is bought by the user to perform specific applications or t
- Say for example making a document or making a presentation or handling invent
anaging the employee database.
- An application software can be of two types:
- General Purpose Application Software &
- Customized Application software.

General Purpose Application Software

- Some of the application software is made for the common users for day t
pplications and uses.

- These are also referred as Office Tools.
- The users may use them in the manner they want.
- Some of the popular types of general purpose application software are:
- Word Processor
- Presentation Tools
- Spreadsheet Packages
- Database Management System

Customized Application Software

- Customized Software is one which is tailor made as per the user's requirement
ype of software is customer specific.
- It is made keeping in mind the individual needs of the user and so are also refer
omain Specific Tools

xamples:

- Inventory Management System & Purchasing System
- School Management System
- Payroll System
- Financial Accounting
- Hotel Management
- Reservation System
- Weather Forecasting system

Memory

- Memory is one of the most important components of a computer system as it
ata and instructions.

- Every memory chip contains thousands of memory locations. In the computer, th
s stored in the form of bits and bytes.
- A bit is the smallest storage unit of memory. A nibble is a collection of 4 bits. Eig
ombined together to form a single byte, which in turn represents a single characte

Memory Unit.

mory unit	Relationship with earlier memory unit	In equivalent Bytes
Byte (KB)	1 Kilo Byte = 1024 Bytes(or 2^{10} Bytes)	1024
Byte (MB)	1 Mega Byte = 1024 Kilo Byte(or 2^{10} KB)	1024x1024
Byte (GB)	1 Giga Byte = 1024 Mega Byte(or 2^{10} MB)	1024x1024x1024
Byte (TB)	1 Tera Byte = 1024 Giga Byte(or 2^{10} GB)	1024x1024x1024x1024
Byte (PB)	1 Peta Byte = 1024 Tera Byte(or 2^{10} TB)	1024x1024x1024x1024x 1024
yte(EB)	1 Exa Byte = 1024 Peta Byte(or 2^{10} PB)	1024x1024x1024x1024x 1024x1024

Types of Memory

he computer memories can be divided into following categories:

- Primary Memory
- Cache Memory
- Secondary memory

Primary Memory

rimary memory or main memory is a Metal Oxide Semiconductor (MOS) memory
or storing program and data during the execution of the program. It is d
ccessible to CPU.

roadly primary memory can be of two types :–

. Random Access Memory (RAM)
. Read Only Memory (ROM)

Random Access Memory

- the memory can be accessed from any desired location randomly.
- The instructions and data that we input into the computer are stored in
he RAM of the Computer.
- It is a read/write memory, so data can be both read from and written to the RAM
- It is a volatile memory and loses its contents when the power is switched
nterrupted.
- Nowadays RAMs are available in gigabytes. The normal memory access time of a
s 20-80 ns.

AM can be broadly classified into two categories:

- Dynamic RAM (DRAM) and
- Static RAM (SRAM).

Dynamic RAM (DRAM)

- It consists of a transistor and a capacitor that stores electric charge.

- The DRAMs are physically smaller, cheaper and slower memories. They are s
ecause the data stored in them needs to continuously refreshed and this consum
f processor time.
- Each refresh operation takes several CPU cycles to complete. This is beca
apacitor tends to loose charge over a period of time which needs to be refreshed
nd again.

Static RAM (SRAM)

- This type of RAM is large in physical size but is an expensive and faster memory.
- It is faster because it is made up of flip flops to store data and these flip flops d

equire any refreshing.

- Static RAM is also volatile and is easier to use as compared to dynamic RAM. The

sed in specialized applications.

Dynamic RAM(DRAM) vs Static RAM (SRAM)

Static Random Access Memory (SRAM)

- Semi conductor memory
- Use flip-flop to store each bit of memory so does not need to be periodically refreshed
- Faster and consumes low power
- Expensive and have complex structure (6 transistors) so not use in high capacity applications

Dynamic Random Access Memory (DRAM)

- Store each bit of memory in capacitor in an integrated circuit
- Real capacitors leak charge so capacitors need to be refreshed periodically
- Simple structure (1 transistor and 1 capacitor per bit) so it has very high density

Read Only Memory (ROM)

s non volatile memory, ie, the information stored in it, is not lost even if the
upply goes off. It's used for the permanent storage of information. It also
andom access property. Information can not be written into a ROM b
sers/programmers. In other words the contents of ROMs are decided b
anufactures.

ypes of ROM

. PROM(**Programmable ROM**)
. EPROM(**Erasable PROM**)
. EEPROM(**Electrically Erasable PROM**)

Cache Memory

- Cache memory is a special high speed memory made up of high speed static RAM
- It is used to hold frequently accessed data and instructions.
- We know that the processing speed of CPU is much more than the main me
ccess time of the computer.
- This means the CPU has to wait for a substantial amount of time.
- Alternatively we have the cache memory which is a small, expensive but fast me
hat is placed between the CPU and the main memory.
- Whenever some data is required, the CPU first looks into cache.
- If data is found, we call it a cache hit and the information is transferred to the CPU
- In case of a miss, the main memory is accessed.

Introduction to computer language

programming language is a set of instructions and syntax used to create software programs. Some
ey features of programming languages include:

yntax: The specific rules and structure used to write code in a programming language.

ata Types: The type of values that can be stored in a program, such as numbers, strings, and boolea

ariables: Named memory locations that can store values.

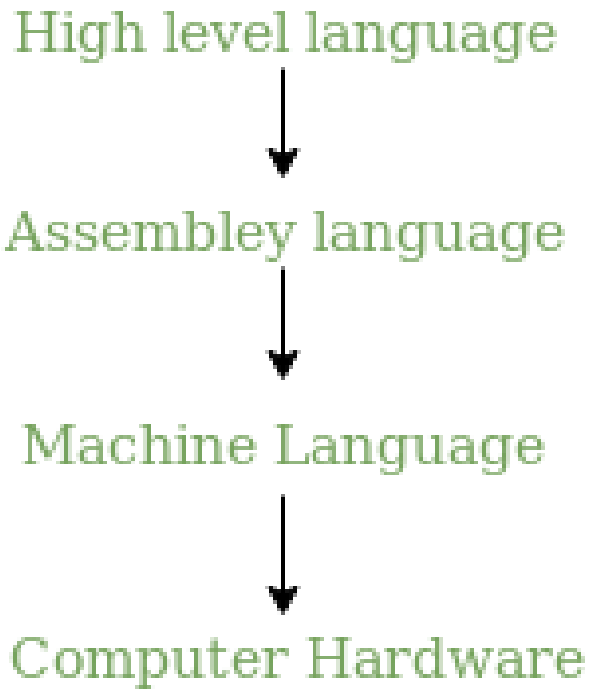
perators: Symbols used to perform operations on values, such as addition, subtraction, and compar

ontrol Structures: Statements used to control the flow of a program, such as if-else statements, loo
nd function calls.

braries and Frameworks: Collections of pre-written code that can be used to perform common tasks and spe
evelopment.

aradigms: The programming style or philosophy used in the language, such as procedural, object-oriented, or
nctional.

Hierarchy of Computer language –



Characteristics of a programming Language

programming language must be simple, easy to learn and use, have good readability, and be human recogniz
bstraction is a must-have Characteristics for a programming language in which the ability to define the compl
ructure and then its degree of usability comes.
portable programming language is always preferred.
rogramming language's efficiency must be high so that it can be easily converted into a machine code and its
xecution consumes little space in memory.
programming language should be well structured and documented so that it is suitable for application develo
ecessary tools for the development, debugging, testing, maintenance of a program must be provided by a
rogramming language.
programming language should provide a single environment known as Integrated Development Environment
programming language must be consistent in terms of syntax and semantics.

Basic Terminologies in Programming Languages:

lgorithm: A step-by-step procedure for solving a problem or performing a task.
ariable: A named storage location in memory that holds a value or data.
ata Type: A classification that specifies what type of data a variable can hold, such as integer, string, or boole
unction: A self-contained block of code that performs a specific task and can be called from other parts of the
rogram.
ontrol Flow: The order in which statements are executed in a program, including loops and conditional staten
yntax: The set of rules that govern the structure and format of a programming language.
omment: A piece of text in a program that is ignored by the compiler or interpreter, used to add notes or
xplanations to the code.
ebugging: The process of finding and fixing errors or bugs in a program.
DE: Integrated Development Environment, a software application that provides a comprehensive developmen
nvironment for coding, debugging, and testing.
perator: A symbol or keyword that represents an action or operation to be performed on one or more values
ariables, such as + (addition), – (subtraction), * (multiplication), and / (division).
tatement: A single line or instruction in a program that performs a specific action or operation.

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ips for learning new programming language:

art with the fundamentals: Begin by learning the basics of the language, such as syntax, data types, variables
mple statements. This will give you a strong foundation to build upon.

ode daily: Like any skill, the only way to get good at programming is by practicing regularly. Try to write code
ay, even if it's just a few lines.

Vork on projects: One of the best ways to learn a new language is to work on a project that interests you. It co
simple game, a web application, or anything that allows you to apply what you've learned that is the most im
art.

ead the documentation: Every programming language has documentation that explains its features, syntax, a
ractices. Make sure to read it thoroughly to get a better understanding of the language.

oin online communities: There are many online communities dedicated to programming languages, where yo
sk questions, share your code, and get feedback. Joining these communities can help you learn faster and ma
onnections with other developers.

earn from others: Find a mentor or someone who is experienced in the language you're trying to learn. Ask th
uestions, review their code, and try to understand how they solve problems.

ractice debugging: Debugging is an essential skill for any programmer, and you'll need to do a lot of it when le
new language. Make sure to practice identifying and fixing errors in your code.

Compiler

he language processor that reads the complete source program written in high-level language as a
one go and translates it into an equivalent program in machine language is ca
ompiler. Example: C, C++, C#.

a compiler, the source code is translated to object code successfully if it is free of errors. The co
pecifies the errors at the end of the compilation with line numbers when there are any errors
ource code. The errors must be removed before the compiler can successfully recompile the sourc
gain the object program can be executed number of times without translating it again.

Assembler

he Assembler is used to translate the program written in Assembly language into machine co
ource program is an input of an assembler that contains assembly language instructions. The
enerated by the assembler is the object code or machine code understandable by the co
ssembler is basically the 1st interface that is able to communicate humans with the machine. W
n assembler to fill the gap between human and machine so that they can communicate with eac
ode written in assembly language is some sort of mnemonics(instructions) like ADD, MUL, MU
IV, MOV and so on. and the assembler is basically able to convert these mnemonics in binary cod
hese mnemonics also depend upon the architecture of the machine.

nterpreter

he translation of a single statement of the source program into machine code is done by a language proces
xecutes immediately before moving on to the next line is called an interpreter. If there is an error in the sta
he interpreter terminates its translating process at that statement and displays an error message. The int
oves on to the next line for execution only after the removal of the error. An Interpreter directly e
structions written in a programming or scripting language without previously converting them to an object
achine code. An interpreter translates one line at a time and then executes it.