

Fundamental of Computer

Q. What is FC?

Ans. The basic concepts of computer including how they work how to use them and how they interact they that is called computer fundamental.

Some important points

- (i) Identifying typical computer and digital device components.
- (ii) Understanding the function of basic digital components.
- (iii) Negative digital services.
- (iv) Understanding cloud computing.
- (v) Understanding online safety and responsibility.

Introduction to Number System

* The number system is the system of naming or representing number. We know that number is a mathematical value that helps to count or measure objects and it helps in performing various mathematical calculation.

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Types of Number Systems:

- Decimal no. system (0 to 9) (0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
- Binary no. system (0, 1)
- Octal number system (8) (0, 1, 2, 3, 4, 5, 6, 7)
- Hexadecimal number system (16) (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F)
- * Decimal number system (base 10)
 - ⇒ Decimal number system has a base of 10 because it uses 10 digits from 0 to 9. In the decimal number system the position succession to the left of decimal point represent units, tens, hundred, thousand and so on. This system is expressed in decimal number. Every position is a particular power of base.
- * Binary number system (base 2 (0, 1))
 - ⇒ The base 2 number system is also known as binary number system. Where only 2 binary digit exist. ex- 0 and 1. The usual base 10 is decimal.
- * Octal number system → In the octal number system [base 8] and it uses from 0 to 7 to represent number. Octal number are commonly use in computer animations.

(99)₂
decimal (313 + 21)

* Hexadecimal number system → In the hexadecimal number system numbers are written are represented with [base 16]. In hexadecimal system the numbers are represented using alphabet from [a to f].

Q. Solve :- (i) $(233)_{10} = ?$

Sol. $2 \times 10^2 + 3 \times 10^1 + 3 \times 10^0$ (Decimal - 0 to 9 is $10^{0, 1, 2, 3}$)
 $\Rightarrow 200 + 30 + 3 = 233$

(ii) $(432)_{10} = ?$

$\Rightarrow 4 \times 10^2 + 3 \times 10^1 + 2 \times 10^0$
 $= 400 + 30 + 2 = 432$

(iii) $(436)_{10} = ?$

$\Rightarrow 4 \times 10^2 + 3 \times 10^1 + 6 \times 10^0$
 $= 400 + 30 + 6 = 436$

(iv) $(5432)_{10}$

$5 \times 10^3 + 4 \times 10^2 + 3 \times 10^1 + 2 \times 10^0$
 $= 5000 + 400 + 30 + 2 = 5432$

(v) $(99)_{10}$

$9 \times 10^1 + 9 \times 10^0$
 $= 90 + 9 = 99, \text{ Ans}$

Signature.....

(i) $(1011)_2$

$$= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 8 + 0 + 2 + 1 = 11$$

(ii) $(1001)_2$

$$= 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$

$$= 8 + 0 + 0 + 1 = 9$$

(iii) $(0001)_2$

$$= 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$

$$= 0 + 0 + 0 + 1 = 1$$

(iv) $(1111)_2$

$$= 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 8 + 4 + 2 + 1 = 15$$

Note

* octal no. use in computing as a short hand or binary.

hexadecimal

* Common in computing and programming.

* consist 16 symbol:-

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f

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Convert Decimal to Binary

(i) 15

2	15	1
2	7	1
2	3	1
2	1	1
2	0	

2	15	1
2	7	1
2	3	1
2	1	1
2	0	

$15 = (1111)_2$

(ii)

2	24	0
2	12	0
2	6	0
2	3	1
2	1	
2	0	

$= (11000)_2$

(iii) 512

2	512	0
2	256	0
2	128	0
2	64	0
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0

2	702	0
2	351	1
2	175	1
2	87	1
2	43	1
2	21	1
2	10	0
2	5	1
2	2	0
2	1	

$702 = (101011110)_2$

$512 = (1000000000)_2$

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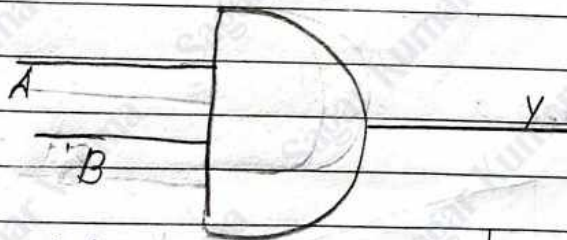
LOGIC GATES

Logic gates are in fundamental building blocks there are basically seven main types of logic gates which are used to perform various logical operation in digital system.

Types of Logic Gates

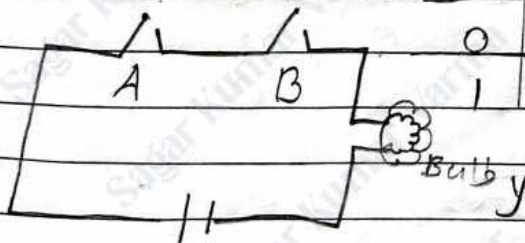
- (i). AND Gate
- (ii). OR Gate
- (iii). NOT Gate
- (iv). NAND Gate
- (v). NOR Gate
- (vi). XOR Gate
- (vii). XNOR Gate

(i) AND Gate (दोनों से Input होना चाहिए)



$$Y = A \cdot B$$

A	B	X
0	0	0
1	0	0
0	1	0
1	1	1



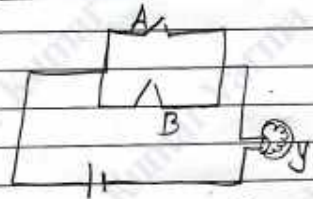
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* An AND Gate is used to perform logical multiplication of binary input. The output state of the AND Gate will be high (1) if both the inputs are high (1) else the output state will be low (0).

(ii) OR Gate (किसी एक में भी होना चाहिए)



$$Y = A + B$$

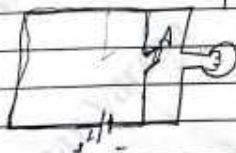


A	B	$Y = A + B$
0	1	1
1	0	1
0	0	0
1	1	1

(iii) NOT Gate (उत्तर उल्टा करता है)



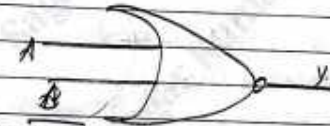
$$Y = \bar{A}$$



A	$Y = \bar{A}$
0	1
1	0

* NOT Gate:- In digital electronics the NOT Gate is one of the basic logic gates having only a single input and a single output. It is also known as inverter (अन्वर्त).

(iv) NOR Gate



$$Y = \overline{A + B}$$

* The NOR Gate is the type of universal logic gate. It takes two or more inputs and gives only one output. The output state of the NOR Gate will be high (1) when all the inputs are low (0). $Y = \overline{A + B}$.

Signature.....

Ch-3. Introduction of Computer Concept.

- * The Evolution of the computers can be understood through distic generation. Each marked by significant technological advancement.

Evolution of Computer:

(i) First Generation (1940-56)

- * Vacuum tubes computers

(ii) Second Generation (1956-1963)

- * Transistors computer

(iii) Third Generation (1964-1971)

- * Integrated circuits computer

(iv) Fourth Generation (1971-Present)

- * Microprocessors computer

(v) Fifth Generation (1982)

- * Artificial intelligence computer. (AI computer)

Computer Network

- A group of computer which are connected to each other for the purpose of sharing there resources is called computer network.

- * First computer Network: ARPANET (Advanced Research Project Agency Network)

- * Characteristics of computer:

(i)

(ii) Communication speed

(iii) Back up

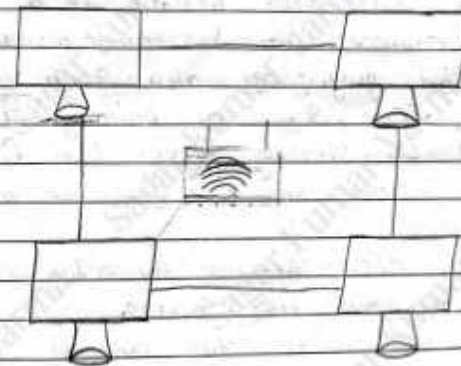
(iv) Scalability

(v) Software and Hardware sharing.

(vi) Security.

Network Devices

- * Hub, Router, Gateway, NTC, Modem, WAP, VPN etc.



* Type of Computer Network:-

1. PAN (Coverage area: up to 10 meters)
2. LAN (i.e. up to a few kilometers, approx. 50 m)
3. MAN (i.e. up to 50 kilometers)
4. WAN (i.e. spans regions, countries or continents)

1. PAN:- A Personal Area Network is a small network designed for personal use connecting devices that are located close and individual. The network usually covers a range of few meters typically 10 meters.

Examples:-
i) connecting a smartphone to a Bluetooth.

ii) using a smartwatch connected to a smartphone.

iii) Wi-Fi connecting

2. LAN:- A Local Area Network is a network that connects computers and devices within a limited geographical area, such as a home, office, school or building. It is designed for sharing resources like files, printers and Internet connections amongst multiple devices.

Examples:-
i) Office Network connecting computer's, printers and files servers.

ii) School Network connecting computer's lab and administrative offices.

3. MAN:- A Metropolitan Area Network is a type of computer network that spans a city or a large campus. It is ^{larger} than a Local Area Network (LAN) but smaller than a Wide Area Network (WAN). MANs are used to connect multiple network LANs within a Metropolitan Area for seamless data exchange and resource sharing.

Ex:-

i) A city government offices connected through a centralized network.

ii) University campuses spread across a metropolitan area sharing resources.

iii) Cable TV Network within a city.

4. WAN:- A Wide Area Network is a large computer network that connects devices and smaller networks (like LANs & MANs) across vast geographic areas such as cities, countries or even continents.

Internet:-

Examples:-
i) The largest example of WANs.

ii) Clouds & access:- Accessing data stored on remote servers.

Data processing

- Data processing involves the collection, organization, transformation and analysis of data to extract meaningful information. These are the primary methods of data processing.

* Types of Data processing:

1. Manual data processing: Data is processed manually without the use of automated tools.

- * Advantages: (i) Low cost (no need for advanced system)
(ii) Inexpensive for small data sets.

- * Disadvantages: (i) Time-consuming and slow.
(ii) Analyzing data using pen or paper.

2. Mechanical Data Processing: Mechanical devices like typewriters, calculators or basic machine are used to process data.

- * Advantages: Faster than manual processing.
- * Disadvantages: Limited capacity requires human interventions.
i.e.: using an abacus or a calculator.

3. Electronic Data Processing: This is the most widely used method today, where data is processed using electronic devices like computers and advanced software data tools. Automated and fast.

Handles large volume of data efficiently.

Signature.....

- * Advantages: (i) High accuracy reliability.
(ii) Capable of processing complex data sets.
(iii) Analyze data in real time.

- * Disadvantages: (i) Initial setup costs are high and requires technical expertise.
(ii) Processing sales data using excel or analyzing trends which business intelligence look like Tableau.

4. Batch Processing: In batch processing data is collected and processed in groups or batches at specific time.

- * Data Characteristics: Not process immediately schedule processing.

- * Advantages: (i) Efficient for large-scale repetitive tasks.
(ii) Efficient for handling large volume of data.
(iii) Saves processing time and resources.

- * Disadvantages: (i) Cannot process data in real time.
(ii) Delays in getting results.
or: Payroll systems where employee salaries are processed monthly in batches.

5. Real-Time Data Processing: Data is processed instantly as soon as it is generated or entered into the system.

- * Characteristics: (i) Require a continuous data stream.
(ii) Immediate feedback and results.

- * Advantages: (i) Immediate decision making.
(ii) Useful for time sensitive.

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- Disadvantages:- Requires robust systems and infrastructure.
 - (ii) Can be costly. e.g. ATM transaction, online ticket booking, or life share market trading.

Single user programming:- Single-user programming refers to a computer seen a group where a single programmer is responsible for the design development and execution of a data processing system or program. This setup is typically used in small scale projects, personal task or when the scope of the data processing work load is limited and does not require collaboration with others.

• Key Feature of single user programming:-

- Independent control:- The programmer has full control over the development process.
- Simplified Communication:- Since there is not team involve there is no need code extensive codification.
- Small scale:- Based suited for task like data analyze scripts reduce over head.

• Advantages:-

Disadvantages:-

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Multi-programming:- Multi-programming refers to the capability of a computer system to execute multiple programs. Multiple program concurrently by efficiently utilization the CPU's time. It is a concept that is merge to improve system grow productivity and ensure better issue utilizing.

• Key Features of Multi-programming:-

- Multiple programs and the CPU switches between them based on availability.
 - Efficient resource.
 - Increased through work.
- e.g.:- one program makes a sorting data set.
- Another program may be performing calculations on a different data set.

Computer Security

→ Computer security refers to the practice of protective computer systems, networks and data from unauthorized access, damage or misuse. Its primary goal is to ensure the safety and integrity of data and resources, primarily malicious action by unauthorized users or programs.

* Key features of computer security:

1. Confidentiality: (i) Ensures that information is accessible only to authorized individuals.

(ii) Prevents unauthorized access to sensitive data.

2. Integrity: (i)

(ii) Protective data from unauthorized modification or
(iii) Ensure accuracy and reliability to information. (distraction)

3. Availability:

(i) Ensuring the systems and accessible data to authorized ^{users} when needed.

(ii) Prevents disruptions caused by attacks like DDOS.
(Distributed Denial of Service)

4. Authentication:

(i) Verifying the identity of user or device accessing the system.

(ii) Accountability tracking and recording user activities to identify and address any security breaches.

Signature.....

Type of computer security

1. Network security:

(i) Protecting networks from unauthorized access using firewalls, encryption and antivirus software.

2. Data security: Safeguarding data through encryption, backups and access control.

3. Application security: Ensuring software is secure from vulnerability and malicious exploits.

4. Cyber security: Broad measures to prevent and respond to cyber crimes and online threats.

Sources of Threats (Computer security)

→ The sources of computer security threats can be categorized based on their origin or intent.

* Types of Threats:

1. External Threats:

(i) Hackers and cyber criminals: Individuals or groups attempting to breach systems or financial gain, data theft.

(ii) State sponsored actors: Government or organization conducting cyber espionage/attacks for political or economic motives.

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(iii) Compilers : R. hate / Rival Compiler attempting to steal information.

civ) Tatarious originator - Groups aiming to destrud creation/ infrastructure or spread fear.

iv) Third party Vendors: Vendors with insecure systems or poor practices can expose organisations.

8. Internal Threads:-

ii. Disgruntled employees: Current or former employees with malicious intent to harm the organization.

(ii) Negligent Employee's Mistakes or unintentional actions by employees such as clicking phishing links or sharing sensitive information.

(iii) Contractors:- Partners or Contractors who miss - use their access to systems or data.

3. Environmental sources:

(i) Natural Disasters :- Events like earthquakes, floods or fire causing physical damage to its infrastructure.

(ii). Hardware Obsolescence :- Mail Functioning or outdated hardware leading to security vulnerability.

4. Technological sources:-

in software vuln. availability: Bugs or flaws in software that can be exploited by attackers.

Git Unpatched Systems & Outdated systems lacking critical securities updates. Signature.....

5. Human Sources:-

ii Social Engineering: Manipulation of individual to reveal sensitive information.

(ii) Phishing attacks: Deceived emails or messages tricking users into sharing informations.

6. Supply chain: use of unauthorized or malicious products.

Unit- Introduction to operating system and computer organization

Introduction to operating system:

Q What is an operating system?

Ans. An operating system is a system software that acts as an interface between the computer hardware and the user. It manages all hardware and software resources and provides a smooth environment for users to operate the computer efficiently.

Function of an operating system:

in Process Management: Manage the execution of multiple processes in the CPU.

iii) Memory Management: Allocates and monitors system memory for efficient use.

(iii) File Management: Handles the storage access and organization of file.

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(i) Device Management: Controls input and output devices like keyboard, mouse and printer.

(ii) User Interface: Allows users to interact with the system via a graphical user interface.

Computer organization:

* Computer organisation refers to the internal structure and functioning of a computer system. It explains how different hardware components work together to process data efficiently.

* Main components of computer organization:

1. CPU (Central Processing Unit)

(i) ALU (Arithmetic Logic Unit): It performs mathematical calculations and logical operations.

(ii) CU (Control Unit): Manages and coordinates activities of all components.

(iii) Registers: Temporarily store data and instructions for quick access.

2. Memory:

(i) Primary memory: Includes RAM (Temporary storage for quick access) and ROM (Permanent storage for booting).

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(ii) Secondary memory: Includes hard drives, SSD and USB drives for long term data storage.

3. Input devices: Devices like keyboard, mouse, scanner and microphone which allow users to enter data into the computer.

4. Output devices: Devices like monitor, printer and speakers which display or produce the result of processing.

5. Bus system:

(i) Data bus: Transfers data between components.

(ii) Address bus: Helps locate data in memory.

(iii) Control bus: Manages and directs operations within the system.

6. Input output system: Manages communication between input output devices and the computer system.

7. Clock & Timing system: Controls the speed and the computer system. Synchronization of all operations within the computer.

Signature.....

Overview of functional units of the computer.

⇒ A computer system consists of several functional units that work together to process data and execute instructions efficiently. These units ensure smooth communication between hardware components, enabling the computer to perform various tasks.

1. Input unit:-

- The input unit allows users to enter data and instructions into the computer. It converts human-readable input into a machine-readable format.

* Functional unit:- Accepts data from external sources.

- Convert data into binary form.
- Sends the converted data to the memory unit for processing.

e.g.:- keyboard, mouse, scanner, joystick, microphone, touchscreen etc.

2. CPU (Central Processing Unit):-

- CPU is the brain of the computer. It executes instructions and processes data to produce meaningful results. It consists of 3 components:-

1. ALU (Arithmetic Logic Unit):-

- Performs arithmetic operations (addition, subtraction, multiplication, division).
- Executes logical operations (comparison and, or, not).

2. CU (Control Unit):-

- Direct & coordinates all activities of the computer.

Signature.....

- Fetches, decodes, and executes instructions.
- Controls the flow of data between different functional units.

3. Registers:-

- Small, high-speed memory location inside the CPU.
- Temporarily store data and instructions during execution.

e.g.:- Accumulator, instruction register, program counter.

4. Memory unit:- The memory unit stores data, instructions, and results. It acts as the computer workspace.

Types of Memory:-

1. Primary Memory (Main memory):-

- RAM:- Volatile memory used for active processes.
- ROM:- Non-volatile memory that stores firmware.

2. Secondary Memory:- Permanent data storage.

e.g.:- hard drives, USB, DVD etc.

3. Cache Memory:-

- High-speed memory between the CPU and RAM.
- Stores frequently accessed data for faster processing.

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Q. Different between RAM & ROM?

RAM	ROM
(i) It is stands for Random Access memory.	(i) It is stands for Read only memory.
(ii) It is volatile in nature. Data is lost when the computer shut down.	(ii) It is non-volatile in nature. Data is retains even the computer shut down.
(iii) It is a short term memory.	(iii) It is a long term memory.
(iv) A temporary memory that stores data currently in use by the CPU.	(iv) A permanent memory that stores essential system data.

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Stored Program Concept

→ The stored program concept is a fundamental principle of modern computing 1st proposed by John von Neumann in the 1940s. It states that both instructions (programs) and data can be stored in computers memory and accessed when needed. This allows the computer to executed different programs without requiring hardware modification.

* Key Features of the stored program concept:-

- **Program and data in memory:-** Instructions and data are stored in same memory it easy to modify program.
- **Sequential and Execution:-** The CPU fetches, decodes and execute instructions sequentially from memory.
- **Flexible & Reprogrammable:-** Since programs are stored in memory users can change them without altering the physical structure of the computer.
- **Binary Representation:-** Instructions and data are represented in Binary (0s and 1s) making processing efficient.

* Impact of the stored program concept:-

- Led to the development of general purpose computers.
- Allows for the creation of modern operating system and software application.
- Enabled programming languages and compiler based computing.

Signature.....

Basic Programming:- Programming is the process of writing instructions that a computer can understand and execute. These instructions called code are written using a programming language like python, C or JavaScript.

1. * Key Features of Programming Concepts

(a) Algorithm:- An Algorithm is a step by step process to solve a problem.

- Take two number as input.
- Add them together.
- Display the result.

(b) Programming Language:-

Different programming languages are used based on purpose.

- High level language (Python, Java, C++):-
Easier to write and understand.

- Low level language (Assembly machine code):-
Faster but harder to write.

(c). Syntax & Semantics:-

- Syntax:- The rules of writing code (like grammar in english)

- Semantics:- The meaning of the code.

2. * Basic Programming Concept:-

(a) Variables & data types:-

- Variables store value in memory.

- Data types:- Define what type of data a variable can hold.

Example:-
`a = "Sagar" # String`
`a = 25 # Integer`
`height = 5.6 # Float`

operators

- Arithmetic operators:- `+`, `-`, `*`, `/`, `%`

- Comparison operators:- `=`, `!=`, `>`, `<`, `>=`, `<=`

- Logical operators:- `and`, `or`, `not`

ex:-
`x = 10`

`y = 5`

`Sum = x + y`

`x > y (T/F)`

Control Statement (Flow Control)

- Use to control the flow of the program

- Conditional Statement:-

ex:-
`age = 10`

`if age > 10:`

`print("eligible")`

`else:`

`print("not eligible")`

- Loops:-

`for i in range(5):` `i = variable`
`print(i)`

- Functions:- A function is a block of reusable code.

def- `greet(name):`

`print("Hello")`

`greet("Sagar")`

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* Writing and running a simple program.

A simple program to add two numbers

a = 1

b = 2

Sum = a + b

print(Sum)

* Debugging and error handling

Error can occur while writing code there are three main types:

(i) Syntax errors: Incorrect code structure (missing parenthesis)

(ii) Logical errors: Codes runs but give wrong result.

(iii) Run time errors: Errors that occur while running (division by 0).

```
# for i in range(10):  
    print("Sagar")
```

} i = variable

Signature.....

Object oriented programming.

(i) Class: A blue print for objects.

(ii) Object: An Instance of class

(iii) Methods: Function inside a class.

Programming languages.

Programming language is a formal set of instructions that allows human to communicate with computers to develop software. Application and system programming languages can be classified based on their level of abstraction and purpose.

Types of programming languages

Low level languages: These languages interact directly with the computer hardware and are highly efficient but difficult to learn.

• Machine language (Binary code - 0s and 1s):

(i) The native language of computers.

(ii) Difficult for humans to read and write.

ex: 1010110

• Assembly language (Symbolic representation of machine code): (i) Uses mnemonics (Add, Sub, etc.) (Short symbolic code): Instead of binary.

(ii) Requires an assembler to convert to machine code.

ex: Move - a, b (move data from b to a)

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2. High level language: High level language are easier to write, read and maintain. They require a compiler or an interpreter to convert code into machine language.

- Procedural languages (Based on step by step instructions)
ex: C, Fortran.

- Object oriented language (OOP)
ex: Java, Python, C++

- ~~Functional~~ Functional language (Based on mathematical function)
ex: Haskell
use: Use pure function without changing data.

- Scripting language (Used for automation and web development)
ex: JavaScript, PHP

- Markup and query languages (Use for data representation and data base queries.)
ex: HTML, SQL

Generation of Programming Languages

⇒ Programming languages have evolved over time and classified into five generation each offering improvement in usability, efficiency and automation.

1. First Generation (Machine language → 1940s - 1950s)

- Consists of binary code (0s and 1s) which is directly understood by the computer.
- Fast and efficient but extremely difficult to read and write.

- No translator required since it is the computer's native language. ex: 10110101
This represent a machine instruction but it is unreadable for humans.

2. Second Generation (Assembly language → 1950s - 1960s):

- Uses mnemonics (Symbolic representation) instead of binary code.

- Requires an assembler to convert it into machine language.

- Easier to understand than machine code but still hardware dependent.

ex: in Mov, A, B

or ADD, A, C (This moves data from B to A and then Add C).

3. Third Generation (High-level languages → 1960s - present)

- Uses English like syntax, making programming easier and more portable.

- Requires a compiler and interpreter to convert into machine code.

- More abstract reducing direct hardware instruction.
ex: C, language
int a = b + c

4. Fourth Generation (Very high-level languages → 1970s - present)

- Focuses on problem-solving rather than how to execute task.
- Requires less coding, making it faster and more productive.
- Mostly domain-specific languages (DSLs).

ex: (SQL) (structured query language)

SELECT * FROM STUDENT WHERE AGE > 18
popular languages - SQL

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5. Fifth Generation (AI & visual programming)

- Designing for Artificial Intelligence, Machine learning and automation.
- Uses logic based and visual programming instead of traditional coding.
- Allows programs to make decision and learn their own. ex: python (AI Libraries).

***** Functions *****

* Sagar() → Function call

* Function → def (python)

1/p use

def add():

a = 5

b = 5

print(a+b)

def sub():

a = 10

b = 5

print(a-b)

def mul():

a = 10

b = 5

print(a*b)

def div():

a = 100

b = 5

print(a/b)

add()

sub()

mul()

div()

Output

10

5

50

20

Sagar Kumar Varma

General Functions of variables and constant

→ In programming variables and constant are fundamental concepts used to store and manage data.

1. Variables: A variable is a named storage location in memory that holds data and its value can be changed during program execution.

* Characteristics of variables:

- Use to stored values.
- Value can be change at anytime.
- Have a name that follows naming rules.

* Types of variables:

i) Local variables: Define inside a function and accessible only within that function.

ii) Global variables: Define outside all functions and accessible through out the program.

iii) Instance variables, iv) Class variables

2. Constant: A constant is a variable whose value remains fixed through out the program and can not be change once assigned.

realme C67 5G of constant:

- Helps improve code readability and prevents accidental modification.

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Ex:- (i) $PI = 3.14$ ($PI = \pi = 3.14$ value)
`print(PI)` , Output $\rightarrow 3.14$

(ii) $GIRAVITY = 9.8$
`print(GIRAVITY)` , Output $\rightarrow 9.8$

Signature.....