

CONCEPT NOTES



COMPUTER KNOWLEDGE



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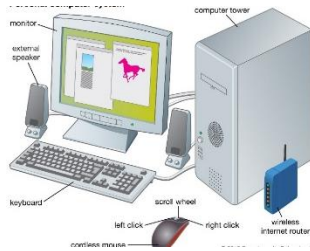
Introduction to Computer

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1 Computer



A computer is an electronic machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It can accept raw data as input, process it, and produce information as output.

A computer uses the IPO cycle to process raw data and produce meaningful information.

1.1 Data

- ✓ Data can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing by human or electronic machine.
- ✓ Data is represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9) or special characters (+, -, /, *, <, >, = etc.)

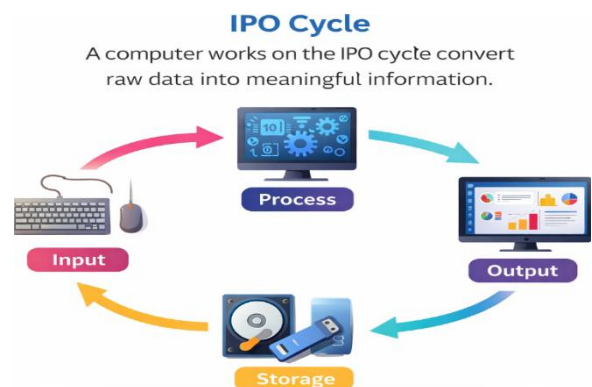
1.2 Information

- ✓ Information is organized or classified data, which has some meaningful values for the receiver. It is the end point or the final output of any processed work. Information is the processed data on which decisions and actions are based.
- ✓ For the decision to be meaningful, the processed data must qualify for the following characteristics –
 - Timely – Information should be available when required.
 - Accuracy – Information should be accurate.
 - Completeness – Information should be complete.

2 IPO Cycle

Input-Process-Output cycle or IPO refers to the stages that a set of instructions undergo to achieve the desired result.

- ✓ **Input:** Input means entering data or instructions into the computer. Examples: Keyboard, Mouse, Scanner, Microphone
- ✓ **Process:** Process means the computer works on the input data according to instructions. This work is mainly done by CPU. Examples: Calculation, sorting, comparison, searching
- ✓ **Output:** Output means the final result produced after processing. Examples: Result on monitor, printout, sound from speaker
- ✓ **Storage:** Storage means saving data, instructions, or results for future use. Examples: Hard disk, SSD, Pen drive, Cloud storage



3 Characteristics of Computer

- ✓ **Speed :** Computers work very fast. They can perform millions of calculations in seconds.
- ✓ **Accuracy:** If correct data and program are given, result is correct.

- ✓ **Reliability:** Computer can work again and again with same performance.
- ✓ **Storage Capacity:** Can store huge amount of data.
- ✓ **Automation:** Once started, computer can complete tasks automatically.
- ✓ **Diligence:** No tiredness, boredom, or laziness.
- ✓ **Versatility:** Used in many fields: banking, education, hospitals, defence, business.
- ✓ **Multitasking:** Can perform multiple tasks together. Example: Playing music while browsing internet.

Speed Units.

Computer speed is measured in very small units of time.

- *Millisecond (ms) = 10^{-3} second*
- *Microsecond (μ s) = 10^{-6} second*
- *Nanosecond (ns) = 10^{-9} second*
- *Picosecond (ps) = 10^{-12} second*

Instruction Speed Terms

- *KIPS = Kilo Instructions Per Second*
- *MIPS = Million Instructions Per Second*
- *FLOPS = Floating Point Operations Per Second*

4 Limitations of Computers

Following are certain limitations of computers:

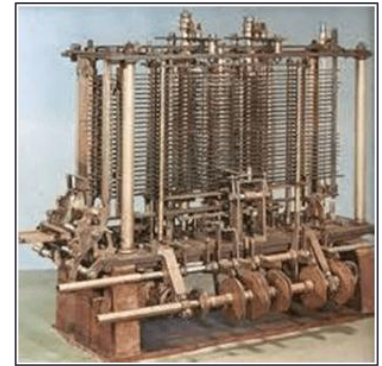
- ✓ **No IQ:** Computer cannot think on its own.
- ✓ **No Feelings:** No emotions or judgment.
- ✓ **Depends on User:** A computer depends on the user for instructions and data.
- ✓ **GIGO:** Garbage In Garbage Out. Wrong input gives wrong output.
- ✓ **Security Risks:** Can be affected by virus, hacking, malware.
- ✓ **Needs Power and Proper Environment:** Requires electricity and proper conditions.

5 History of Computers

A Computer was intended for making a person capable of performing numerical calculations with the help of a mechanical computing device.

5.1 Charles Babbage's Calculating Engines (1792-1871)

- ✓ Charles Babbage invented the Difference Engine to solve algebraic expressions and mathematical tasks accurately.
- ✓ Later, he designed some improvements to his first computer. The modified machine is called the Analytical Engine.
- ✓ He intended to design a machine with a collection of the four basic arithmetic functions. The design principle of the Analytical Engine can be divided into Input, Output, Memory, Central Processing Unit. The parts and working principle of an Analytical engine are the same as today's computer.
- ✓ Charles Babbage is known as the father of Computer.

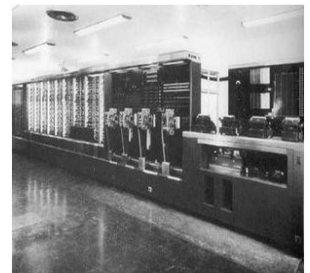


Alan Turing is known as the father of the Modern computer.

- *He conceptualized the Turing machine, a theoretical framework that laid the foundation for modern computers.*
- *His work provided insights into the design and operation of digital computers, including concepts such as the stored-program computer, which became a fundamental principle in modern computer design.*
- *During World War II, Turing's work in breaking the Enigma code, a cryptographic device used by the Germans, showcased the practical application of computing technology in cryptanalysis.*

5.2 Mark I Computer

- ✓ The first electro-mechanical computing device was developed by Howard Hathaway Aiken. He used Hollerith's punch card and Babbage's statements to develop Mark I computer with IBM.
- ✓ In Mark III computer, uses some electronic components and Magnetic drum memory.
- ✓ In Mark IV computer, uses all electronic components and Magnetic drum memory & Magnetic core memory.



5.3 First Un-programmable Electronic Digital Computer (ABC)

- ✓ The Atanasoff-Berry Computer (ABC) was the first electronic computer. It was designed by John Vincent Atanasoff and Clifford E. Berry.
- ✓ It was designed to solve systems of linear algebraic equations. It was also the first to use capacitors for storage.

5.4 Electronic Numerical Integrator and Calculator – ENIAC

- ✓ ENIAC was the first electronic computer used for general purposes, such as solving numerical problems.
- ✓ It was invented by J. Presper Eckert and John Mauchly.

5.5 Electronic Discrete Variable Automatic Computer – EDVAC

- ✓ EDVAC was the successor of ENIAC. In this computer, Binary numbers were used for arithmetic operations and the internal storage of instructions were also written in digital forms.

5.6 Electronic Delay Storage Automatic Calculator – EDSAC

- ✓ EDSAC was the first practical general-purpose stored-program electronic computer. It was built according to the von Neumann machine principles.

5.7 Universal Automatic Computer - UNIVAC

- ✓ UNIVAC was the first commercially available computer. It was made by the Eckert-Mauchly Computer Company. It represents the birth of the modern computers.

5.8 Micro Processor – INTEL 4004

- ✓ In 1969, Intel Corporation designed the first general-purpose programmable processor INTEL 4004. It was a set of four chips known as the MCS-4.

6 Generation of Computers

6.1 First Generation Computers (1946 – 1959)

- ✓ The first-generation computers were used vacuum tubes as the electronic components. They produce more heat, so needed cooling devices.
- ✓ They consumed huge electricity, occupied a very large space, huge cost etc.
- ✓ Machine languages are used as programming language.
- ✓ Examples – EDSAC, EDVAC, UNIVAC, IBM-701, IBM-650.



6.2 Second Generation Computers (1959 – 1965)

- ✓ The second-generation computers replaced Vacuum Tubes with Transistors.
- ✓ They were cheap, compact, faster programming and produced less heat than the first-generation computers.
- ✓ They used assembly languages and batch processing operating system.
- ✓ Magnetic cores and magnetic tapes were used as storage.
- ✓ Examples – IBM-1620, IBM -7094, CDC-1604, CDC-3600.



6.3 Third Generation Computers (1965 – 1971)

- ✓ The third-generation computers replaced transistors with integrated circuits (ICs). They performed computation in Nanoseconds.
- ✓ It used high-level languages like FORTRAN, COBOL, PASCAL, ALGO-68, BASIC was used.
- ✓ In this generation, remote processing, time-sharing, multi-programming operating system were used.
- ✓ Examples – IBM-360 series, Honeywell-6000 series, PDP, IBM-370/168.



6.4 Fourth Generation Computers (1971 – 1980)

- ✓ The fourth-generation computers are used Very Large Scale Integrated (VLSI) circuits.
- ✓ Semi-conductor devices are used as primary memory. Magnetic disks are used as secondary storage.
- ✓ Problem-oriented fourth generation languages (4GL) are used. Multi-processing and multiprogramming operating systems are used.
- ✓ Example – Apple series – I & II, IBM 4341, DEC 10, STAR 1000, PUP 11.



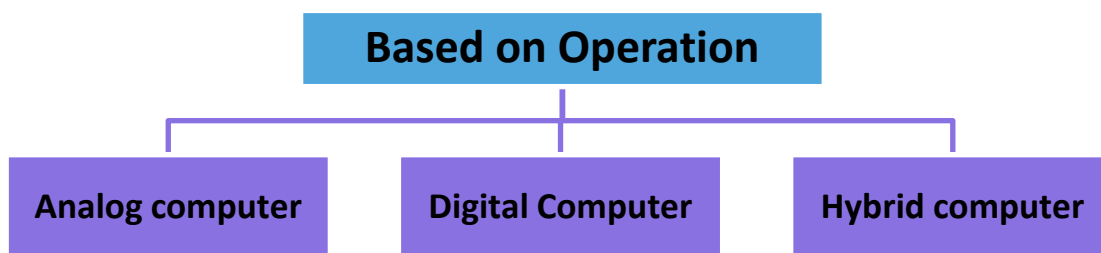
6.5 Fifth Generation Computers (1980 – Present)

- ✓ The fifth-generation computers use Ultra Large Scale Integrated (ULSI) chips that contain millions of components on a single chip.
- ✓ They are in the developmental stage which is based on the artificial intelligence.
- ✓ These computers can also respond to natural language input.
- ✓ Fifth generation focuses on Artificial Intelligence, robotics, natural language processing, and advanced computing systems..
- ✓ Examples – Robots, Supercomputers.



7 Types of Computers

7.1 Based on Operation



7.2 Analog Computer

- ✓ An Analog computer stores data continuously in the form of physical quantities and perform calculations with the help of measures.
- ✓ It produces output in the form of a graph. They are used in the calculation of physical variables such as voltage, pressure, temperature, speed, etc.



7.2.1 Digital Computer

- ✓ A Digital computer is the most commonly used type of computer and is working with data represented in digital form, usually binary 0s and 1s.
- ✓ It can perform faster and give more accurate results. They are extensively used for solving complex problems in the field of engineering & technology, design, research and data processing.

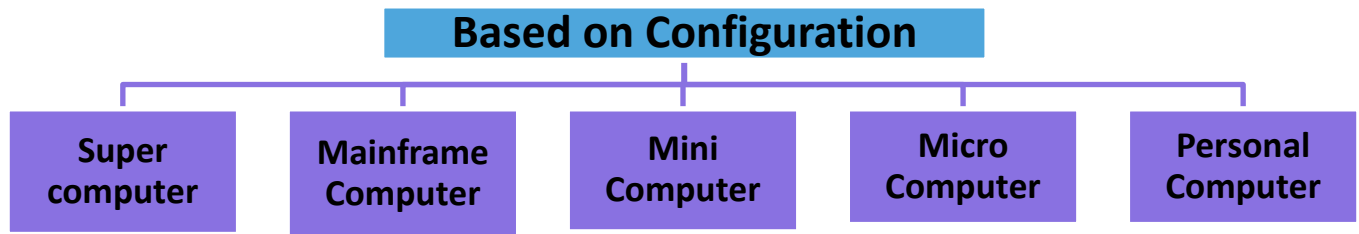


7.2.2 Hybrid Computer

- ✓ A Hybrid computer is a combined feature of Analog and Digital computers.
- ✓ In large industries and businesses, a hybrid computer can be used for logical operations as well as efficient processing of differential equations.



7.3 Based on Configuration



7.3.1 Super Computer

- ✓ Supercomputers are powerful, expensive and the fastest computers. They have architectural and operational principles from parallel and grid processing for performing billions and trillions of calculations per second.
- ✓ They are used for applications that require large amounts of mathematical computations like weather forecasting, fluid dynamics, graphic design etc.



7.3.2 Mainframe Computer

- ✓ Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously.
- ✓ Mainframe executes many programs concurrently and supports many simultaneous executions of programs.



7.3.3 Mini Computer

- ✓ Minicomputers possess most of the features and capabilities of a large computer but are smaller in physical size.
- ✓ They are used as small or midrange operating business and scientific applications.



7.3.4 Micro Computer

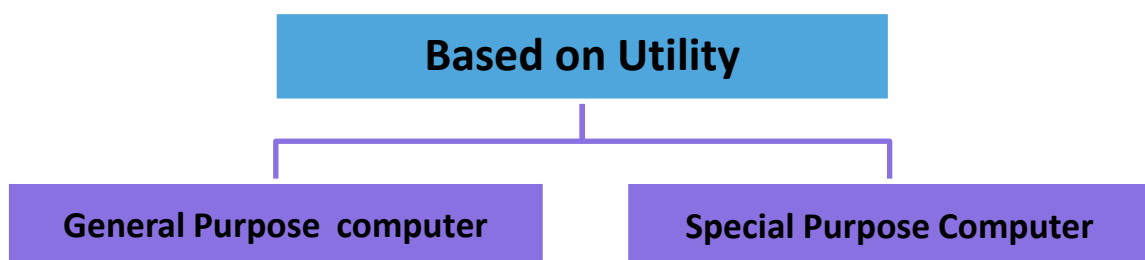
- ✓ Microcomputers are small, inexpensive computer for personal use.
- ✓ They are popularly used at homes for playing games and surfing the Internet.



7.3.5 Personal Computer (PC)

- ✓ A personal computer is a cost-effective computer that is designed for a single end-user. PC is dependent on microprocessor technology, which allows PC makers to set the entire central processing unit (CPU) on a single chip.

7.4 Based on Utility



7.4.1 General Purpose Computer

- ✓ A general-purpose computer can perform an extensive variety of operations. It can store and execute different programs in its internal storage.
- ✓ All mainframes, servers, laptop and desktop computers, smartphones and tablets are general-purpose devices.

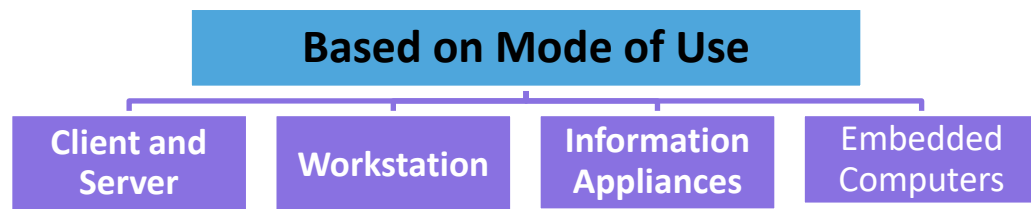
7.4.2 Special Purpose Computer

- ✓ Special purpose computers are designed to solve specific problems. The instructions are pre-programmed permanently in the computer.
- ✓ It completely controlled by automated manufacturing processes. Example – Aircraft control system, Electronic voting machines etc.

Quantum computers

These are a type of special-purpose computers designed to leverage the principles of quantum mechanics to perform computations. Unlike classical computers, which use bits as the fundamental unit of information (either 0 or 1), quantum computers use quantum bits, or qubits, which can exist in multiple states simultaneously due to phenomena such as superposition and entanglement.

7.5 Based on mode of Use



7.5.1 Client and Server

- ✓ The server is a device that manages the sharing of network resources to the users. An Application server, File server, Virtual server, Mail server are some types of server. A client is the receiving end of the service which made by the server. It requests the server and gains access with the server.

7.5.2 Workstation

- ✓ Workstation (WS) is faster than Personal Computer. It is designed for a user or group of users with better multitasking capability, additional Random-Access Memory, Higher-speed graphics adapters and drive capacity.

7.5.3 Information Appliances

- ✓ Information appliances are the portable or handy devices designed to perform simple operations like calculations, games, etc. They have limited memory and limited operations capabilities and software. Example – Mobile phones, Tablets, etc.

7.5.4 Embedded Computers

- ✓ Embedded computers are used in other machines to serve limited requirements. It executes program in the non-volatile memory to operate an intended machine or electronic device. They cannot be rebooted unlike normal computers, required to operate continuously. Embedded computers are used widely in day-to-day life. Example – Washing Machine, DVD player, etc.

8 Important Personalities

Personality	Known As / Contribution
Charles Babbage	Father of Computer
Ada Lovelace	First Computer Programmer; wrote algorithm for Analytical Engine
Alan Turing	Father of Modern Computer / Father of AI
John von Neumann	Father of Stored Program Architecture
Tim Berners-Lee	Father of World Wide Web (WWW)
Howard Aiken	Developed Mark I Computer
J. Presper Eckert	Co-inventor of ENIAC / UNIVAC
John Mauchly	Co-inventor of ENIAC / UNIVAC
Vint Cerf	Father of Internet (with Bob Kahn)
Bob Kahn	Father of Internet (with Vint Cerf)
Bill Gates	Co-founder of Microsoft
Steve Jobs	Co-founder of Apple
Larry Page & Sergey Brin	Founders of Google
Vijay Bhatkar	Father of Indian Supercomputer (PARAM)