**BASICS OF COMPUTING**

**Motivation of Computer:**

* term is derived from "compute" which means "calculate".
* apply math operations like +, -, \*, etc.,
* manual complex calculations take much longer time for humans
* accuracy mayn't be there
* man need machine to perform all math calculations faster and accurate.

**Definition**:

It is an electronic device which processes given data to derive the required & useful info

Computer is machine which takes inputs, processes and gives outputs.

During processing, the computer has to perform various functions like

* Receives data(input- input devices)
* Processes data(process- CPU)
* Produces output(information- output devices)
* Stores results(storage- storage devices)

**Characteristics:**

***speed:***

* Computer should process data in higher rate
* Few sec by computer=many days/years by man
* Measured in Millions Instructions per Second(MIPS) or MHz

***Accuracy***:

* Accuracy of computers is consistently high enough which avoid any errors
* If there are errors, they are due to errors in instructions by programmer

***Reliability:***

* Measurement of performance of computer
* Built-in diagnostic capabilities for continuous monitoring

***Storage capability:***

* Store large volumes of data in small storage devices
* can read stored info at any time
* have levels memory with different architectures

***Versatility:***

* multiple tasks simultaneously with equal ease
* multi program, multi processor, multi core

***Diligence:***

* Should not get tiredness or lack of concentration
* should work 24x365 with same accuracy and speed as the first run

***Resource Sharing:***

* Same printer can be used by any number of device
* Computers are connected in the form of network. Using network, I should share any number/type of resources both in the form of software or hardware devices.
* Single large info or single database can be created and can be shared among multiple computers.

**Evolution: how computers have evolved from various levels, with various technologies and with various set of features.**

* Sand tables
* Abacus
* Napier Bones
* Slide rule
* Pascaline
* Stepped Reckoner
* Punch card system
* Difference engine
* Analytical engine
* Hollerith’s Tabulator

***Sand Tables: Used for counting***

* Uses pebbles for calculation like finger
* Consists of 3 grooves in the sand with max of 1o pebbles in each.
* To increase count, one pebble is added at right hand groove
* When reaches 10, remove all pebbles from that groove and add one at the immediate left

***Abacus: Used for addition and Subtraction***

* Consist of 2 parts, upper (2) and lower (5)
* Both parts have some sliders.
* In sliders, we have sliding beads.
* By Sliding beads position, calculation is done.
* Upper- raised =0, lowered=5
* Lower- raised=1, lowered=0

***Napier Bones: Used for multiplication***

* Ivory bones
* John Napier

eg., 46x5=? 2(03)0=230

4X5=20, prefix is 2

6X5=30, suffix is 0

Second digit of 4x5 and first digit of 6x5 should be added. i.e., 0+3=3

2 0+3 0 = 230

***Slide Rule:***

* Edmund Gunter and William Oughtred in 1620
* Embodied by 2 sets of scales that are joined together
* Slide freely to get results of multiplication
* Eg., if we want 4x5, 4 will be on lower scale and 5 will be on upper scale. By sliding, we will get the result of 4x5

***Pascaline:***

* Blaise Pascal(1942)
* Basic mathematical calculations
* Set of wheels, gears and windows for displaying numbers
* Operated by series of dials(0-9)

***Stepped Reckoner:***

* First Mass produced calculating machine
* Extension of Pascaline, performed multiplication, division and square root
* System of gears and wheels

***Punch card:***

* Joseph marie jacquard(1804)
* Piece of stiff paper with holes. If there is hole, presence of data. Else, absence of data.
* Used to control sequence of operations
* Digital data can be used for data processing applications or to control automated machinery.
* Set of actions can be done.
* First computer that has 0 or 1 concept

***Difference Engine:***

* Charles babbage(1822)
* Mechanically generate math tables
* Huge complex abacus
* Solves differential equations as well
* Base for analytical engine

***Analytical Engine: first general-purpose programmable computer by Charles Babbage***

* Set of instructions. Each instructions gives one task
* Worked based on sign of number
* Designed to advance or reverse the flow of punch card
* Occupies large space

***Hollerith’s Tabulator:***

* Herman Hollerith
* Able to read the information on the card and process it electronically
* Consists of tabulator, sorter with compartments controlled by tabulator’s counter.
* In 1896, Hollerith started tabulating machine company, later renamed as IBM.

**Generations: Levels of evolutions**

* Stages of technological development or innovation
* The computers are categorized into various generations based on the type of processor. We have 5 generations:
  1. First generation(1940-56) –Vacuum Tubes
  2. Second Generation(1956-63) –Transistors
  3. Third Generation(1964-early 70s) –Integrated Circuits(IC)
  4. Fourth Generation(Early 70s- till date) –Microprocessors
  5. Fifth Generation(present and beyond) –Artificial Intelligence(AI)

***First Generation:***

* vacuum tubes/thermionic valves. For each calculation, single computer will occupy complete row.  we have many valves. each valve takes
* we use vacuum tubes for circuitary(calculations) and magnetic drums (storage)
* inputs- punch cards; output- printouts
* input- binary code
* one problem at a time
* lack of speed and versatility
* for rerunning on other machine, instructions must be rewritten and recompiled
* Example: ENIAC. EDVAC & UNIVAC

***Second Generation:***

* Transistor technology.
* the computational time decreased from milliseconds(vacuum) to microseconds
* input- assembly language. Converted to machine level language by using appropriate converters
* less prone to hardware failure.
* We need to assemble individual component manually

***Third Generation:***

* Transistors were replcard with ICs.
* This made computers smaller in size, reliable and efficient
* Keyboards and monitors to communicate with computer via OS
* Computational time reduced from microseconds to nanoseconds
* Highlevel languages became possible. Converted into assembly and assembly to machine language

***Fourth Generation:***

* Microprocessor –based system
* Small in size, cheapest, portable, reliable
* Generate negligible amount of heat, no need of ACs
* Min maintainence
* Cost of production is low
* GUI
* Interconnection of computers & resource sharing

***Fifth Generation:***

* AI
* From 1990
* Reasoning and Decision making
* Eg. Expert system
* Still evolution
* THREE CHARACTERISTICS
  1. Mega chips (Super Large Scalar Integrity- SLSI)
  2. Parallel processing (Multiprocessor)
  3. AI (speech recognition, robotics, etc.)

**Classification of Computers:**

**Why?**

When we are taking any comp, I can go for computer for the particular application, particular purpose or to solve a particular problem or some tasks.

I have to chose computer based on the need.

Computer may be laptop, server, super computer or mobile phone.

**Based on purpose**, utilization, problem, I have to select a specific type of computer because different type of computer have their own properties. Eg., if we need to move it at easiest, we chose mobile phone.

* + Computers are different in size, types.
  + Can fit in our palm or occupy entire room.
  + May use difernt os and processors
  + Some for single user and some for many users
  + Different data-processing abilities
  + Differet software.

**Classification**:

Based on purpose: General & Specific

Data handling: Analog, Digital and Hybrid

Functionality: Micro[desktop, laptop, Handheld], Mini, Mainframe & Super

**Based on Purpose:**

* ***General***: are designed for any no. of appls. If you need any specific app, you can simply install and use it.

For writing, can use word type of app.

For web design, can use any web designing app.

Various apps

Versatile but lack in speed & efficiency

Ex. Computers used in school

* ***Specific***: Only one application

Handle specific problem or to perfomre single task

Cannot be used for other applications unless circuits are redesigned.

Poor in versatitlity but effieciency and high speed

Ex. Computers for weather forecasting, satellite tracking and air traffic control

**Based on Data handling:**

* ***Analog***: operates data in form of cont. variable

Used for special scientific or rngineerinf purpose

Get graffical results

Less accuracy

* ***Digital***: operates with info in the form of numbers or represented as digital form(binary)

Processes data(text, sound, graphics or video) into digital form( 0s and 1s)

Analog data shoud be converted into digital and viceversa

More accuracy and faster

Ex. Desktop pc

* ***Hybrid***: analog+digital

Measurement feature- analog & Counting feature- digital

Communicates via coverters to convert analog to digital and vice versa

For computational purposes- analog divices & for storage- digital divices

Ex. Used in scientific apps, various fields of engineereing and industrial control app(exc. To control motors)

**Based on Functionality:**

* ***Micro***: Workstation

Smallest, low cost

Only for individual users

Can be connected to other workstations to increase processing capacity.

Can serve more than one users when connected.

Microcomputers include Desktop, laptop, handheld(pda

Ex. Apple, Lenovo, del, hp

* ***Mini***: Midrange

Designed for multi users. Over the network, we can connect some set of workstations to a server to share resources

4 to 200 simultaneous users

It serves as centralized storehouse for a cluster of workstations or as network server.

Used in interactive apps in industries, research organizations which need to collect several data from many devices.

* ***Mainframe***: centralized mechanism

highest capacity(to store large storage) data storage

access and processing the data from different computers at different locations.

used fir large businesses and for scientific purposes.

Ultra high performance computer made for high volume, processor-intensive computing.

executes many programs simultaneously at a high speed.

Ex: IBM's ES000, VAX 8000 & CDC 6600

* ***Super Computer***: special purpose

FLOPS(floating point operation per second)

Highest processing(400-10000 MFLOPS)

Contiants multiple cpus operates in parallel

Solves scientific and engineering problems like Data retrieval

Ex. CRAY-3, Cyber 205, IBM Intrepid (runs 164000 processors)

India has super computer named “Pratyush”: Fastest and first multi PetaFLOPS at IITM, pune. Max speed : 6.8 PFLOPS.

Used for weather forecasting and climate monitoring. 53rd rank among TOP 500.

Applications of Computer:

* Science (chandrayan)
* Education (online class)
* Health (scanning, xray)
* Engineering/Architectuere/Manufacturing (design)
* Entertainment (ott, ebook, gaming)
* Communication (internet, fb, insta)
* Business Apps (analysis- excels)
* Publishing (news, dtp processing)
* Banking (internet banking, upi)