1.1 Introduction of Computer

What is Computer :

Computer is an electronic device which is used to store the data, as per given instructions it gives results quickly and accurately.

- *Data:* Data is a raw material of information
- *Information:* Proper collection of the data is called information

Characteristics Of Computer

- **SPEED** : Computer is very fast calculating device. It can execute basic operations like subtraction, addition, multiplication and division at a few microseconds. It can move and copy data at a speed in the order of billion instruction per second.

- **ACCURACY** : Computer always gives accurate results. The accuracy of Computer does not go down when they are used continuously for hours together.
  It always gives accurate results.

- **STORAGE CAPACITY** : Computers have a very large storage capacity. A large volume of information can be stored in the memory of computer and information can be retrieved correctly when desired.

- **VERSATILITY** : The working of computer with different types of data is known as versatility. That means computer can perform different types of job efficiently. Computer can works with different type of data and information such as visuals, text, graphics & video etc. So, versatility is a most important characteristic of computer.

- **DILLIGENCE** : A Computer can work for long hours with the same accuracy and speed because it is free from problems of boredom or lack of concentration.

- **POWER OF REMEMBERING***:* It can remember data for us.

- **NO IQ :** Computer does not work without instruction.

- **NO THOUGHTS** : Computers have no thoughts because they are machine and they have no feelings. Since, computers have no thoughts and feelings so they can't make judgement based on thoughts and feelings.

History Of Computers

The history of the computer dates back to several years. There are five prominent generations of computers. Each generation has witnessed several technological advances which change the functionality of the computers. This results in more compact, powerful, robust systems which are less expensive. The brief history of computers is discussed below:

First Generation (1940-1956)

The first generation computers had the following features and components −

Hardware

The hardware used in the first generation of computers was: **Vacuum Tubes** and **Punch Cards**.

Features

Following are the features of first generation computers −

- It supported machine language.
- It had slow performance
- It occupied large size due to the use of vacuum tubes.
- It had a poor storage capacity.
- It consumed a lot of electricity and generated a lot of heat.

Memory

The memory was of 4000 bits.

Data Input

The input was only provided through hard-wired programs in the computer, mostly through punched cards and paper tapes.

Examples

The examples of first generation computers are −

- ENIAC
- UNIVACTBM 701

Second Generation (1956-1963)

Several advancements in the first-gen computers led to the development of second generation computers. Following are various changes in features and components of second generation computers:

Hardware

The hardware used in the second generation of computers were −

- Transistors
- Magnetic Tapes

Features

It had features like −

- Batch operating system
- Faster and smaller in size
- Reliable and energy efficient than the previous generation
- Less costly than the previous generation

Memory

The capacity of the memory was 32,000 bits.

Data Input

The input was provided through punched cards.

Examples

The examples of second generation computers are −

- Honeywell 400
- CDC 1604
- IBM 7030

Third Generation (1964-1971)

Following are the various components and features of the third generation computers –

Hardware

The hardware used in the third generation of computers were −

- Integrated Circuits made from semi-conductor materials
- Large capacity disks and magnetic tapes

Features

The features of the third generation computers are −

- Supports time-sharing OS
- Faster, smaller, more reliable and cheaper than the previous generations
- Easy to access

Memory

The capacity of the memory was 128,000 bits.

Data Input

The input was provided through keyboards and monitors.

Examples

The examples of third generation computers are −

- IBM 360/370
- CDC 6600
- PDP 8/11

Fourth Generation (1972-2010):

Fourth generation computers have the following components and features −

Hardware

The Hardware used in the fourth generation of computers were −

- ICs with Very Large Scale Integration (VLSI) technology
- Semiconductor memory
- Magnetic tapes and Floppy

Features

It supports features like −

- Multiprocessing & distributed OS
- Object-oriented high level programs supported
- Small & easy to use; hand-held computers have evolved
- No external cooling required & affordable
- This generation saw the development of networks and the internet
- It saw the development of new trends in GUIs and mouse

Memory

The capacity of the memory was 100 million bits.

Data Input

The input was provided through improved hand held devices, keyboard and mouse.

Examples

The examples of fourth generation computers are −

- Apple II
- VAX 9000
- CRAY 1 (super computers)

Fifth Generation (2010-Present)

These are the modern and advanced computers. Significant changes in the components and operations have made fifth generation computers handy and more reliable than the previous generations.

Hardware

The Hardware used in the fifth generation of computers are −

- Integrated Circuits with VLSI and Nano technology
- Large capacity hard disk with RAID support
- Powerful servers, Internet, Cluster computing

Features

It supports features like −

- Powerful, cheap, reliable and easy to use.
- Portable and faster due to use of parallel processors and Super Large Scale Integrated Circuits.
- Rapid software development is possible.

Memory

The capacity of the memory is unlimited.

Data Input

The input is provided through CDROM, Optical Disk and other touch and voice sensitive input devices.

Examples

The examples of fifth generation computers are −

- IBM
- Pentium
- PARAM

1.2 Applications of Computer

Computers play a role in every field of life. They are used in homes, business, educational institutions, research organizations, medical field, government offices, entertainment, etc.

Home

Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. They provide communication through electronic mail. They help to avail work from home facility for corporate employees. Computers help the student community to avail online educational support.

Medical Field

Computers are used in hospitals to maintain a database of patients' history, diagnosis, X-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes. It also helps to monitor the fetus inside the mother's womb.

Entertainment

Computers help to watch movies online, play games online; act as a virtual entertainer in playing games, listening to music, etc. MIDI instruments greatly help people in the entertainment industry in recording music with artificial instruments. Videos can be fed from computers to full screen televisions. Photo editors are available with fabulous features.

Industry

Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing, video conferencing, etc. Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas. Stock markets have seen phenomenal participation from different levels of people through the use of computers.

Education

Computers are used in education sector through online classes, online examinations, referring e-books, online tutoring, etc. They help in increased use of audio-visual aids in the education field.

Government

In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment. The country's defense organizations have

greatly benefitted from computers in their use for missile development, satellites, rocket launches, etc.

Banking

In the banking sector, computers are used to store details of customers and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

Business

Nowadays, computers are totally integrated into business. The main objective of business is transaction processing, which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. People can analyze investments, sales, expenses, markets and other aspects of business using computers.

Training

Many organizations use computer-based training to train their employees, to save money and improve performance. Video conferencing through computers allows saving of time and travelling costs by being able to connect people in various locations.

Arts

Computers are extensively used in dance, photography, arts and culture. The fluid movement of dance can be shown live via animation. Photos can be digitized using computers.

Science and Engineering

Computers with high performance are used to stimulate dynamic process in Science and Engineering. Supercomputers have numerous applications in area of Research and Development (R&D). Topographic images can be created through computers. Scientists use computers to plot and analyze data to have a better understanding of earthquakes.

1.3 Types of Computers

Since the advent of the first computer different types and sizes of computers are offering different services. Computers can be as big as occupying a large building and as small as a laptop or a microcontroller in mobile & embedded systems.

The four basic types of computers are.
1. Super computer
2. Mainframe Computer
3. Minicomputer
4. Microcomputer

Supercomputer

- The most powerful computers in terms of performance and data processing are the supercomputers.
- These are specialized and task specific computers used by large organizations.
- These computers are used for research and exploration purposes, like NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose.
- The supercomputers are very expensive and very large in size.
- It can be accommodated in large air-conditioned rooms; some super computers can span an entire building.

Uses of Supercomputer

- Space Exploration
- Earthquake studies
- Weather Forecasting
- Nuclear weapons testing

Mainframe computer

- Although Mainframes are not as powerful as supercomputers, but certainly they are quite expensive nonetheless, and many large firms & government organizations uses Mainframes to run their business operations.
- The Mainframe computers can be accommodated in large air-conditioned rooms because of its size.
- Super-computers are the fastest computers with large data storage capacity, Mainframes can also process & store large amount of data.
- Banks educational institutions & insurance companies use mainframe computers to store data about their customers, students & insurance policy holders.

Minicomputer

- Minicomputers are used by small businesses & firms.
- Minicomputers are also called as "Midrange Computers".
- These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as super-computers & Mainframes.
- These computers are not designed for a single user.
- Individual departments of a large company or organizations use Mini-computers for specific purposes.
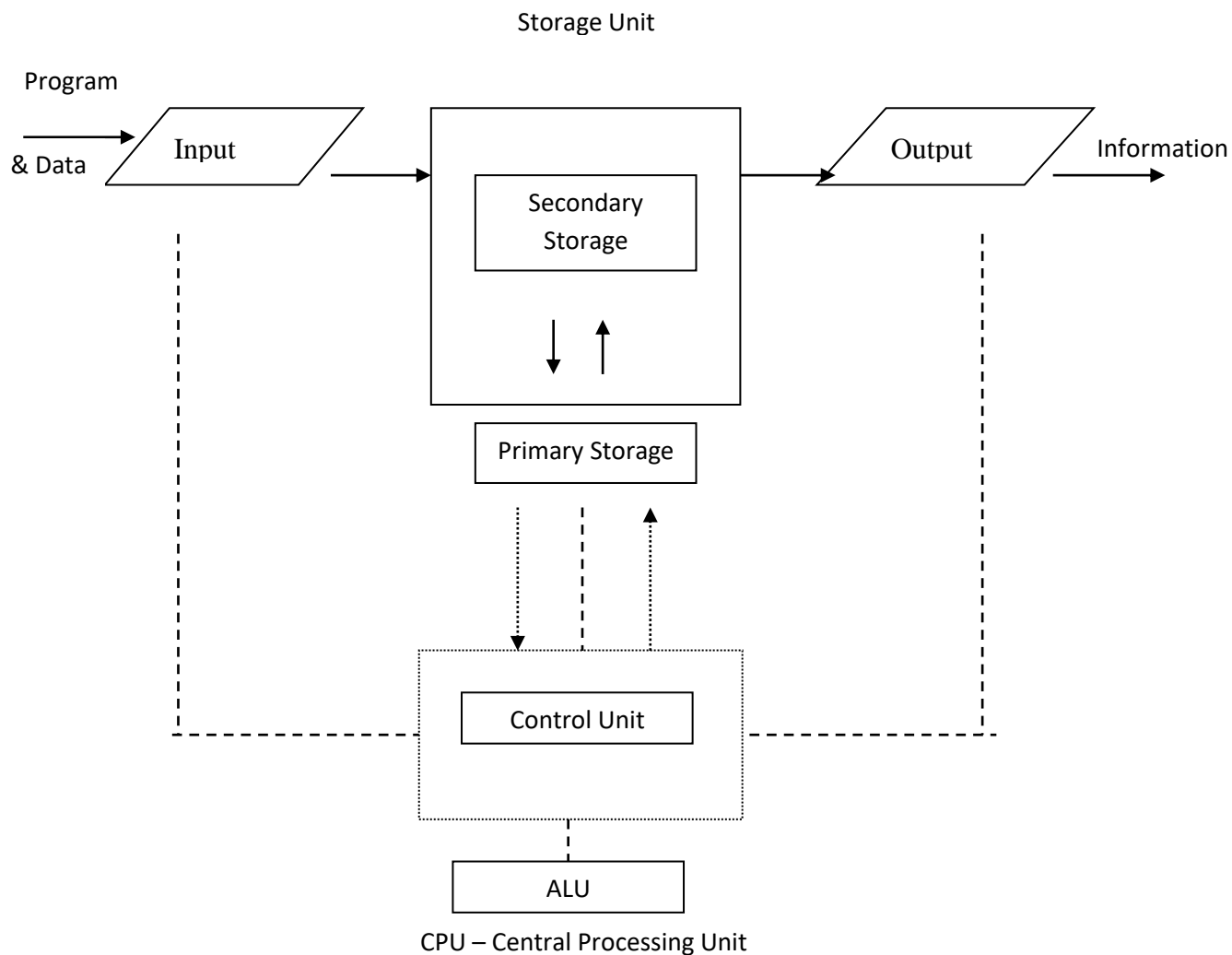- For example, a production department can use Mini-computers for monitoring certain production process.

Microcomputer

- Desktop computers, laptops, personal digital assistant (PDA), tablets & Smartphone's are all **types of microcomputers**.
- The micro-computers are widely used & the fastest growing computers.
- These computers are the cheapest among the other three types of computers.
- The Micro-computers are specially designed for general usage like entertainment, education and work purposes.
- Well known manufacturers of Micro-computer are Dell, Apple, Samsung, Sony & Toshiba.
- Desktop computers, Gaming consoles, Sound & Navigation system of a car, Netbooks, Notebooks, PDA's, Tablet PC's, Smartphones, Calculators are all type of Microcomputers.

1.4 Block Diagram and functional units of computer

- o Following are the components of computer:
  1. Input Unit
  2. Output Unit
  3. Storage Unit
  4. CPU
  5. ALU
  6. CU

Storage Unit

Program

Input → Secondary Storage → Output → Information
& Data

Primary Storage

Control Unit

ALU

CPU – Central Processing Unit

→Indicates flow of instruction

--- Indicates control exercised by control unit

1. Input Unit:
   - It performs following functions:
     a. Accepts instructions and data from outside world.
     b. It converts instructions and data in computer acceptable form.
     c. It supplies the converted instructions and data to the computer system for further processing.
   - Data and instructions enter in the computer in a form that depends upon input device being used.
   - All input devices must transform input signals to binary codes which are done by input interface.
   - Input interface watch unique physical and electrical characteristics of input device.
2. Output Unit:
   - It performs reverse of input unit.
   - It performs following functions:
     a. It accepts the results produced by the computer, which are in coded form. (can't understand by us)
     b. It converts these coded results to human readable form.
     c. Supplies the results to outside the world.
   - Results produced in binary form. Output interfaces convert binary code into human readable form.
3. Storage Unit:
   - It holds:
     a. Data and instructions required for processing.
     b. Intermediate results of processing.
     c. Final results of processing data before they are released to output unit.
   - 2 types of Storage Unit:
     a. Primary Storage:
        o It is also known as **Main Memory**.
        o It stores pieces of programs and data, intermediate results and recently produced results.
        o The CPU can directly access these pieces at fast speed.
        o It is volatile.
        o It has limited storage space.
        o It is made up of semiconductor devices.
   - Secondary Storage:
        o It is also known as Auxiliary Device.
        o It is cheaper than Primary storage.
        o It is non-volatile memory.
        o Magnetic disk, Hard disk is used as secondary storage.

4. CPU (Central Processing Unit):
   - Control Unit (CU) and Arithmetic Logic Unit (ALU) together are known as CPU.
   - It is brain of computer.
   - It performs all major calculations and comparisons.
   - It activates and control operations of other units of computer system.

5. ALU:
   - Computer performs all calculations and comparisons operations in ALU.
   - During processing, data and instructions stored in primary memory are transferred to ALU.
   - ALU does processing and results are temporarily transferred to primary memory.
   - Design of ALU determines type and number of arithmetic and logic operations that can be performed.

6. CU:
   - It doesn't perform actual processing but acts as central nervous system.
   - It manages and coordinates the operations of all other components.
   - It obtains instructions from a program stored in the main memory, interrupts the instructions and issues signals so that other units execute the instructions.