Unit I: Computer Basics

A computer is an electronic machine that accepts data from the user, processes the data by performing calculations and operations on it, and generates the desired output.

Computer performs both simple and complex operations, with speed and accuracy.

Characteristics of Computer

Speed: The computer can process data very fast, at the rate of millions of instructions per second. Some calculations that would have taken hours and days to complete otherwise, can be completed in a few seconds using the computer.

Accuracy: Computer provides a high degree of accuracy. For example, the computer can accurately give the result of division of any two numbers up to 10 decimal places.

Diligence: When used for a longer period of time, the computer does not get tired or fatigued. It can perform long and complex calculations with the same speed and accuracy from the start till the end.

Storage Capability: Large volumes of data and information can be stored in the computer and also retrieved whenever required.

Versatility: Computer is versatile in nature. It can perform different types of tasks with the same ease. At one moment you can use the computer to prepare a letter document and in the next moment you may play music or print a document.

Resource Sharing: Computers can be easily connected with each other and can share resources like printer, memory, etc.

Evolution of Computers

The first counting device was **ABACUS** or SOROBAN.

In 1642, a French mathematician, **Blaise Pascal** invented the first functional automatic calculator , called **pascaline.**

Later **John Napier** discovered **Napier bones**, which added more calculating functions.

In 1822, **Charles Babbage**, known as "*Father of Computer*",proposed a machine to perform differential equations, called a **Difference Engine**. Later he developed another device called "**Analytical Engine**" in 1833.

In 1840 ,**Ada Lovelace** ,known as "worlds first computer programmer",*provided first algorithm* for analytical engine.

In 1889, **Herman Hollerith** devised a machine that run on electricity for calculation and recording data- called **tabulator**. *It was capable of reading both numbers and letters.*

In 1896, Hollerith established his own company called "Tabulating Machine Company", which was later named **IBM** (International Business Machines).

In 1936, **Alan Turing** presents the model of a universal machine, later called the **Turing machine**, capable of computing anything that is computable. The central concept of the modern computer was based on his ideas.

Generations of Computers

First Generation Computers (1940-56):

First generation computers used **vacuum tubes** for circuitry and magnetic drums for memory. It used about 18,000 vacuum tubes.

Vacuum tubes were weak glass tube that can control electronic and electric signal.

They were very large in size, expensive ,used large amount of electricity and produced more heat .

First generation computers relied on machine language.

Examples of First generation computers include: **ENIAC, EDVAC, UNIVAC,**

Second generation Computers (1956-1963)

Second generation Computers used **Transistors** instead of vacuum tubes.

Computers became smaller, faster, cheaper, energy-efficient and more reliable than first generation computers.

They replaced machine language with assembly language .

Punched cards were used for input and printouts as output.

Early high level programming languages such as COBOL and FORTRAN were developed in this period.

Advantages

These were smaller as compared to the first generation computers

These were more portable and generated less amount of heat

Programming became more efficient .

Examples: PDP-8, IBM 1401, and IBM 7090

Third generation computers (1964-early 1970s)

Transistors were replaced with **Integrated Circuit (IC)** Chips.

IC was a combination of number of transistors and other electronic components integrated in a single chip.

Computers became smaller in size, reliable ,portable and more efficient than second generation computers.

Instead of punched cards and printouts, users interacted with keyboards and monitors and interfaced with operating system.

Example:-NCR 395, and B6500.

Fourth generation Computers (Early 1970-2000)

Here IC were replaced with **Microprocessors**.

A microprocessor consist of thousands of IC's built on single chip.

Computing speed was increased, was more reliable ,portable and efficient than third generation.

This generation also saw the development of the GUI (Graphical User Interface), mouse, and handheld devices.

Computers became smaller in size and affordable price. Heat generated was negligible.

Examples: Apple II, Altair 8800 and CRAY-1

Fifth generation computers (Present and beyond)

Fifth generation of computers were based on **Artificial Intelligence**.

The goal of fifth generation computers is to develop devices that respond to natural language and capable of self-learning.

AI comprises a group of related technologies:

- Expert System (ES)

- Natural Language Processing (NLP)

- Speech Recognition

- Robotics

It refers to a series of related technologies that try to simulate and reproduce human behavior, including thinking, speaking and reasoning.

Classification of Computers

A computer is an electronic machine, operating under the control instructions stored inside its memory.

Computers may be classified according to the principles of operation, purpose and on the basis of their configuration.

1. **Types of Computers based on Operating Principles**

   - Analog Computers

   - Digital Computers

   - Hybrid Computers

Analog Computer is a computing device that works on continuous range of values. The results given by the analog computers will only be approximate since they deal with quantities that vary continuously. It generally deals with physical variables such as voltage, pressure, temperature, speed, etc…

Digital Computers: Digital computer operates on digital data such as numbers. It uses binary number system in which there are only two digits 0 and 1. Each one is called a bit. Digital Computers can give more accurate and faster results. Digital computer is well suited for solving complex problems in engineering and technology.

Hybrid Computers: A hybrid computer combines the desirable features of analog and digital computers. It is mostly used for automatic operations of complicated physical processes and machines. Now-a-days analog-to-digital and digital-to-analog converters are used for transforming the data into suitable form for either type of computation. For example, in hospital"s ICU, analog devices might measure the patients" temperature, blood pressure and other vital signs. These measurements which are in analog might then be converted into numbers and supplied to digital components in the system. These components are used to monitor the patient"s vital sign and send signals if any abnormal readings are detected.

2. **Types of Computers based on the purpose**

- **General-Purpose Computers:** A general-purpose computer is one that has the ability to store different programs of instruction and thus to perform a variety of operations. The general purpose computer can be used to prepare stores report, sales report, payroll, etc.

- **Special-Purpose Computers**: is designed to perform one specific task. The program of instructions is built into, or permanently stored in the machine. Specialization results in the given task being performed very quickly and efficiently.

3. Types of Computers based on Configuration

Super Computers: A super computer is an extremely fast computer that can process **billions of instructions per second.** Normally, they will be used for applications which require intensive numerical computations such as stock analysis, weather forecasting etc. Other uses of supercomputers are scientific simulations, (animated) graphics, nuclear energy research and analysis of geological data. Essentially, it contains a number of CPUs that operate in parallel to make it fast. CRAY-3, Cyber 205, and PARAM are some well-known super computers.

Mainframe Computers: Mainframe computers can also process data at very high speeds, hundreds of *million instructions per second* and they are also quite expensive. Mainframe allows its user to maintain large information storage at a centralized location and be able to access and process this data from different computers located at different locations. Normally, they are used in banking, airlines and railways etc… for their applications. Examples of mainframe computers are IBM"s ES000, VAX 8000, and CDC 600.

Mini Computers: Mini computers (sometimes called a mid-range computer) are lower to mainframe computers in terms of speed and storage capacity. They are less expensive than mainframe computers. Mini Computers is designed to meet the computing

needs for several people simultaneously in a small to medium sized business environment. Some of the widely used mini computers are **PDP 11, IBM (8000series), and VAX 7500.**

Micro Computers: A microcomputer is a small, low cost digital computer, which usually consists of a micro-processor, a storage unit, an input channel, and an output channel.

Microcomputers include desktop, laptop, and handheld models such as PDAs (Personal Digital Assistants).

Desktop Computers. It can be defined as a small, relatively inexpensive computer designed for an individual user. A desktop computer is a personal computer(or PC)used to handle daily tasks by individual users. It is designed for regular use.

Laptop Computer: Laptop computers are portable computers. They are lightweight computers with a thin screen. They are also called as notebook computers because of their small size. They can operate on batteries and hence are very popular with travelers.

Handheld Computers: Handheld computers or Personal Digital Assistants (PDAs) are pen-based and also battery-powered. They are small and can be carried anywhere. They use a pen like stylus and accept handwritten input directly on the screen. They have touch screens which we use with a finger or a stylus. Since these computers can be easily fitted on the palmtop, they also have known as palmtop computers.

Personal Computer and Workstation Workstation

Workstation

It is a type of computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other types of applications that require a moderate amount of computing power and relatively high quality graphics capabilities. ¬ Workstations generally come with a large, high-resolution graphics screen, at large amount of RAM, built-in network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive.

Personal computer

It can be defined as a small, relatively inexpensive computer designed for an individual user. A desktop computer is a personal computer used to handle daily tasks by individual users. It is used for tasks such as word processing, web browsing, gaming, accessing audio files, video files, etc. ¬ It is designed for regular use at a single location on or near a desk or table due to its size and power requirements

Applications of Computers

In the last few decades, computer technology has revolutionized the businesses and other aspects of human life all over the world. Nowadays every company, large or small, is directly or indirectly dependent on computers for data processing.

Some of the areas where computers are being used are listed below.

Science: Scientists have been using computers to develop theories, to analyse and to test the data. The fast speed and the accuracy of the computer allow different scientific analyses to be carried out. They can be used to generate detailed studies of how earthquakes affect buildings or pollution affects weather pattern etc.

Education: Computers have also revolutionized the whole process of education. Currently, the classrooms, libraries and museums are utilizing computers to make the education much more interesting. Computer-aided education (CAE) and computer-based training (CBT) packages are making learning much more interactive.

Medicine and Healthcare: There has been an increasing use of computers in the field of medicine. Now, doctors are using computers right from diagnosing the illness to monitoring a patient's status during complex surgery. By using automated imaging techniques, doctors are able to look inside a person's body and can study each organ in detail (such as CAT scans or MRI scans)

Engineering/Architecture/Manufacturing: The architects and engineers are extensively using computers in designing and drawings. Computers can create objects that can be viewed from all the three dimensions, By using techniques like virtual reality, architects can explore houses that have been designed but not built.

Entertainment: Computers are finding greater use in the entertainment industry. They are used to control the images and sounds. Computerized animation and colourful graphics have modernized the film industry.

Communication: E-mail or electronic mail ,instant chat messengers, video conferences etc are widely used for communication using computers.

Business Application: The computer plays a vital role in business communication ,inventory management, Sales analysis ,advertisement ,employ recruitment etc.

Publishing: In Desktop Publishing (DTP), with the help of a computer one can perform all the publishing job .

Banking: All banking transactions nowadays are made using computers . ATM services are widely used for cash deposit and withdrawal.

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/

Data and Information

Data

Unorganized fact and figures is called data. It can be any number, text, video, audio etc.

Example: Afran , 20 , old, year .

Information

Processed data are called Information. They are organized and meaningful.

Example: Afran is 20 year old