Paper Code: **Semester-I**

BASICS OF COMPUTER-I

Bachelor of Commerce (B.Com)
Three Year Programme

B.Com-I (First Semester)
Basics of Computer-I
PAPER CODE:

Theory Paper Max Marks: 80

Time: 3 Hrs **Internal marks: 20**

Note: - The Examiner shall set nine questions in all covering the whole syllabus. Question No.1 will be compulsory covering all the units and shall carry 8 small questions of 2 marks each. The rest of the eight questions will be set from all the four units. The examiner will set two questions from each unit out of which the candidate shall attempt four questions selecting one question from each unit. All the questions shall carry 16 marks each.

Unit-I

Fundamentals of Computers: Model of a digital computer, functioning of a digital computer, Historical evolution of computers, Classification of computers: According to Purpose, According to Technology, According to Size and Storage Capacity, Human being v/s Computer.

Unit-II

Input output devices Storage devices: Input Devices: Mouse, Keyboard, Light pen, Track Ball, Joystick, MICR, Optical Mark Reader and Optical Character Reader Scanners, Voice system, Web Camera. Output Devices: Hard Copy Output Devices; Line Printers, Character Printers, Chain Printers, Dot-matrix Printers, Daisy Wheel Printer, Laser Printers, Ink Jet Printers; Plotters, Soft Copy device – Monitor, Sound Cards and speakers.

Unit-III

Introduction to windows: Types of windows, Windows as an operating system, Windows explorer, using clipboard, using paint brush, control panel installing a printer.

Unit-IV

MS-WORD: Fundamentals of MS-WORD: Menus, Toolbars, Ruler Scroll bar, creating, Editing saving. Importing Exporting and insert fig files; Working with Frames, Columns, Pictures, Tables, Macros and Mail Merge.

Suggested Readings:

1. Introduction of Information System ALEXISLEON,
2. Computer Fundamentals-Nasib Singh Gill.

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Remarks

CHAPTER-1

FUNDAMENTALS OF COMPUTERS

OBJECTIVES OF THIS LESSON

This lesson is aimed to make you understand the following about a computer system:

- Historical evolution of computers and computer generations
- Working model of a digital computer and functions of a digital computer
- Basic characteristics of digital computer
- Types of computers
- Classification of digital computers-
- Similarities between human beings and computer system

STRUCTURE OF THIS LESSON

1.1 INTRODUCTION

Let us begin with the word ‘compute’, which means ‘to calculate’. We all are familiar with calculations in our day to day life. We apply mathematical operations like addition, subtraction, multiplication, etc. and many other formulae for calculations. Simpler calculations take less time but complex calculations take much longer time. Another factor is accuracy in calculations. So man

Remarks

explored the idea to develop a machine which can perform this type of arithmetic calculation faster and with full accuracy. This gave birth to a device or machine called **'computer'**.

Definition of Computer

"A computer is an electronic machine that operates under the control of instructions, that accepts the input data, processes or manipulates the given data according to the predefined instructions and stores the result for future use".

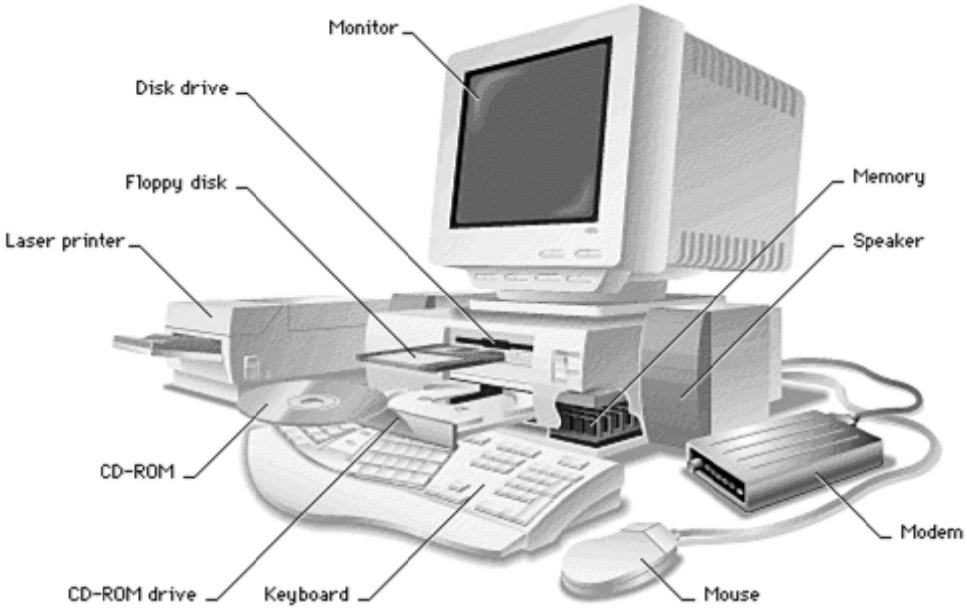

Figure 1.1: Components of a Computer

It can also retrieve the stored results as and when required again. Now-a-days, data is processed with the help of computer. This modern technique to process data is known as Electronic Data Processing (EDP). Computer is also known as Electronic Data Processing machine.

The term data processing means:

- Arithmetic and logical operations on data to get required results.
- To send and receive information from one location to another.
- Arranging data into a specific order etc.

1.2 HISTORICAL EVOLUTION OF COMPUTERS

Man has developed from time to time various instruments to assist him in day-to-day calculation and for his data-processing needs. Depending upon the type of instruments used, the span of period has been split into following three ages:

- ***Dark Age (5000 B.C. - 1890 A.D.)***
- ***Middle Age (1890 - 1944)***
- ***Modern Age (Since 1944)***

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Dark Age (5000 B.C. - 1890 A.D.)

In this age all the computing devices were manual-mechanical in nature and all the earliest data processing equipment were all manual-mechanical devices. We refer to the era when these machines were used exclusively as the Dark Ages of data processing. This age introduced several devices such as Abacus, Napier's bones, Pascal's Calculator, etc.

Middle Age (1890-1944)

In the Middle Age, all computing devices were electro-mechanical in nature. In other words, these worked mechanically with the help of electricity. Examples include Hollerith's Tabulating Machine, Atanasoff Berry Computer (ABC), etc.

Modern Age (Since 1944)

Computers changed over time; they improved in speed, power and efficiency. Those changes are recognized as a progression of generations of discoveries, each characterized by specific developments.

Mark I (1944)

Howard H. Aiken of Harvard University in 1937 designed a machine that could automatically perform a sequence of arithmetic operations and it was completed in 1944. It was named Mark I. It was an electromechanical (relay) device, like the calculators which preceded it.

1.3 COMPUTER GENERATIONS

Each generation of computers is characterized by major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, and more powerful and more efficient and reliable devices. Read about each generation and the developments that led to the current devices that we use today.

The term generation indicates the type of technology used in the computer construction. As new technology was emerging, it was being used in the making of computer. The new technology improved the speed, accuracy and storage capacity of the computers. Different technologies have been used for computers in different times.

Therefore, computers can be divided into five generations depending upon the technologies used. **These are:**

1. First Generation (1946 – 1959)
2. Second Generation (1959 – 1965)
3. Third Generation (1965 – 1971)
4. Fourth Generation (1971- 1985)
5. Fifth Generation (1985 onwards)

1.3.1 First Generation (1946-1959)

All subsequent computers after Mark I were all electronic. The early first-generation computers were powered by thousands of vacuum tubes. The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. A magnetic drum, also referred to as drum, is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored. Magnetic drums were once use as a primary storage device but have since been implemented as auxiliary storage devices.

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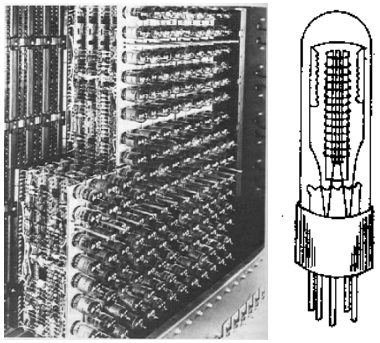

Figure 1.2: Vacuum Tubes

Examples:

- Electronic Numerical Integrator and Calculator (ENIAC),
- Electronic Discrete Variable Automatic Computer (EDVAC)
- Electronic Delay Storage Automatic Computer (EDSAC)
- UNIVAC I

Characteristics of First Generation

- *Vacuum tubes*
- *Magnetic tape and magnetic drum for external storage*
- *Punched cards for input*
- *Punched cards and paper for output*
- *Machine and assembly languages*
- *Human operators to set switches*
- ***Examples :*** *UNIVAC I, UNIVAC II, Datamatic 100, EDSAC, Burrough 2202, etc.*

1.3.2 Second Generation (1959-1965)

Transistors replaced vacuum tubes and ushered in the second generation computer. Transistor is a device composed of semiconductor material that amplifies a signal or opens or closes a circuit. Invented in 1947 at Bell Labs, transistors have become the key ingredient of all digital circuits, including computers. Today's **latest microprocessor** contains tens of millions of microscopic transistors.

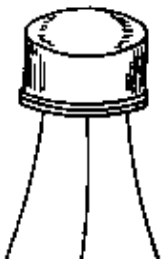

Figure 1.3: Transistor

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The first computers of this generation were developed for the atomic energy industry.

Characteristics of Second Generation

- *Transistors*
- *Magnetic-core storage*
- *Magnetic tape and magnetic disk for external storage*
- *Punched cards and magnetic tape for input*
- *Punched cards and paper for output*
- *High-level languages- FORTRAN, COBOL, PL/I, BASIC and others*
- *Human operators to handle cards*
- ***Examples :*** *Honeywell 200-, 400-, 800-series, IBM 7070/7080, CDC 1604, Burrough B5000 series, etc.*

1.3.3 Third Generation (1965-1971)

During this time integrated circuits with transistors, resistors, and capacitors were etched onto a piece of silicon. This reduced the price and size of computers, adding to a general trend in the computer industry of miniaturization. The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.

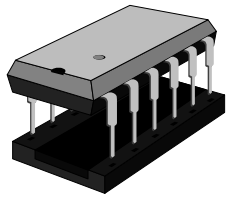

Figure 1.4: Integrated Circuits

Characteristics of Third Generation

- *Integrated circuits*
- *Improved disk storage*
- *Monitors and keyboards for input and output*
- *More high-level languages, including RPG and Pascal*
- *First complete operating system meant less involvement for human operators*
- *Family of computers introduced allowing compatibility*
- *Minicomputers used commercially*
- *Examples: IBM System/360, IBM System/370, Burrough 5700/6700, PDP-8 Series, PDP-11 Series, etc.*

1.3.4 Fourth Generation (1971-1985)

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits we rebuilt onto a single silicon chip. A silicon chip contained a CPU. In the world of personal

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computers, the terms microprocessor and CPU are used interchangeably. At the heart of all personal computers and most workstations sits a microprocessor.

Figure 1.5: Microprocessor

Microprocessors also control the logic of almost all digital devices, from clock radios to fuel-injection systems for automobiles.

Three basic characteristics differentiate microprocessors:

- **Instruction Set:** The set of instructions that the microprocessor can execute.
- **Bandwidth:** The number of bits processed in a single instruction.
- **Clock Speed:** Given in megahertz (MHz), the clock speed determines how many instructions per second the processor can execute.

Characteristics of Fourth Generation

- *LSI and VLSI*
- *Magnetic disk most common external storage*
- *Introduction of microcomputers*
- *Fourth-generation languages (4GLs) emerged and application software for microcomputers became popular*
- *Microcomputers used - Compaq Deskpro 386*
- ***Typical examples** : Burroughs B7700 and HP 3000 minicomputers*

1.3.5 Fifth Generation (Beyond 1985 and till-date)

The changes that have occurred since 1985 are plentiful. Computers have got tinier, more reliable, and many times faster. Computers are mostly built using components from many different corporations.

Computers have become more and more online orientated in modern times, especially with the development of the World Wide Web. Popular companies like Google and Yahoo! were started because of the internet.

Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. Artificial Intelligence is the branch of computer science concerned with making computers behave like humans. The term was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology.

Characteristics of Fifth Generation

- *Development of true artificial intelligence*
- *Development of Natural Language Processing*

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- *Advancement in Parallel Processing*
- *Advancement in Superconductor Technology*

Fifth generation computers are supposed to be the ideal computers. The scientists are working to design such computers that will have the following features.

1. Having their own thinking power
2. Making decisions themselves
3. Having capabilities of learning
4. Having capabilities of reasoning
5. Having large capacity of internal storage
6. Having extra high processing speed
7. Having capabilities of parallel processing

1.4 MODEL OF A DIGITAL COMPUTER

Modern computer systems are available in numerous physical shapes and sizes, and truly speaking there is no end to it. In Computer System, different parts of a computer are organized in such a way that, it helps to perform various operations to complete the given specific task. A computer is a sort of electric brain, which capable to solve mathematical problems with in movements or produce desired information or a controlling order.

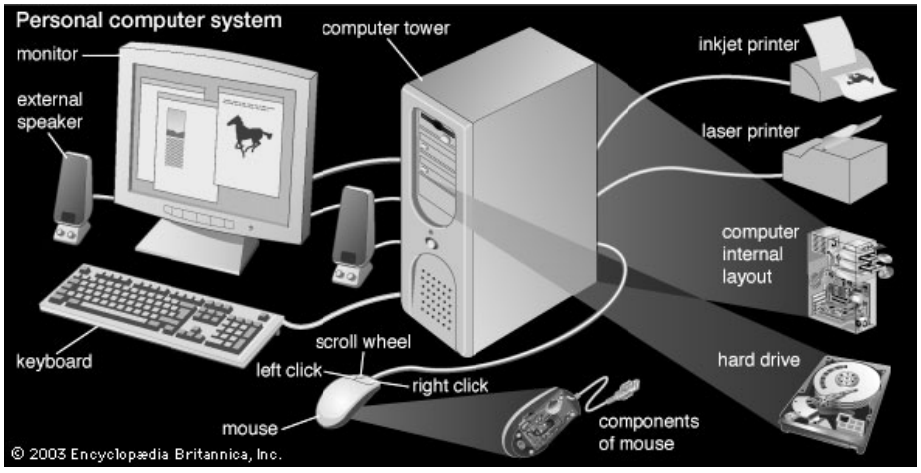

Figure 1.6: Basic Components of a Digital Computer

All modern digital computers consist of three main components. These are indicated in the block diagram ***(Fig. 1.7).***

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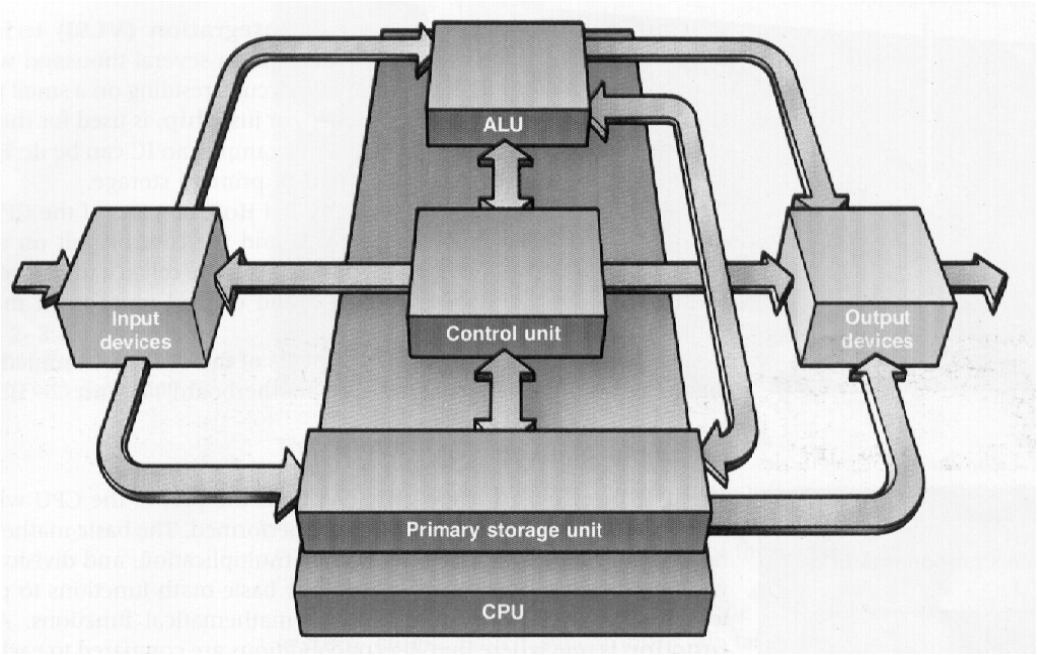

Fig. 1.7: Model of a Digital Computer

1.5 FUNCTIONING OF A DIGITAL COMPUTER

Let us now study the organisation and function of each unit in detail.

I. Input Unit

A unit provided to supply data to the computer is called ***Input Unit.*** This unit is also called Input Devices Unit and uses devices like mouse, lightpen, keyboard etc. to transfer data/information to the computer directly or may collect data on magnetic disks and tapes and later transfer it to the system.

Peripherals is the term applied to all devices that are connected to the CPU but are not part of the CPU. These include the Input/Output (I/O) and mass storage devices and other computer devices such as analog-to-digital converters. The collection of all peripheral equipments is called the computer configuration.

There are two types of peripherals given as under:

i) Off-line Peripheral and

ii) On-line Peripheral.

Auxiliary devices that are not directly connected to the CPU, such as keypunches, card sorters, and so on. These are called off-line devices. The term on-line devices refers to equipment that is connected to the CPU.

II. Central Processing Unit (CPU)

This unit is called the brain or heart and soul of the computer system. It comes in different shapes viz. Vertical CPU, Mid-Tower, Horizontal CPU, etc. Few popular CPU types are shown in ***Fig. 1.8.***

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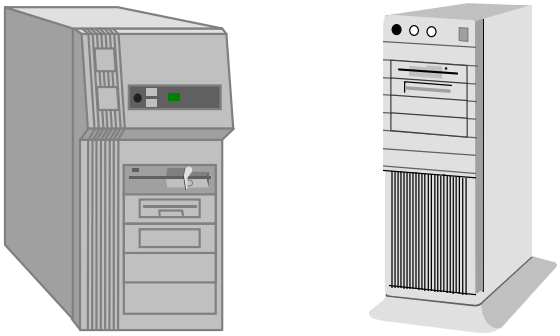

(a) Mid Tower CPU *(b) Vertical CPU*

Fig. 1.8: Few Popular CPU Shapes

It has the following three sub-units:

i) Primary Storage Unit (or Memory Unit)

ii) Arithmetic & Logic Unit (ALU)

iii) Control Unit

a) Primary Storage Unit

We are already aware that the computer is capable of storing data/instruction/information into it. Where does the data get stored? The answer to this question is the memory unit. Memory is a part of the microcomputer that holds data for processing, instructions for processing the data and information i.e. processed data.

As we have different types of data to be stored, this memory unit has four major logical areas, which are not shown in the figure to avoid complexity.

i) Input Storage Area

The input data does not straight away go to the processor. It is first stored in this area till the processor asks for it.

ii) Working Storage Area

'Working storage area' is like a sheet of scratch paper. When the data is being processed, there are some intermediate results that are not required as output but are required to obtain the output. Such results are stored in ***working storage area***.

iii) Output Storage Area

The final output is not taken by the output devices immediately but is stored in memory till the output device is ready to receive it. Thus an ***'output storage area'*** holds the finished results of the processing operations until they are released on the output device.

iv) Program Storage Area

In addition to above, the primary storage also contains a ***'program storage area'***. The instructions for data manipulation are stored in this area.

b) Arithmetic & Logic Unit (ALU)

This unit is capable of performing arithmetic operations and logical operations on the data stored in storage area. The basic arithmetic and logical operations include addition, subtraction, multiplication,

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division, ORing, ANDing, NOT (complementing), increment, decrement, shifting, clearing operations, etc. The data is transferred to ALU for processing and the intermediate results and final results are transferred to the storage area.

c) Control Unit

This unit controls the operation of each unit of computer system by issuing control signals on the basis of instructions provided to the computer as a program. So this unit can be called the central nervous system of the computer. This unit generates timing and control signals necessary for execution of instructions. It provides status, control and timing signals necessary for the operation of other parts of the CPU, memory, and I/O devices. It controls the entire operation of the computer. It is actually the control section of the CPU, which acts as the brain of a computer.

III. Output Unit

The result generated by CPU is either transferred directly or from the output area of the memory to the output devices like visual display units (VDU) or printers, etc.

Mass Storage Devices

The primary storage area of the computer is limited in size and is expensive. Only, the frequently required instructions are stored in it. To supplement this limited memory, we use auxiliary or secondary storage devices like magnetic tapes and disks. The data can be transferred to/from these devices by the processor at a very fast speed. But as compared to primary storage, secondary storage is slow. But the advantage of secondary storage devices is that apart from being cheap, they are transferable which primary storage is not. There is no limit to secondary storage memory. This can be compared to human beings who use a note-book or pocket-diary to store the notes to supplement the brain.

1.6 CHARACTERISTICS OF DIGITAL COMPUTER

Now-a-days computer is playing a main role in everyday life it has become the need of people just like television, telephone or other electronic devices at home. It solves the human problems very quickly as well as accurately. The important characteristics of a computer are described below:

1. Speed

2. Arithmetical and Logical Operations

3. Accuracy

4. Reliability

5. Storage

6. Retrieving data and programs

7. Automation

8. Versatility

9. Communications

10. Diligence

11. No Feelings

12. Consistency

13. Precision

Remarks

1.7 CLASSIFICATION OF COMPUTERS

Though in general we use digital computers, however, present day computers may be classified into three categories:

- *Analog*
- *Digital*
- *Hybrid*

1.7.1 Analog Computers

Analog computers are computers which work on the basis of continuous measurement of physical quantities, e.g. pressure, voltage, current, temperature, current, length, etc. We can quote a number of instruments that work on the principles of analog computers.

Limitations of Analog Computers

- *These don't have logical facilities afforded by programming*
- *Don't have the ability to store data in large quantities*
- *Cost of implementation of computation is very high*

Examples **:** Thermometer, Speedometer, Wall-clock, Voltmeter, Ammeter, etc.

1.7.2 Digital Computers

Digital computers are computers which represent data in terms of discrete number and processes data using the standard arithmetic operations. These computers directly operate on numbers and produce precise results. These are used in a unlimited number of applications. The basic differences between analog and digital computers are listed in ***Table No. 1.1.***

We will be concerned with digital computers only because of the following reasons :

- *The tasks that can be done on analog computers can also be done on digital computers while the reverse is not true.*
- *To understand the calculations made by an analog computer, some mathematical background is necessary, whereas digital computer can be used and understood without much mathematical background.*
- *The digital computer is used extensively in many areas of application.*

1.7.3 Hybrid Computers

Design features of Analog and Digital computers can be combined to create a Hybrid Computer. Such computers are used for special applications only. Examples of such computers include:

- *Chemical Process Control*
- *Patient Monitoring System*
- *Electronic Calculating Scale*
- *Missile Guidance Computer*
- *Flight Simulators For Training Air-plane Pilots*
- *Petroleum Distillation Monitoring Systems*

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1.7.4 Difference between Analog and Digital Computers

Table 1.1 : Analog Vs. Digital Computer

S.No	*Analog Computers*	*Digital Computers*
1.	Represent continuous measurement of physical quantities e.g. rotation, voltage, temperature, etc.	Represent numbers by discrete coded patterns
2.	Accuracy is quite limited	Unlimited accuracy
3.	Represent physical or mathematical quantities	Represent numbers, letters and other symbols
4.	Data-storage scattered in various non-interchangeable devices	Data-storage concentrated in space, interchangeable and unlimited in duration
5.	Distinct elements used for each operation	Identical elements used in sequence
6.	Sets up analogy of problem	Breaks down problem into arithmetic operations
7.	Best-suited to represent measurable quantities and simulate response of physical systems by mathematical analogies	Best suited to handle discrete random processes, statistical data, and numerical problems of business and scientific nature
8.	Serves as model and mirrors relations of actual system	Digital computer compounds arithmetic data, unrelated to system it represents
9.	Operations usually carried out in real-time of physical system	Time of operations usually does not correspond to real-time.
10.	Relatively few devices used and easier programming	Many devices needed and difficult programming
11.	Basic operation performed by relatively few 'single-purpose' devices (integrators, multipliers, magnitude-comparators, etc.	Operation performed by relatively many interchangeable arithmetic devices such as adders, registers, accumulators, etc.

1.8 CLASSIFICATION OF DIGITAL COMPUTERS

There is a wide variety of computers in the market today which differ in terms of physical size, price, capacity, and performance. The variety is so wide that it is sometimes difficult to see those elements that are shared by many computers and those elements that tend to differ among computers.

Depending upon their speed and memory size, computers are classified into following four main groups.

1. Supercomputer
2. Mainframe computer

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3. Mini computer
4. Microcomputer

This classification implies differences between classes between in one or more characteristics. In the 1960s, before the microcomputer, there was a clear-cut distinction between minicomputers and mainframes. The most important characteristics that could be used to differentiate the two types of computers were :

- *Speed*
- *Instruction sizes*
- *Number of CPU registers*
- *Word Length*
- *Main Memory Size*
- *Complexity of I/O modules*
- *Operating System Complexity*
- *Physical size*
- *Cost*
- *Virtual address space*
- *Secondary Memory Size*
- *Degree of Multiprogramming*

1.8.1 Supercomputer

Supercomputer is the most powerful and fastest, and also very expensive. It was developed in 1980s. It is used to process large amount of data and to solve the complicated scientific problems. It can perform more than one trillions calculations per second. It has large number of processors connected parallel. So parallel processing is done in this computer. In a single supercomputer thousands of users can be connected at the same time and the supercomputer handles the work of each user separately.

Supercomputers are mainly used for:

- Weather forecasting.
- Nuclear energy research.
- Aircraft design.
- Automotive design.
- To control industrial units.

A supercomputer is shown in ***Fig. 1.9.***

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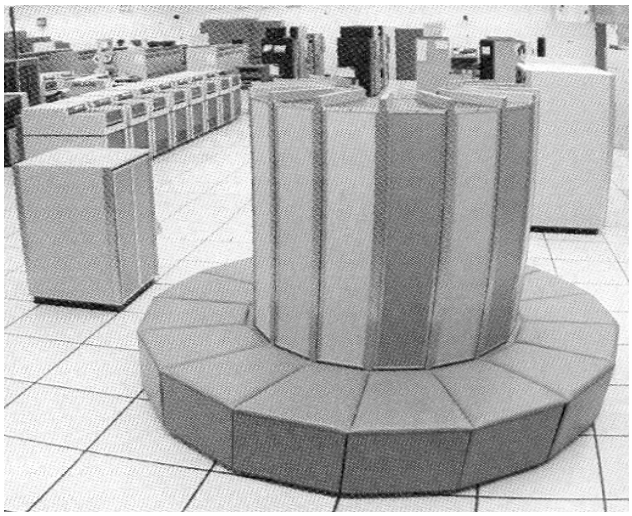

Fig. 1.9: Super Computer

Examples :

- *CRAY X-MP/14, X-MP/24, X-MP/48*
- *CRAY Y-MP, Y-MPC*
- *CRAY 2*
- *CRAY 3*
- *ETA (EDC-ETA 10, ETA 20)*
- *C-DAC's PARAM*
- *NEC (NEC SX-3)*
- *IBM 3090 (with vector)*
- *Fujitsu (VP Series)*
- *Hitachi (HITAC S-300)*
- *PARAM,*

  etc.

1.8.2 Mainframe Computers

The mainframe remains a distinct class of computers and is very powerful large general purpose computers. Large organisations use mainframe computer. Some of the key differences between the high end of mainframe class and the high end of the minicomputer class are there. One of the most dramatic differences is the speed of the two classes.

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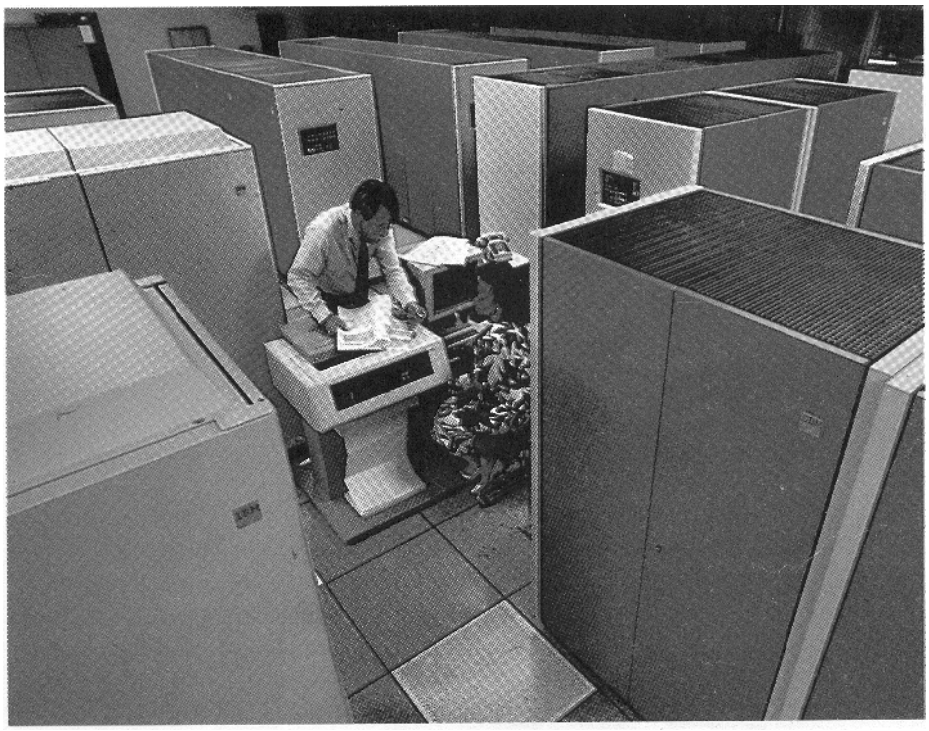

Fig. 1.10: Mainframe Computer

Examples :

- *DEC's VAX-8350, -8650*
- *HP 9000 Model 870S/400, Model 870S/300*
- *IBM 4300 Series (small to medium-size models)*
- *IBM 308X Series (large models)*
- *Latest model IBM 3090 Series (IBM 3090/600 installed in 1988)*
- *IBM Enterprise System/9000 Series*
- *ICL Series*
- *MEDHA Series*
- *Sperry Series; etc.*

1.8.3 Minicomputers

Minicomputers are faster and more powerful than microcomputers. The word-length of these computers is usually 32-bits or more. A minicomputer can support up to 64 or even 100 terminals. Minicomputers can support a greater variety of fast peripheral devices. Minicomputers are extensively used for multi-user and interactive applications in colleges, universities, research organisations, government organisations, industries and so on. These are also used for sophisticated real-time Industrial controls and interactive engineering design work.

Examples :

- *Wipro S-68030V and S-68033V built around Motorola 68030 CPU*

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- *HP 9000 series 800 (a Supermini) built around HP's VLSI RISC Processor*
- *HCL Magnum built around 68030 and 68040 CPUs*
- *IBM AS/400/B60 (installed in 1988)*
- *DEC's VAX 8842 (installed in 1988)*
- *Wipro LandMark 860 (a Supermini) built around Intel's 64-bit RISC processor i860 CPU, and so on.*

The capabilities of a minicomputer are between mainframe and personal computer. These computers are also known as midrange computers.

The minicomputers are used in business, education and many other government departments. Although some minicomputers are designed for a single user but most are designed to handle multiple terminals. Minicomputers are commonly used as servers in network environment and hundreds of personal computers can be connected to the network with a minicomputer acting as server like mainframes, minicomputers are used as web servers. Single user minicomputers are used for sophisticated design tasks.

The first minicomputer was introduced in the mid-1960s by Digital Equipment Corporation (DEC). After this IBM Corporation (AS/400 computers) Data General Corporation and Prime Computer also designed the mini computers.

1.8.4 Microcomputers and its Types

The microcomputers are also known as personal computers or simply PCs. Microprocessor is used in this type of computer. These are very small in size and cost. The IBM's first microcomputer was designed in 1981 and was named as IBM-PC. After this many computer hardware companies copied the design of IBM-PC. The term "PC-compatible" refers any personal computer based on the original IBM personal computer design.

On the basis of cost and performance, personal computers can be classified as :

- *Personal Computer (PC)*
- *Personal Computer with Extended Technology (PC/XT)*
- *Personal Computer with Advanced Technology (PC/AT)*
- *Super AT or Super Micro*

Personal Computer (PC)

PC is the simplest and cheapest type of personal computer. It uses Intel 8086/8088 as CPU, 640 KB RAM, 8KB ROM and normally two floppy disk drives. One of the drives is normally meant for holding bootable floppy diskette and the second one is used for holding the application package as well as for secondary storage. This type of computer does not contain any hard-disk. It is a single-user system. Its ROM can be extended from 8KB to 64 KB. It uses MS-DOS operation system. It may also employ 8087 math co-processor.

PC/XT

This type of computer contains hard-disk(s) as well as floppy disk drive i.e. 360 KB/1.2 MB. Its cost is obviously more than the PC due to additional components. It is also a single-user system. Its ROM

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can also be extended up to 64 KB. It also normally uses MS-DOS operation system. It may also employ 8087 math co-processor.

PC/AT

It contains 80286 as CPU, 640 KB RAM (can be expanded to 4 MB), 64 KB ROM (can be expanded to 128 KB), hard-disk drive and floppy-disk drive (360 KB/1.2 MB). Microprocessor 80286 is more powerful than the microprocessors of PC and PC/XTs. Up to 4 terminals can be connected to PC/AT to make it multi-user system by using XENIX as an operating system. Hard-disk capacity may lie in the range 20-80 MB. It uses 80287 math co-processor. Processing speed of PC, PC/XT and PC/AT lies in the range 1-5 MIPS.

Super AT (or Super micros)

These computers use a 32-bit CPU such as Intel 80386 or 80486. The processing speed of 80386 and 80496 may range from 3 to 5 MIPS and 12 MIPS at 25 MHz respectively. RAM size of these lie in the range 2-8 MB. In case of 80386 microprocessor, it can be extended up to 32 MB and in case of 80486 up to 64 MB. Hard-disk capacity of these lies in the range 200 MB-780 MB. Normally, UNIX is used as a multi-user operating system on these systems. 80386 CPU offers the connectivity up to 8-12 terminals whereas 80486 offers the connectivity up to 16-64 terminals.

Personal computers are available in two models. These are:

1. Desktop PCs
2. Tower PCs

A desktop personal computer is most popular model of personal computer. The system unit of the desktop personal computer can lie flat on the desk or table. In desktop personal computer, the monitor is usually placed on the system unit.

Another model of the personal computer is known as tower personal computer. The system unit of the tower PC is vertically placed on the desk of table. Usually the system unit of the tower model is placed on the floor to make desk space free and user can place other devices such as printer, scanner etc. on the desktop. Today computer tables are available which are specially designed for this purpose. The tower models are mostly used at homes and offices.

Microcomputers are further divided into following categories.

1. Laptop computer
2. Workstation
3. Network computer
4. Handheld computer

Laptop computer

Laptop computer is also known as notebook computer. It is small size (85-by-11 inch notebook computer and can fit inside a briefcase. The laptop computer is operated on a special battery and it does not have to be plugged in like desktop computer. The laptop computer is portable and fully functional microcomputer. It is mostly used during journey. It can be used on your lap in an airplane. It is because it is referred to as laptop computer.

Remarks

Workstations

Workstations are special single user computers having the same features as personal computer but have the processing speed equivalent to minicomputer or mainframe computer. A workstation computer can be fitted on a desktop. Scientists, engineers, architects and graphic designers mostly use these computers.

Workstations use sophisticated display screens featuring high-resolution color graphics and operating systems such as UNIX, Windows NT, 95, 98 those permitted multitasking. Workstations also use powerful networking links to other computers.

Most significant feature of workstations is the powerful processor which churns out results much faster than the PCs.

Examples : Sun-, Apollo-, Hewlett-Packard-, NeXT- and IBM-workstations.

Network Computers

Network computers are also version of personal computers having less processing power, memory and storage. These are specially designed as terminals for network environment. Some types of network computers have no storage. The network computers are designed for network, Internet or Intranet for data entry or to access data on the network. The network computers depend upon the network's server for data storage and to use software. These computers also use the network's server to perform some processing tasks.

Handheld Computer

In the mid 1990s, many new types of small personal computing devices have been introduced and these are referred to as handheld computers. These computers are also referred to as Palmtop Computers. The handheld computers sometimes called Mini-Notebook Computers. The type of computer is named as handheld computer because it can fit in one hand while you can operate it with the other hand. Because of its reduced size, the screen of handheld computer is quite small. Similarly it also has small keyboard. The handheld computers are preferred by business traveler. Some handheld computers have a specialized keyboard. These computers are used by mobile employees, such as meter readers and parcel delivery people, whose jobs require them to move from place to place.

The examples of handheld computers are:

1. Personal Digital Assistants
2. Cellular telephones
3. H/PC Pro devices

Personal Digital Assistants (PDAs)

The PDA is one of the more popular lightweight mobile devices in use today. A PDA provides special functions such as taking notes, organizing telephone numbers and addresses. Most PDAs also offer a variety of other application software such as word processing, spreadsheet and games etc. Some PDAs include electronic books that enable users to read a book on the PDA's screen.

Many PDAs are web-based and users can send/receive e-mails and access the Internet. Similarly, some PDAs also provide telephone capabilities.

Remarks

Cellular phones

A cellular phone is a web-based telephone having features of analog and digital devices. It is also referred to as Smart Phone. In addition to basic phone capabilities, a cellular phone also provides the functions to receive and send e-mails & faxes and to access the Internet.

H/PC Pro Devices

H/PC Pro dive is new development in handheld technology. These systems are larger than PDAs but they are not quite as large as typical notebook PCs. These devices have features between PDAs and notebook PCs. The H/PC Pro device includes a full-size keyboard but it does not include disk. These systems also have RAM with very low storage capacity and slow speed of processor.

1.9 HUMAN BEINGS VS COMPUTER SYSTEMS

We have already gone through the anatomy of a digital computer and functioning of a computer system using its various components. Besides, we are also well versed and aware with the functioning of human-beings using its various organs.

Processing of data by hand is satisfactory only when the amount of data to be processed is small and also the manual data processing is slow, monotonous and often subject to error. Human-beings utilises past experiences and intuitions for decision making whereas computer follows an algorithmic procedure. Human-beings as a decision maker utilises heuristic. Society will benefit most if complementary strengths of human beings and computers are utilised. Definitely, computers today have more intelligence than in the past and the strides are being made to increase machine capabilities.

The Newell-Simon model suggests that there are limitations on the ability of human as information processors :

* *One set of limits concerns the processing of data and is directly related to short-term memory*
* *Another set of limits is the ability of humans to detect differences*
* *Humans are also limited in their ability to generate, integrate, and interpret probabilistic data.*

Functional similarities of a computer system with human being is in the following ***Table 1.2.***

Table 1.2 :Computer Vs. Human-being (Similarities)

S.NO.	COMPUTER ELEMENT	PURPOSE	HUMAN-BEING
1.	Input	*Used to receive data and instructions in computer-compatible form*	*Input to the system is through ears, eyes, mouth or nose*
2.	Main Storage	*Used to hold input data and instructions temporarily before it is processed*	*Data and instructions are stored in brain and can be recalled whenever needed*
3.	Secondary Storage	*Used as an extension to main storage and the*	*Use pocket-diaries, notebooks, etc. to store*

Remarks

		contents stored in it are retained permanently	*contents for permanent use.*
4.	ALU	*Used to carry out arithmetic and logical computations desired in an instruction execution*	*Portion of our brain is used to carry out comparisons and calculations for helping out in logical judgements*
5.	Control Unit	*Used to receive stored instructions in serial fashion and one at a time.* *Interpret each instruction and prompt its execution by one of the units like input, output, storage or ALU.*	*Our brain controls our mental or body actions on the basis of calculations and comparisons.* *Before taking any action, the old results stored in brain are also referred to and thus brain acts as a CPU.*
6.	Output	*Used to give out results via a suitable device e.g. VDU, printer, plotter, etc.*	*Output is either in the form of a speech using mouth or some action e.g. writing, gesture, body language, etc.*

SUMMARY OF THE LESSON

You learnt the following in this lesson:

- A computer is an electronic machine that operates under the control of instructions, that accepts the input data, processes or manipulates the given data according to the predefined instructions and stores the result for future use.
- In Dark Age (5000 B.C. - 1890 A.D.), all the computing devices were manual-mechanical in nature and all the earliest data processing equipment were all manual-mechanical devices.

  In Middle Age (1890-1944), all computing devices were electro-mechanical in nature
- In Modern Age (SINCE 1944), computers changed over time; they improved in speed, power and efficiency.
- The computers can be divided into five generations depending upon the technologies used. These generation are:
  - First Generation (1946 – 1959)
  - Second Generation (1959 – 1965)
  - Third Generation (1965 – 1971)
  - Fourth Generation (1971- 1985)
  - Fifth Generation (1985 onwards)

Remarks

- Modern computer systems are available in numerous physical shapes and sizes, and truly speaking there is no end to it.
- The important characteristics of a computer are *speed, arithmetical and logical operations, accuracy, reliability, storage, retrieving data and programs, automation, versatility, communications, diligence, no feelings, consistency and precision*
- Though in general we use digital computers, however, present day computers may be classified into three categories – *Analog, Digital and Hybrid.*
- Digital computers are computers which represent data in terms of discrete number and processes data using the standard arithmetic operations
- Design features of Analog and Digital computers can be combined to create a Hybrid Computer. Such computers are used for special applications only.
- Depending upon their speed and memory size, computers are classified into four main groups – Supercomputer, Mainframe computer, Mini computer and Microcomputer.
- The examples of handheld computers are Personal Digital Assistants and Cellular telephones.
- Processing of data by hand is satisfactory only when the amount of data to be processed is small and also the manual data processing is slow, monotonous and often subject to error.
- Human-beings utilises past experiences and intuitions for decision making whereas computer follows an algorithmic procedure. Human-beings as a decision maker utilises heuristic.

SELF ASSESSMENT QUESTIONS AND EXERCISES

1. What is a Computer? What capabilities does a computer possess?
2. How do analog computers differ digital computers?
3. State the criteria for classification of digital computers.
4. Is digital computer more accurate than analog computer? Justify your answer.
5. Discuss the important features of micro, mini, mainframes and super-computers.
6. What are the operations that a computer is able to perform?
7. How do you compare human beings and computers?
8. What are the fundamental components of a computer system? Which component of a computer system executes the program?
9. Why are microcomputers so popular in comparison to other computers?
10. What is a digital computer? Provide its anatomy and explain the functioning of such a computer through its block diagram