UNIT 2 INTRODUCTION TO COMPUTERS

Structure

2.0 OBJECTIVE

After reading this Unit, you will be able to:

- explain what a computer is and how it has been developed into its present from;
- distinguish between different categories and types of computers and identify the characteristics of each;
- identify the functional components of a modern computer system and explain its working;
- differentiate between hardware and software; and
- understand, assess and select suitable application software for the operation and management of information systems and services.

2.1 INTRODUCTION

The creation of computer was in a sense the culmination of several centuries of technological innovation. Today, there is hardly any field of human activity where computer does not find its application.

The computer may enable the next big leap in evolution of human intellect. Let us consider what the computer offers. For example, it gives us direct, focused access to millions of publications from around the world. It allows us to, with almost unlimited capacity, store everything we know, and access it at will. It allows us to communicate with 'local, organisation of wide, and global networks of colleagues with whom we might not otherwise communicate. It also enables us to quickly sketch ideas in a variety of forms and freely manipulate those words, numbers, and images. With the advances taking place in artificial intelligence, the computer can even interact with us as a colleague, pushing us to be more creative and thoughtful. In other words, computers may be considered as supplements of human mind! These might be some of the many reasons as to why the computer has become indispensable in contemporary society.

For the last one and half decades or so, computers are being used in India, in airlines operations, in railways, in banking sector and in other industrial fields. The library and information profession has also become aware of the potential of computer as a powerful tool, which can be utilised to improve both the operational efficiency of library and information personnel, and the quality and range of services provided to users. Such awareness has been reinforced by the successful experiments carried out in this direction in many of the developed countries. It is a common feature to find computers being used in all library and information activities in countries like USA and UK. The availability of computing power at a comparatively

cheaper cost has further contributed to the present use of computers in Indian libraries and information profession.

In other words, today one can observe a lot of effort is directed towards use of computers in a big way for library and information services in India. Computers may be studied at many levels with different points of view. A beginner would always like to know what a computer is and what he needs to know about it in order .to use it effectively to solve his problems.

This Unit introduces some basic concepts necessary to understand the functioning of a modem computer. It also provides the basic information and know-how necessary to understand the ,capabilities of a modem computer and the ways and means of using it effectively to solve problems associated with library and information systems and services.

A brief account of hardware, software and storage aspects has been discussed to enable you to understand the technology relating to computers.

2.2 CONCEPTS AND TERMINOLOGY OF COMPUTER

2.2.1 What is a Computer?

People call a lot of things, computers. Some of them are cheap, but can only process numerical information. Such devices would better be described as `calculators' rather than computers. Historically speaking the word computer has been derived from the Latin word `computere', which means to calculate. Therefore, the term computer can logically be applied to any calculating device. However, in technical parlance, the term has come to refer specifically an electronic computer. In other words, it may be stated that the `computer' uses electronic devices such as transistors, resistors, diodes based on two measurable states (i.e., `on' and `off).

As generally understood computer has some defined characteristics. These are:

i) **It is an electronic device.** That is to say that electronic devices are used as component parts in making a computer.

ii) **It has internal storage**. Computer has an internal storage (memory) for storing both the program as well as the data processed by the computer.

iii) **It has a stored program.** Every computer has a program of instructions, which specifies the sequence of operations to be followed, stored in its internal memory. It is this stored program which makes the computer automatic because the entire set of steps to be taken is determined in advance and no human intervention is required during its execution.

iv) **Program Modification:** A distinguishing feature of the computer is its ability to change the stored program of instructions during the execution of the program steps. The modification is based on the form, quantity or value of the data being processed. In other words, a computer is essentially an electronic device that can receive and store data and a set of instructions and then act upon these instructions in a pre-determined and predictable fashion to process the data in a desired manner. A computer contains a large number of electronic circuits arranged in such a way as to enable it to :

   a) perform arithmetic operations;
   b) evaluate logical conditions;
   c) store values and retrieve values from its memory;
   d) process input and output data.

Although there are many shapes and sizes, makes and prices, computers have some features which are common.

Firstly, computers are able to store internally not only the information to process, but also the set of instructions which tells them how to process it. Both instructions and information are ' represented in the computer as patterns of electrical states in electronic circuits.

Secondly, computers are extremely fast. Since the computer processes information electronically without the use of mechanical moving parts, it can, in principle, process several millions of instructions in a second.

Thirdly, computers process information in coded form. Information is often prepared for computer processing by using a keyboard, and is automatically converted into coded form.

2.3 EVOLUTION OF A COMPUTER

Although `computer', as we understand it today, is relatively of recent innovation, its development rests on centuries' of research. This section presents some of the landmarks that -led to its present state of development. Though machines such as **abacus** have been used as aids in day-to-day numerical calculation for many hundreds of years, it was not until the middle of the nineteenth century that Charles Babbage first devised the idea of a general purpose computing machine. He realised that it should be possible to design a machine which could carry out an infinite number of possible sequences of operations, the actual operations required for any particular purpose being specified by the programming of the machine. This concept of stored program control provides the basis for all modem computers, while Babbage also introduced many other modern concepts, such as the idea of separate storage and arithmetic units in a computer, and the input of programs and data on punched cards.

The engineering technology of Babbage's time did not allow him to implement his designs successfully. Thus, his **analytical engine** could not become popular.

The next landmark in this direction was the effort of Herman Hollerith, who first developed electromechanical calculating machines in 1890. These machines used punched card input arid performed simple arithmetic calculations and card sorting operations. They were controlled by **hand wired** control panels.

In 1920s and early 1930s significant advances in punched card equipment resulted in machines that could not only perform addition and substraction, but also multiplication. These machines have been further improved with capabilities to interpret alphabetic data apart from being able to perform arithmetic operations. With these enhanced capabilities these machines were used for record keeping and accounting functions. That was the reason why such machines were referred to as **`accounting machines'**.

Another significant step towards the development of computer was made in the year 1944 by Froward Aiken of Harvard University in the form of designing an **automatic calculator**, which was known as Mark 1. It was an electronic computer but **utilised electromagnetic relays** and **mechanical counters**. Instructions were fed to Mark 1 by means of holes in a punched paper tape and the result (output) was obtained in the form of holes punched in the card.Maik 1 was an **electromechanical device** rather than an **electronic one**; It was used for the computation of tables of mathematical functions. The substitution of vacuum tubes for electromechanical relays set the stage for development of electronic digital computer. A model electronic digital computer was built by John Atanasoff and his assistant Clifford Berry at Iowa University between the years 1939-1942. In fact, there has been a difference of opinion as to who should be credited with this invention - whether it is J.P. Eckert and John Mauchly or Vincent Atanasoff and Clifford Berry. In 1974, the Federal Court of America declared John Vincent Atanasoff to be the real inventor along with his assistant Clifford Berry. In competition with Atanasoff and Berry for the honour of developing the first electronic computer were J.P. Eckert and J.W. Mauchly of the University of Pennsylvania. Their project was completed' in 1946. The machine they designed was called the -ENIAC (Electronic Numerical Integrator and Calculator). The ENIAC could perform a multiplication in three thousandths of a second (1/3000 of a second). It was a huge machine with 18,000 vacuum tubes and occupied a space of 10 ft high, 10 ft wide and 100 ft long. Since this machine had no internal memory, instructions had to be fed into it by the use of combination of switches. On the other hand; the computer built by Atanasoff and Berry combined a vacuum tube computation unit with a **rotating electrostatic memory drum**. For reasons of simplicity, Atanasoff chose **binary** over **decimal** arithmetic for computation.

Yet another landmark in this direction was the enunciation of coding instructions by John Von Neumann. Neumann's principles paved the way for the development of *the* first stored **Program** computer. A group of experts working at Cambridge University, England had designed a machine EDSAC (Electronic Delay Storage Automatic Computer). EDSAC was the first computer to perform arithmetic and logical operations without human intervention, depending solely on stored instructions. It could perform a computation in **three milliseconds**.

Till 1950, the period was marked by intense research activity to develop stored program, self-sufficient calculating machines and more of these were laboratory prototypes. *In* the year 1951, UNIVAC-l (Universal Automatic Computer) was built by J.W. Mauchly and J.P. Eckert and was commercially made available.

2.3.1 Computer Generations

From the early 1940's to the present, computer scientists have been able to identify clear-cut stages in the development of computer technology. With each stage radical breakthroughs in electronics occurred, with the result that the computers based on the older technology of electronics have been replaced by a newer form of machine& These stages have been referred to as generation, where each computer generation had certain unique characteristics or properties. Some of these aspects are discussed in the following paragraphs.

From first generation of vacuum, tube computers, computer design advanced through developments in hardware and software. On the hardware side, the computer changed with the replacement of vacuum tubes by transistors, the progressive miniaturisation of integrated circuitry, and the development of enhanced electronic memory. The transistor invented at Bell Laboratories in 1948, did not completely replace the vacuum tube in computers *until* the beginning of the 1960s. The second generation of computers was based on transistors and magnetic core memory. Although integrated circuit was developed in the late 1 950s, it was too expensive and untested for wide spread commercial use. However military applications of integrated circuits in the rocket and space flight programmes proved the reliability of integrated circuit technology.

The third generation computers based on integrated circuits and semiconductor memory, appeared in the late 1960s. From 1970s on, rapid advances in large-scale integration (LSI)of transistors on silicon chips, inexpensive random access memory (RAM), and microprocessors led to the production of powerful fourth generation mainframes, midsize minicomputers, personal computers, and workstations. Throughout this period, the steady *advance of semi*-conductor technology allowed the number of transistors on a chip to double every year, reaching the levels of 500,000 transistors integrated on a square centimeter. Chips with one million elements are now in production.

On the software skip, the development of operating systems, computer languages, programming techniques and applications accompanied the changes in hardware. The first computers were programmed with assembly language code. As this method was difficult and lime consuming, programming languages evolved quickly through second generation intermediate code to third generation high level languages. In 1953, John Backus at IBM developed the first high level language, FORTRAN for scientific applications. In the year 1959, Grace Hopper was mainly responsible for the creation of COBOL, a language for commercial and record-keeping applications. The movement from batch processing to time-sharing systems with terminals in the 1960s and 1970s led to the development of more interactive languages such as BASIC and APL Programmers have also written many special purpose languages for artificial intelligence (e.g., LISP and PROLOG), simulation (SNOBOL and SIMULA), and other uses.

In recent years, as computer scientists became concerned with program clarity and efficiency, they created structured modular languages such as Pascal and Modula 2. Structured modular languages are easily understood and maintained than was previously the case. Some fourth-generation languages and software have moved from a procedure-oriented to object-oriented approach for the control of information in the computer. Such fourth generation software allows the user to create Program application by visual programming or making selections from a menu. However, most large programs continue to be written by programmers in procedure-oriented languages.

As computer languages have evolved from first to fourth generation, the user has been moved further and further from the hardware of the machine. Recent software and languages have tended toward an almost natural language or icon interface. The end user is insulated from the rigors of third-generation programming. A third generation programming potential may be embedded in a fourth generation application, but the users do not usually need to do any programming. They can begin productive use of an application in a matter of hours. When fifth-generation intelligent assistant programs are integrated into the existing fourth-generation software, there will be even less call for the user to program the 'machine, The significant aspects relating to different generations of computers are summarised and given in a tabular form.

Table: Different Generations of Computers

First Generation	Second Generation	Third Generation	Fourth Generation	Fifth Generation
Vacuum tubes were used in electronic circuits	Use of transistors	Use of integrated circuits	Use of VLSI techniques	Because of new technology these machines will be different from earlier four generations both conceptually and functionally
Had very small internal memories based on relays or magnetic drums	Utilised magnetic core for internal memory	Magnetic core and solid state main storage	Increased storage capacity and speed of operation	The new machines would be known as Knowledge Information Processing Systems (KIPS)
Machines were physically large and utilised punched card for input	Possessed increased storage capacity	More flexibility with input/output which is disk oriented	Modular design and compatibility between equipment (hardware) provided by different manufacturers	They are going to be based on sophisticated electronics and artificial intelligence
Slow input/output devices	Use of high level programming languages such as FORTRAN, COBOL	Smaller in size, better performance and reliability	Availability of sophisticated programs	They will have natural language interface using knowledge processing systems and problem solving software, utilising parallel processing
Low level symbolic Languages are used for programming purposes	The machines of this generation were smaller in size and produced less heat during operation	Extensive use of higher level programming languages	Greater versatility	Characteristics such as voice recognition, speech synthesis and image processing are going to be associated with the machines of fifth generation
Less reliable	Utilised tape oriented faster I/O devices	Remote processing and time sharing through communications	Greater versatility of I/O devices	Presently only laboratory prototypes are stated to be under experimentation
Intense air conditioning is required	Credited with speed of operation and reliability	Availability of operating system	Internal memory based on semi-conductor devices	
Slow in operation (1/1000th second) per instruction. Example:UNIVAC I, IBM 650.	Useful for batch oriented applications	Usability for on-line processing	Advent of microprocessors and micro computers	
	xamples of machines: IBM 1401, Honeywell 200	Speed of operation in the order of nano second range Example: IBM 360		

2.3.2 Categorisation of Computers

Depending on computing power and other capabilities, computers may be grouped into different categories: super computers, mainframes, mini computers, microcomputers and personal computers. Let us try to understand some of the basic characteristics associated with these machines.

Super Computers

The specialised demands and requirements of science, industry and military have led to the creation of powerful super computers. For numerically intensive computing (geological exploration, wind tunnel simulations, molecular physics, and space and defence systems), computers capable of performing multiple giga flops (billion floating point operations per second) are being produced. These computers, of which Cray is a well known example, use vector and parallel processing to achieve the necessary number-crunching power. Vector and parallel processing require unusual computer architecture and special programming. For vector processing, the computer architecture works with vector arrays rather than discrete scalar elements, and the numerically intensive portions of a program must be written to use this facility. To achieve full speed and power in vector arrays processing, the super computer must not be interrupted in the middle of its program. which limits the interactive use of super computers. Scientists and engineers have found that they can experiment with more design and research solutions in a short period of time on interactive engineering and graphics workstations.

Super computers built with a parallel processing architecture are designed to overcome the processing bottleneck caused by using a Von Neumann-type of single instruction stream. The parallel computer architecture must coordinate communication and timing across an array to allow simultaneous computation of subroutines. Although, massively parallel super computers, such as those made by Sequent and Floating Point Systems, are in principle faster and less expensive than the serial super computers, the unconventional programming required to utilise the parallel architectures has been an obstacle to wide wise of these machines.

It may be stated here that while research continues in the United States and Japan to create faster super computers, some of the techniques employed in super computer architecture are being transferred to microprocessor design. For example, Intel has produced a RISC (Reduced Instruction Set Computing) microprocessor, the 80860, modeled on the Cray super computer. The design uses one million transistors to provide a 64 bit processor, data and instruction caches, integer and floating point math units and a graphics processor. The math units can operate in parallel using a pipe lining system and the data cache. Integrating these functions on a single chip makes it possible to sustain high processor speed over time. The Intel 80860 and similar RISC chips are produced by Motorola and other companies.

Mainframe Computers.

Mainframe computers are large and powerful machines. They usually support many users with varied applications. They can process large quantum's of data at greater speeds (i.e., 10 million instructions per second) and support many input, output and auxiliary storage devices. The mainframes are multi-user facilities and therefore support large network of terminals and remote job entry stations. Generally, they play the role of central machine of a large organisation.

Mini Computers

The mini computers are intermediate in power, and may function as small mainframe computers. They are often dedicated to a particular purpose such as data base access and support several users at a time. Cost wise, they are less expensive compared to mainframes.'

Micro Computers

Micro computer systems have received a great deal of attention in recent years. They are physically small, and relatively cheap. Originally they were of low power and only single user.

Recent developments in chip and processing technology has resulted in the emergence of new micro computers capable of out performing mini computers in certain applications, usually heavy computational or simulation applications.

Descriptions of microcomputers usually refer to the type of chip that is at the heart of the CPU and there are two main 'families' :- The Motorola series and the Intel series.

The Motorola 68000 series are particularly adept at handling graphics and are used in personal computers such as the Commodore, Atari, and Apple Mackintosh ranges.

The Intel series was adopted by IBM and IBM compatibles or clones and is the most widely used in business micro computers.

For example	:	8088/8086 was used in the First IBM PC and then in IBM PC XT and compatibles
80286		formed the basis for the IBM PC AT and compatibles. Software for PC and XT can run on AT machines.
80386		At this juncture the micro computer manufacturers were divided into two camps: IBM Micro Channel Architecture (MCA) ps/2 range and Extended Industry Standard Architecture (EISA). Special software had to be written for the ps/2 range to make full use of its capabilities. EISA machines can make use of existing software.
80486		Introduced in 1989 and capable of out performing mini computers if suitably configured. Available in both MCA and EISA machines.
80586		Under development since 1990
80860		Microchip using RISC (Reduced Instruction Set Computing) technology. This is hailed as bringing the `power of a Cray to your desktop'. Suitable only for `number-crunching' because of the special software that is required, but being incorporated into micro computer as a maths co-processor rather than as the main. CPU. The Motorola equivalent is 88000 series.

It is important to remember that the overall performance of a micro computer is **not determined solely by the processor.** The memory architecture, disk system, graphic system, and input/ output channel also play important roles. The safe rule is to see the machine working with the software of interest to you.

Personal Computers:

These are basically microcomputers used for day-to-day personal applications of individuals. They have become popular due to their low price. In fact, many predictions put forward before 1975 about the ways computers would be used have had to be adjusted to take land account several noteworthy changes brought about by the personal computer:

i) the PC, by allowing individuals to have their own machines, removed many of the obstacles that separated users from mainframes;

ii) through ease of access and portability, the PC user was encouraged to try using the machine in new ways, which stimulated the development of new applications;

iii) the development of a user friendly operating environment allowed refinement of techniques for using the computer as a personal tool in word processing, data management, and a variety of other specialised areas. The wide spread use of personal computers only goes to prove that the computer has transformed itself from a tool of only large institutions and corporations to a tool that can be used generally in society. Users, once passive recipients of a computer service, have been actively involved with the computer and its software. These changes have really altered the relationship between society and computers and given a net meaning to the computer revolution.

Self Check Exercise

l) Explain in a few sentences the main characteristics of a computer.

2) Explain briefly what you understand by the expression ‘computer generations’.

3) How are computers categorized or grouped.

Note: i) Write your answer in the space given below

ii) Check your answer with the answers given at the end of this Unit.

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2.4 HARDWARE BASICS

In the foregoing section of this Unit, an attempt has been made to explain to you the historic perspective relating to the development of computer from its earliest stages to the present day. A brief account of the generations of computers along with a discussion of different types of computers as we understand them today has been provided to enable you to know different characteristics of these machines.

In the present section, an attempt is made to acquaint you with some hardware basics regarding computer.

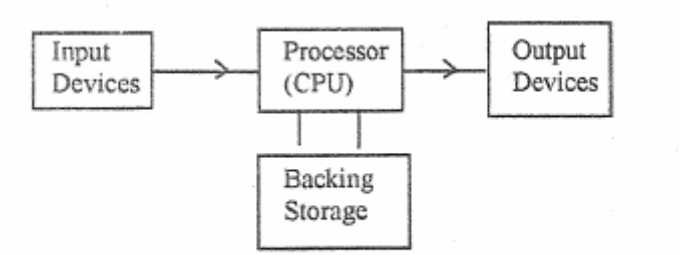
2.4.1 Computer Processing

Most of the earliest computer memories have been based on physical elements which can exist in just one of the two states (on or off): such an element corresponds to one bit of information. Binary symbols are used because electronic devices can store and process them rapidly and cheaply. The physical devices used have been changed greatly,, but the principles of information representation mid manipulation within digital computers have remained essentially the same. The size of a computer can be described by the number of bits (binary digits) which its memory contains, but for most purposes larger units of storage are used to characterise machines. Generally, these are denoted by a byte which normally consists of 8 bits, and is sufficient to represent one character, and a word which can be of length -8, 16, 32 bits, is the smallest unit of storage to which most of the computer's instructions can be applied. Memories are usually described as being of a size measured in Kilobytes (K bytes) or Megabytes (M bytes).

The sets or patterns of bits which make up bytes and words are used to represent all information within a computer, whether it is program instructions or data items. The exact method of representation will vary from one machine to another, particularly with respect to instructions formats. An 8 bit byte can accommodate 256 different bit patterns and so it is sufficient to allow for most of the characters which could be required to be printed, e.g., upper and lower case letters A-Z, together with the numbers 0-9 and also a range of punctuation symbols, with allowance for non-printing characters such as end-of-line. The set of bit patterns corresponding to a set of characters is called a character code. Standard codes are ASCII

and EBCDIC. Numbers are normally represented by one or more computer words. In case of integers, the set of 8,16, or 32 bits (as per the computer's word length) is treated as a binary integer (i.e., encoded in the notation of binary arithmetic). A real number is represented by dividing a computer word into two components: a simple decimal number (i.e., the mantissa portion) together with the power to which it must be raised (i.e., the exponent).

The general pattern of computer architecture has remained unchanged over the last four decades or so. It has a single processor, which accepts data from an input device or obtains it from backing storage, performs some operations on it, and returns the processed data to storage or to an output device. Information is passed between the components by means of a high speed data channel, (see the block diagram of a digital computer) known as a bus. The operation is serial, with a single operation being performed on a single data item.



Block Diagram of a Digital Computer

The result is a general purpose computer, able to be used for different tasks. Over the years many improvements have been made to this sort of computer to improve its speed and power. One example is the emergence of RISC (Reduced Instruction Set Computing) machines, which give faster performance for some types of applications by using a smaller set of machine instructions.

It maybe mentioned that the main change in computer architecture that is now widens/ay is the emergence of parallel processing. In other words, parallel processing machines can perform the same operation on a number of data items at a time, or may have a number of processing units operating independently, performing different operations on different data items simultaneously. Parallelism has been first developed for super-computers. However, the parallelism requires special software for its applicability. Hence its utility is somewhat limited. It may be mentioned that parallel processor machines are now beginning to be used for database applications. Parallel processing is now becoming generally available in the form of transputer which can be attached with or added to microcomputer systems to improve their performance.

Most of the professionals seeking to automate some aspects of information management will be using microcomputers. However, it is desirable to know developments in larger machines.

The schematic diagram provided earlier illustrates the integration of basic elements of a computer system. They are: i) input devices, ii) the central processing unit (CPU), hi) the auxiliary or backing storage' and iv) the output devices. Let us try to understand their functioning.

i) **Input Devices**: each input device of a computer system reads data from a specific form and converts the data into electrical pulses. It then transmits these pulses to an input area in the CPU. There are different types of input devices such as: Keyboard, Pointing devices, Voice input, Barcodes, OCR, and Image Processing.

The Central Processing Unit (CPU)

The CPU is the physical device that controls computer operations. It is considered as the `brain' of the computer system.

The CPU comprises three components: The control unit, the arithmetic/logic unit, and the main memory (main storage) All these are composed of microelectronic devices, virtually always based on silicon semiconductor technology.

The main memory is the largest component of CPU, and is divided into individual computer *words, each of which* may be accessed individually by its address. All present day computers are based upon semiconductor technology, the ability to place many thousands of electronic components Within a limited area of silicon, which has been doped with carefully controlled amounts of other elements. The main memory holds program instructions and data required as the programs operate.

The **arithmetic/logic** unit contains a set of registers or accumulators, individual words of very high speed storage into which words from the main storage are copied, prior to instructions being applied to them. Attached to the registers is the circuitry which carries out the few hundreds of basic operations available to the computer. In essence, when an individual instruction needs to be carried out on some word in the main storage, that word is copied into a register, the appropriate circuitry activated, and the register's contents copied back to the main location.

The control unit extracts program instructions one at a time in the required sequence from their locations in the main storage, decodes them, and issues instructions to the main storage to access the required word, and to the arithmetic/logic unit to activate the required instruction circuitry.

2.4.2 Computer Storage

Computer systems include two types of digital information storage: internal storage, within the CPU, and the backing (back up) storage on external devices such as disks or tapes. Different types of storage media differ according to a number of criteria such as speed of operation, capacity, cost, reliability, the degree to which information is immediately accessible, etc.

Internal Storage

Internal storage is also known as main, primary, or (for historical reasons) core storage, or, memory. It is used to hold those instructions and data required at any moment while a program is running, which must be available instantaneously. Silicon semiconductor chips are now invariably used for internal storage; these are categorised as either RAM (random access memory) or ROM (read only memory) chips.

ROMs are used for data which is never altered for example, a computer's operating system instructions, while RAM is used for data which is liable to change often, and instructions used in the execution of a program.

Internal storage capacity is measured in. bits or bytes and multiples thereof. The size of individual chips comprising the internal memory has rapidly increased from 4 KB (Kilo Byte chip to 16 MB (Mega Byte) chips.

Backup Storage

Back up (backing) storage, also termed **external** storage, is used to hold programs and data which are read into internal storage when required. The most common form now, as for the last thirty years, is magnetic storage media, either tapes or disks. With both of these, data is recorded onto a plastic surface, coated with a varnish containing an oxide which can be magnetised in one or two directions; each magnetisation representing one bit of data. Data is written or read with the help of read/write heads, small electromagnets, close to the surface.

Magnetic tapes are very commonly used for storing large quantum of data *for which* rapid access is not necessary; specially for archival data backups etc. Tapes are cheap means of storing data but access is generally slow. Small cassette tapes, of relatively low capacity are used with microcomputers.

Magnetic Disks are most widely used form of backing storage, suitable for holding information required rapidly for example, data for a running program. In the type of disk drive in larger computer systems, data is recorded on the flat surfaces of a stack of circular disks revolving on a common spindle, with one read/write head for each disk. Access times, typically 0.01

seconds, although much faster than tape, are rather slow, by comparison with other computer operations, and disk access times are one of the main limiting factors in the speed of operation of retrieval systems with information stored on disk.

Disk capacities have increased greatly, from original values of about 10 MB (Mega Bytes to present units with 1 GB (Gigabytes which is one thousand million bytes). Smaller computer systems use **Winchester** disks, with a single hard disk in a sealed unit, floppy disks, which are compact, cheap and convenient for transfer of programs and data. They are limited in storage capacity, with relatively slow access times, and less convenient than a hard disk in day to day use. Floppy disks now are available in two sizes, 5.25 and 3.5 inches.,

Optical disk storage is relatively new alternative to magnetic storage. Digital data is burnt into the surface of a plastic disk coated with a low wetting point metal by a laser beam. The presence or absence of a hole corresponds to one bit and can be read by another laser: This technology offers a high capacity storage at low cost, and in a form allowing rapid access (analogous to magnetic disks).

WORM (Write Once Read Many Times) disks are ideal for archival purposes allowing organisation to store large volumes of documentation on one disk. For instance a 12 inch disk can hold about 2.5 GB at a cost of few hundred rupees. Storage capacities of 5.0 GB is now available. But, the major problem with WORM technology is the absence of any industry standards. Now 10 inch disks (compact version CD-WORM) is being developed.

The **CD-ROM** (Compact Disk Read Only Memory) is a 4.75" disk capable of holding 650 MB. The CD-ROM has become a means of distributing databases and documentation (including journals and patents) in electronic form.

Input and Output

After having understood the characteristics relating to CPU and storage media, let us *try* to learn about I/O aspects of a computer system.

Input /output (I/O) devices now account for more them 50% of the cost associated with microcomputer system. They also have an impact on the ease of use of computer systems, and their popularity with users. Therefore, it is necessary to think carefully about the sort of I/O hardware required. To enable appropriate choice of the equipment based on requirements of applications software which might be used, a range of available devices are discussed. Many packages, for example, require a colour screen to be fully effective, while to take advantage of the fonts and type faces available in some word processing packages requires a laser printer. However, a brief account of some of the I/O devices is provided' in the following paragraphs.

Input Devices'

i) Keyboard is the most common form of input devices. It was originally designed in the last century. Since then, only minor improvements have taken place in key board design.

ii) Pointing devices: These are used to indicate a point on a screen for example, to make a selection from a menu. They include: The light-pen (where the tip of the pen is touched on. the screen); The touch-screen (touched directly by finger, pen etc.), and the mouse (moved around the desk or other flat surface to move a cursor on the screen, with the required position marked by pressing a button on mouse). These devices will obviously work with appropriate interactive computer software.

iii) Voice input is now in a stage of development where commercial systems are becoming available. It may take some more time for these systems to be trained to recognise each user's voice and are presently limited to vocabularies of a few thousand words. In other words, voice input is only in experimental stage of development. It may take some years before it is made operational.

iv) Barcodes

These incorporate information in a pattern of stripes, produced and read by special equipment. These are widely used in library issue systems and are slowly gaining wider use for general data transfer, particularly as a means of `publishing' computer programs. To the extent they are used in library automation, they can be considered as data input devices.

v) Optical Character Recognition

This method has now developed to a stage, when it can be used as a practical means for routine entry of large quantum of print on paper information into computer systems. Unless special steps are taken, error rates are very high in this technique. Hence, standardisation of input is highly necessary.

Image Processing

This technology is quite advanced and devices are now available for routine scanning and storage of printed pages, graphics, etc., which can then be retrieved and displayed when required.

In the foregoing paragraphs of this section attempt has been made to explain to you some of the developments taking place as far as input devices are concerned. These developments are to be studied along with other input devices such as card reader, terminal, magnetic tape drive and magnetic disk drive., etc. which existed since long time.

Future developments in this direction might include more alternatives to the key board, particularly voice input for commands which is presently available, and wide use of OCR and image 'processing for handling large volumes of information.

Output Devices

Each output unit of computer system transmits information from the CPU and converts the electrical pulses to an appropriate output form. A printer, for example, is an output device that transmits output from the CPU and converts it to a printed form. There are many other output devices that can perform the sane electrical transmission and conversions to produce other output forms.

The Visual Display Unit (VDU) is the most common form of output device. Mostly, it is based on the Cathode Ray Tube (CRT). But these have markedly increased in quality and decreased in price. Standards over, colour monitors developed over the years include the Colour Graphics Adaptor (CGA), Enhanced Graphics Adaptor (EGA) and Vedeo Graphics Array (VGA). These have become widespread. Alternatives to CRT including light emitting diodes, liquid crystals, and gas plasma discharge panels, are coining into use, particularly for portable computers.

Printers: Printers exist in a variety of forms:

Line Printers

These have been widely used for many years in large computer installations. They are designed for the rapid printing of a large amount of information. Till recently, they have had the disadvantage of being noisy, inflexible, and limited to low quality output. However, because they are extremely reliable, they have remained popular with computer departments and now manufacturers are producing quieter and more flexible models of line-printers.

Character Printers

These are known as character printers because they print one character at a time. These are of two kinds: impact printers and non-impact printers.

i) Impact Printers

These are printers in which the print-head strikes a ribbon, and include the daisywheel and thimble printer (good quality, but relatively inflexible and slow), and the dot-matrix printers. Dot-matrix printers have traditionally generated comparatively poor quality output, but the 24 pin and 48 pin versions are capable of producing high quality material. Colour options and graphics are available in some of the recent models.

ii) Non-impact printers

These are silent in operation and are improving in reliability and quality. These include ink-jet and ink-dot printers (particularly suitable for colour graphics); electrostatic printers (used on facsimile machines, etc.), and thermal transfer printers (suitable for smaller computer systems because of low cost, versatility, and portability). Colour printers are available in this type of printers, which are used in publishing add advertising.

iii) Laser Printers

These printers can print a whole page at one command, offer highest quality and can combine text, graphics, etc. They are generally restricted to A4 paper and black and white, though transparencies can also be printed. Colour laser printers are now available but at very high prices. Laser printers are mostly used in electronic publishing.

Future prospects for output devices include: high quality display screens of different sizes, more wide spread use of laser, and similar page printers, greater availability of cheap and versatile thermal printers and a greater role for voice output, etc.

Self Check Exercise

4) Describe the basic components of a modern computer system and explain their role in its working

5) Briefly explain the significance of different types of computer storage media and indicate their use.

Note: i) Write your answer in the space given below

ii) Check your answer with the answers given at the end of this Unit.

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2.5 SOFTWARE BASICS

Software is a generic term covering the concepts, procedures and instructions which cause the computer systems to accomplish the required job, Generally, software is thought of in terms of programs, discrete units of software which enable the computer to carry out a particular task, and or systems or package&$_7$--integrated collections of programs.

The importance of software lies in the fact that it is the software which applies power of the computer to solve the problems faced by the users. Most users require a detailed understanding of the capabilities of software than of hardware.

It has been clear for some years now that the rapid advances in the capabilities of computer systems has not been matched by corresponding advances in the availability and quality of software.

Software may conveniently be divided into two categories: systems software (i.e., programs designed to control the execution of other programs and to utilise hardware effectively), and applications software (i.e., programs which enable to solve users' problems).

The methods by which software is produced have changed considerably in recent years with the emergence of the new discipline known as `software engineering'. The traditional pattern of software development used to be a systems analysis to undertake a detailed study of user needs, leading to an elaborate specification for the software, which would then be converted into a programming language. This process is considered inadequate, and leading to backlogs. It is also felt that this procedure does not meet user needs effectively and is poorly maintained.

Increased availability of packaged software and use of fourth generation languages, and flexible integrated software to produce rapidly modified `prototypes' of programs to meet user needs, are suggested as remedies to the software backlog problem. However, for the average user they mean that there will be an increasing array of packages to meet his requirements.

2.5.1 Systems Software

Systems software is generally supplied by the hardware manufacturers. It includes operating systems, assemblers, compilers, and interpreters (to convert programming languages into machine code) programs for controlling input and output devices, copying data between storage media, etc., and utilities for sorting, merging, and editing files, controlling program libraries, etc. In other words, it is all "supporting" software, which enables the power of the computer to be applied to user's problems.

Operating Systems

The operating system is the software that mediates between the applications programs and a level of instructions nearer to the machine's operations. In other words, it is "software that controls the execution of a computer program, and that may provide scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services".

Operating system software is written specifically for the type of function the computer is going to be used for. Generally, the more complex the function is, the more complicated the operating system will be., There are many types of operating systems available: some are made to work on a variety of different types of hardware, and some are designed for only one specific type of machine. Mainframe and minicomputers generally have their own proprietory operating systems. In the early days of personal computing, all operating systems were single user. Apple, Amiga, Commodore and IBM are all computer hardware manufacturers with machines that run different single-user operating systems. The most commonly used operating system in the world today runs on the IBM PC. This is the Microsoft disk operating system (MS-DOS). Since 1980s, DOS has been improved and refined many times:

A second type of operating system, described as multitasking, is still only capable of having one user but more than one task, operating at a time. The main task that requires the user's attention (for example a Word processing program) remains on the computer monitor, while the other task is working away in the background. The background process could be a complex statistical analysis program that takes a long time to complete, and the user could spend the waiting time for some other work. A multitasking successor to DOS is called Operating System 2 (OS 2).

Microsoft has gone on to develop its Windows environment, an operating system with multitasking and other advanced capabilities. Multitasking operating system must divide the CPU resources between the different tasks. In addition, multitasking itself is a more sophisticated operating system than the single user type, and can take more CPU resources just to run,

The third type of operating system is multi-user. By definition, multi-user systems are also multiprocessing, since each user who is working on the machine accounts for a separate process. Depending on the power of the CPU and the size of the computer, the number of users that can be working at one time might go into hundreds. The most common examples of multi-user systems are in the large mainframe environments. Systems like VMS from DEC and MVSA from IBM are examples of operating systems with the potential for large numbers of users.

UNIX is a multi-user operating system that has gained high popularity. Developed originally at AT&T Bell Labs, UNIX was designed to be used by engineers and scientists. Because of its efficient design and built-in security features, and its reasonable price, application software companies have considered UNIX as an attractive development platform. Probably the most attractive feature of UNIX is that it is an open system and multiplatform. This means that the operating system will work on a range of hardware configurations from microcomputers to mainframes. A new competitor to UNIX on personal computers, workstation and networks is the Windows NT operating system, a new operating system from Microsoft Corporation.

Multiplatform open operating systems are very attractive because applications that are developed for one platform can be run on another with minimum conversion problems. A UNIX word processing software package on a Sun Workstation could also be used on a UNIX P.C. The application is said to be *ported' (portable) from one machine to another. From user's point of view, much of this may not be important. Factors which must be considered are the ease of use of the operating system, and any restrictions it places upon *choice of software.* The latter point is particularly important, since any application program or package is restricted to specific operating systems. For example, something designed for the Macintosh will not run under an IBM operating system and vice versa.

2.5.2 Applications Software

In this section, we will try to learn some general aspects on applications software.

Applications software is the program that allow the user to get the required work done. In other words, applications software comprises the .procedures and instructions which enable computer systems to do what the user requires. The software design essentially involves three abstract concepts: algorithms (i.e., procedures, or recipes, for computation - may be numerical or non-numerical, e.g.; sorting, text searching): Data structures which indicate the way in which information is organised in the computer's memory. In other words, the structure indicates whether it is organised in array or tree pattern. File structures represent the way in which large amounts of information is stored on the storage media for example, whether it is organised sequentially, or in direct access, inverted file.

Even though users do not need any in-depth knowledge relating to the above mentioned three concepts, it is desirable to have some understanding of the terminology, since it is commonly used in software suppliers' literature.

Once a software procedure is expressed in such terms, it can be coded into a form which the computer can use, by means of a programming language. There are a number of programming languages in use. It must be emphasised that a computer can only operate on instructions in machine code (binary), and early computers were indeed programmed this way. Assembly language, a more convenient mnemonic form of machine code, is still us id today for specialised applications.

High level languages (converted to machine code by compiler or equivalent) are much easier to program, as well as to understand. Several high level languages are in use today. Best known are the FORTRAN (Scientific), COBOL (business) and BASIC (interactive) languages. Most recently introduced general purpose languages include PASCAL, ADA and C. Most

recent programming languages are called the `fourth generation' or `very high level' languages, generally as part of integrated program systems, such as DBMS, which facilitate users to program their own applications very easily:

It is not necessary for users of a program or package to have any knowledge of the language in which the package is written, or indeed to know .what that language is.

Let us, learn about some commonly used software packages.

Software Packages

i) Word Processing (WP)

Word Processing is one of the most widespread application software types in use today. Developed as a successor to primitive text editors that were popular on mainframe computers, a word processing program allows interactive editing of documents, enabling easy redrafting and merging of chunks of existing documents, without the need for extensive retyping. Most of the popular programs have features such as `spell' checkers, outlining, choice of fonts, line drawing, as well as page layout settings to produce any type of document .desired. One feature that most of the popular packages offer is a way to just see how the document will look on the printed page; This is a handy feature when laying out complicated tables or columns of text. Some of the examples of word processing software Word Star, Word Perfect, MS Word etc.

ii) Desk Top Publishing Program

Desktop publishing programs contain many of the features of word processing software, but .go even further in the ability to layout the format of a printed page. These packages are being used to control complex components of the printing process right from the PC. Desktop publishing does what used to be called type setting, and has truly changed the printing business. Sophisticated packages like Ventura Publisher and Page Maker allow, in-house departments to' produce page layouts to include graphic images that were digitised with scanners, and print the output to laser printers or high quality devices that produce camera-ready output. Though this procedure was more difficult to use than a word processor, many of the features of desktop publishing software have been streamlined and are now incorporated into word processing packages. While variety of type font and size is not to be *confused* with sound typographical design, in general, application of DTP techniques has improved the look of documents and manuals in many of the organisations that use these techniques. A new development in DTP is, the ability to exchange various personal computer (PC) platforms final documents in published formats. It is stated that this may pave the way for electronic distribution of wide4array of materials, such as newsletters, which are now distributed in print farm.

iii) Data Base Software

Another major type of application comes under the heading database software; which allows for the collection of, searching for and manipulation of information about unique entities. The topic (subject) might be the characteristics of competitor products, the bibliographic and abstract information relating, to relevant research publications and activities dealing with an area of R&D, etc. All topics on which files of information may be collected are susceptible to be controlled by database management software. One of the early arrivals to the PC data base management software market was a product from Ashton-Tate called d'Base. Still in , use today, d-Base also provided a fairly sophisticated third generation programming language. Everyday users can use the software in its standard form but the programming features allow more advanced users to develop customised applications that are tailored specifically to the needs of an organisation.

A common trend in the database market, especially on computers that use UNIX, is the use of relational database. Developed by researchers at IBM, the relational model of database design uses the theories of symbolic logic to define how data are organised. Database software that follows the relational model is specially useful when dealing with large amounts of data. Relational database products can minimise problems that arise with redundant

information and keeping data up-to-date. An example of a successful relational database system in the library environment is Carlyle Systems Voyager Series.

There are some alternative approaches for acquiring software. They are:

i) `off the shelf' software package

ii) `turnkey' package (both hardware and software)

iii) write your own package

iv) have customised programs written for you.

Each of these approaches has its own advantages and disadvantages. Standard packages are by far the most common way of acquiring software. They offer simple and relatively cheap option, with the advantage of a large group of users of common package. Turnkey systems, with all components of hardware, software and communications provided by the vendor (supplier) are simpler for their users as every aspect is looked after by the supplier. This is a common method pursued by some larger libraries. It is desirable that the package acquired is an integrated one - that is to say it can carry out a number of functions within a common framework. Examples could be library automation packages, incorporating acquisitions, cataloguing, circulation etc. There is one possible drawback associated with fully integrated packages, apart from not being flexible; some elements of integrated packages might be inferior to a program dedicated for the same purpose. For example, if database applications are particularly important, it could be a mistake to rely on the database component of a standard package. The `customised' approaches provide flexibility and a product geared precisely to your specific needs. Though popular, software specially written for information services is too expensive and difficult to maintain and modify for it to be a realistic option in many cases. Some ability to modify software is desirable and standard packages offer the chance to modify such aspects as output formats, and help message. Also, some larger systems are available in modular form, with distinct pieces of software carrying out specific functions. Modules for particular purposes can be acquired and then combined as required, giving a fair degree of flexibility in the look of a software system. The obvious example is the library house keeping package with separate modules for acquisitions, cataloguing, circulation, etc..

Detailed information pertaining to software packages is furnished in a separate unit of this course (. Block 2, Units 4-6).

Self Check Exercise

6) What do you understand by the term 'software'? Briefly explain the difference between 'systems Software' and 'Application Software'.

7) What is an operating system ? Explain in simple terms the difference between single user operating system and multi-user operating system.

8) What is meant by word processing ?

9) Briefly explain the meaning of DDT program

Note: i) Write your answer in the space given below

ii) Check your answer with the answers given at the end of this Unit.

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2.6 SUMMARY

This Unit introduces you some basic concepts necessary to understand a modern computer. It explains to you what a computer is and how over the years, it has developed into its present form. Categories and classes of computers and their specific characteristics have been discussed to provide you the backdrop required for a proper understanding. The functional parts of a modern computer system and the role played by each one of them in the efficient functioning of a computer system have been enumerated and explained. Input output devices, the concept of stored program, memory aspects have been discussed briefly. The Unit also furnishes a brief explanation relating to hardware and software, the distinction between Systems Programmes and Applications Programs has been discussed. The details of information contained in the text of the unit will enable you to acquire sufficient knowledge so that you may be able to work with the machine for solving problems relating to library automation and information processing.

2.7 ANSWERS TO SELF CHECK EXERCISES

1) As generally understood computer has some defined characteristics. These are :

   i) electronic devices are used as component parts in making a computer;

   ii) computer has an internal storage (memory) for storing both the program as well as the data to be processed by the computer,

   iii) it has stored program, which specifies the sequence of operations to be followed, , stored in its internal memory. It is this stored program, which makes the computer automatic because the entire set of steps to be taken is determined in advance and no human intervention is required during its execution;

   iv) The computer possesses the ability to change the stored program of instructions during the execution of the program steps;

   v) It is essentially an electronic device, that can receive and store data and also a set fashion to process the data in a desired manner;

   vi) A computer contains large number of electronic circuits arranged in such a way so as to enable it to :

      a) perform arithmetic operations

      b) ' evaluate logical conditions

      c) store values and retrieve values from its memory

      d) process input and output data.

2) From the early 1940s to the present, computer scientists have been able to identify clear-cut in the development of computer technology. With each stage radical changes In electronics have taken place. As a result, the computers based on older technology of electronics have been replaced by a newer form of machines. These stages have been

referred to as generation, where each computer generation had certain unique characteristics or properties. The five stages of development in computers, is commonly discussed and described as five generations of computer.

3) Depending on computing power and other capabilities, computers may be grouped into different categories. These are: Super computers, Mainframes, Mini computers, Microcomputers and Personal computers. Each one of these groups have certain defined characteristics.

   With the recent developments in technology, the computer has transformed itself from a tool of only large institutions and corporations to a tool that can be used generally by everyone in society. Users once passive recipients of a computer service, have been actively involved with the computer and its software.

4) The basic components of a computer system are : i) input devices, ii) the central processing unit (CPU), iii) the auxiliary or backing storage and iv) the output devices. Each input device of a computer system reads data from a specific form and converts them into electrical pulses. It then transmits these pulses to an input area in the CPU. There are different types of input devices such as keyboard, pointing devices, voice input, barcodes, OCR and image processing. Similarly, printers and VDU are the example of output devices.

   The CPU is the physical device that controls computer operations. It is considered the brain of the computer system. The CPU comprises three components : The control unit, the arithmetic/logic unit, and the main memory. All these are composed of microelectronic devices based on silicon semiconductor technology. The main memory is the largest component of CPU and is divided into individual computer words each of which may be accessed individually by its address. The main memory holds program instructions and data required as the programs operate. The arithmetic/logic unit consists of registers or accumulators, individual words of very high speed storage into which words from the main storage are copied prior to the instructions being applied to them. The control unit extracts program instructions one at a time in the required sequence from their locations in the main storage, decodes them and issues instructions, to the main storage to access the required word, and to the arithmetic/logic unit to activate the required instruction circuitry.

   The output unit of the computer system transmits information from the CPU and converts the electrical pulses to an appropriate output form. A printer for example, is an output device that transmits output from the CPU and converts it to a printed form. There are many other output devices that can, perform the same electrical transmission and conversions to produce other output forms.

5) Computer systems include two types of digital information storage within the CPU, and the backing (back up) storage on external devices such as disks or tapes. Different types of storage media differ according to a number of criteria (Such as speed of operation, capacity, cost, reliability, the degree to which information is immediately accessible, etc.). Silicon semiconductor chips arc now commonly used for internal storage. These are categorized as either RAM (Random Access Memory) or ROM (Read Only Memory) chips. ROMs are used for data which is never altered for' example, operating system instructions, while RAM is used for data which is liable to change often, and instructions used in the execution of program. Backup storage is used to hold programs and data which are read into internal storage when required. The common form is magnetic storage media, either tapes or disks.

   Optical disk storage is the new alternative to magnetic media. Optical storage technology offers a high capacity storage at low cost, and in form allowing rapid access.

   WORM disks are ideal for archival purposes and provide storage capacity for large volumes of data. The CD ROM (Compact Disk read Only Memory) disk of 4.75" can hold 650 M bytes of data and has become a means for distributing data bases in electronic form.

6) Software is a generic term covering the concepts, procedures and instructions which cause the computer systems to accomplish required \volt. Generally, software is thought of in terms of programs, discrete units of software which enable the computer to carry out a particular task, and or systems or packages, integrated collection of programs.

The importance of software lies in the fact that it is the software which applies the power of computer to solve the problems faced by the users.

Software is of two kinds: systems software and applications software.

Systems Software

Systems software is generally supplied by the hardware manufacturers. It includes operating systems, assemblers, compilers and interpreters, programs for controlling input and output devices, copying data between storage media, etc. and utilities for sorting, merging and editing of files, controlling program libraries, etc. In other words, it is software which enables the power of the computer to be applied to user's problems.

Applications Software

Applications software is the programs that allow the user to get his required work done. Applications software comprises the procedures and instructions which enable computer systems to do what the user requires. They can be developed by individuals or can be purchased from software firms. Applications programs can be written by programmers without an in-depth knowledge of the computer circuitry. Under the class of applications programs come: a) user application programs, b) application packages.

Applications software packages are of two types : specialized packages oriented towards a specific task or operation such as circulation activity or SDI or general packages from which customized models or personalized services can be developed.

7) The operating system is the software that mediates between the applications programs and a level of instructions nearer to the machines operations. In simple terms, it is the software that controls the execution of a computer program, and which may provide scheduling, debugging input/output control, accounting, compilation, storage assignment, data management and related services. Operating system is written specifically for the type of function the computer is used for. Generally, the more complex the function, the more complicated the operating system. There are different types of operating systems available: some are made to work on a varity of types of hardware, and some are designed for only one specific type of machine. In early days of personal computing, all operating systems were single user. Apple, Amiga, Commodore and IBM are all computer hardware manufacturers with machines that run different single user operating systems. The most commonly used operating system in the world runs on the IBM PC. This is the Microsoft disk operating system (MS -DOS) - since 1980's DOS has been improved and refined many times. Microsoft has developed its Windows environment, an operating system with multitasking and other advanced features. It is a more sophisticated operating system than the single user type, and can take more CPU resources just to run.

   UNIX is a multi user operating system that has gained high popularity. Because of its efficient design and built in security features, and its reasonable price, application software companies have considered UNIX an attractive development platform. The most attractive feature of UNIX is that it is an open system and multiplatform. This means that the operating system will work on a range of hardware configurations from micro computers to mainframes. Windows NT is a new operating system, from microsoft, becoming a competitor to UNIX.

8) Word Processing is one of commonly used applications software in use today. It has been developed as a successor to primitive text editors that were popular on mainframe computers. A word processing program allows interactive editing of documents enabling easy redrafting and merging of chunks of existing documents without the need for extensive retyping. Most of the popular programs have features such as `spell' checkers, outlining, choice of fonts, line drawing as well as page layout settings to produce any type of document that is desired. One of the common features provided in most of the packages is a way to just see how the document will look on the printed page. This is one of the handy features for laying out tables or columns of text. `Word Star', `Word Perfect', `MS WORD' are some of the examples of Word Processing packages.

9) Desk top publishing (DTP) programs contain many features of Word Processing Programs. They have further capability to lay out the format of a printed page. DTP packages are being used to control complex components of the printing process right from the, PC. DTP does what used to be called type setting, and has truly changed the printing business. Many of the features of DTP are now stream lined, and have been incorporated in Word Processing packages. Application of DTP techniques has improved the look of documents. A new development in DTP is the ability to exchange on various personal computer (PC) platforms final documents in published formats. It is stated that this capability may pave the way for electronic distribution of wide array of materials such as `news letters' which are now distributed in print form.

2.8 KEY WORDS

ABC(Atanasoff-Berry Computer)	The first electronic digital computer, built in 1939 by John Vincent Atanasoff and Cliford Berry of Iowa University.
ASCII(American Code Standard for Information Interchange)	A set of codes used to represent characters and other sysbols in the computer for the purposes of digital data manipulation and transmission.
Assembler	A program that converts mnemonics and symbols of assembly language into opcodes and operands of machine language.
Assembly Language	A language similar in structure to machine language but made up of mnemonics and symbols. Programs written in Assembly language are slightly less difficult to write, to understand than programs written in machine language.
BASIC	An acronym for Beginners All-purpose Symbolic Instruction Code. It is a common easy-to-learn computer programming language. The advanced version is known as BASIC-A.
BACKUP	One of the most important computing activities making a second or third copy the data produced using a computer.
Bar Code	Bar codes are ships of black and white lines which can be read by a scanner and interpreted as data.
BIT	A binary digit or the smallest amount of information a computer can hold. A single bit specifies a single value of 0 or 1. Bits could be grouped to form larger values (see Byte).
Booting a System	Bringing a system (hardware or software) up from a scratch so that it can be used by a user.
Byte	A unit of memory capable of storing the equivalent of one character such as a letter of the alphabet generally equivalent to 8 bits.
Character	Any graphic symbol that has a specific meaning letters, numbers, and various symbols (such as punctuation marks) are all characters.
Compiler	A piece of software that translates a complete program into machine language. As it performs this translation process, it also checks for any errors that have been made by the programmer.
Computer Network	Several computers linked together electronically for transmission and sharing of data of all kinds.
CPU	Central Processing Unit of a computer; controls all the processing carried out by the computer and has the logic circuits that enable the machine to handle maths and

	decision-making based on inputs.
Chip	An electronic entity containing one or more semiconductors on wafer of silicon, within which an integrated circuit is formed
Floppy Disk	A thin disk with a magnetic coating enclosed in a plastic jacket. It is used to store information with the help of a floppy disk drive
Floppy Disk Drive	The machine used to give the computer access to the data stored on a floppy
FORTRAN	An acronym for FORmula TRANSlator, a programming language designed for writing problem solving programs that can be stated as arithmetic procedures.
Hard Disk	A rigid medium for storing information. So called because the platter on which data is stored is rigid. It is a high speed, high density alternative to floppy disk
Hardware	The machinery of computing that is the parts one can see and touch.
High Level Language	A language that is more English-like - Programs written in such a language are machine independent.
Integrated Circuit	A small wafer of silicon material into which an electronic circuit is etched. A single IC can contain 10 to 10,000 different electronic components.
Kilobyte (KB)	1024 (just over a thousand bytes of data usually represented as K.
Low Level Language	A language that is written in code. It is machine dependent
Machine Language	The low level language a computer understands. Machine . language is usually binary; instructions in machine language are single-byte opcodes some times followed by various operends
Megabyte (MB)	1 million characters of storage - a quantity normally used as a measure of available storage on a hard disk.
Microprocessor	An integrated circuit that understands and executes machine language programs. It is a computer chip on which are etched the components of a computer's central processing unit.
Mnemonic	An acronym or other symbol used in place of something more difficult to remember.
Mouse	The palm sized device that is rolled around on the desk-top to facilitate interaction with the computer.
Non-volatile Memory	A form of storage that does not lose its contents when the system's power is turned off. It may take the form of bubble memory, or it may be powered by batteries.
Operating System	A set of programs which enhances the performance of a computer and manages the tasks demanded of it by a user. It acts as the interface between the computer and the computer user.
Program	A set of instructions which tells the computer how to perform a certain task
Random Access Memory (RAM)	The memory of a computer. The computer can store values in distinct locations in RAM, then recall them, or it can alter and restore them if needed.

***Read* Only *Memory* (ROM):**	The memory usually used to store important programs or data that must be available to the computer when the power'
	is turned on. Information in ROMs is placed during the process of their manufacture and is unalterable. Information stored on ROMs does not disappear when power is turned off
Software	The programs that enable users to use the computer for a multitude of productivity and other purposes.
Volatile Memory	Memory that is erased when the electrical current to the computer is turned off.
Word Processor	The computer of productivity software used primarily for working with written communication such as text.

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