UNIT I

LESSON – 1

INTRODUCTION TO COMPUTER SYSTEM

1.0. AIMS & OBJECTIVES

After reading this Lesson you will be able to understand:
1.   The characteristics of computers that makes them an essential part of every technology.
2.   Computer system, which includes components such as central processing unit & I/O devices.

1.1 INTRODUCTION

The term computer is derived from the Latin word compute, which means to calculate. A computer is an electronic machine, devised for performing calculations and controlling operations that can be expressed either in logical or numerical terms. In simple terms, a computer is an electronic device that performs diverse operations with the help of instructions to process the information in order to achieve the desired results. Computer application extends to cover huge area including education, industries, government, medicine, scientific research etc.

A computer is one of the most influential forces available in modern times. Due to its memory, high speed and perfection, its application can be extended to almost infinite levels. Millions of complex calculations can be done in mere fraction of time. Difficult decisions can be made with accuracy for comparatively little cost. Computers are widely seen as instruments for future progress and as tools to achieve substantiality by way of improved access to information by means of video conferencing and e-mail. Indeed computers have left such on impression on modern civilization that we call this era as the information age.

1.2 CHARACTERISTICS OF COMPUTERS

The main characteristics of computers are:
a) Speed
b) Storage
c) Accuracy
d) Versatility
e) Automation
f) Diligence
g) Reliability

a) Speed :

Computers are capable of carrying out the task with enormous speed. Today's computers, according to their class, can perform from 4 MIPS (Millions of instructions per second) to 100 MIPS. What may take days for manual calculations may take only a few hours for computers to perform. Inside the computer the information signal travels at incredible electronic speed.

b) Storage:

Computers can store enormous quantity of information. Which is expressed in terms of Kilobytes (or) Mega Bytes (MB) or Gega Bytes (GB). It is achieved through its 'Main memory' or 'Primary storage' and through 'auxiliary storage' or 'Secondary storage'. The Hard disks Floppy disk, Compact Disc(CD) and Magnetic Tape storage are examples of secondary storages. These large volumes of storage occupy much lesser space compared to paper documents and this aspect of computers makes them more powerful.

c) Accuracy:

The accuracy of a Computer is consistently high. In fact, this quality of the computers make them indispensable in various fields such as Scientific Research, Space Research, Weather Predictions and many other areas where precision of a high order is required. The accuracy of the computer is best achieved by programming them in the most efficient manner. When it comes to very complex mathematical or scientific problem the computer's accuracy has no substitute.

d) Versatility:

Computers are versatile in that they can perform almost any task, provided they are given the appropriate logical steps. For example, they are capable of performing wide ranging tasks such as construction of a payroll, inventory management in a factory, hotel billing, hospital management, banking applications and any imaginable task in every walk of life.

e) Automation:

The biggest advantage of computers is that it is automatic in its operation. Once a programming logic is initiated the computer performs repeated operations without human interventions until program completion.

f) Diligence:

Computers are machines and that do not get tired or 'lose concentration' like human beings. If a large number of calculations say million calculations are to be performed the resultant output will remain exactly the same even if operations are repeated any number of times. But when a human being is asked to do the same job this consistency cannot be achieved.

Thus for those who want consistent and continuous standard output, computer's 'diligence' is of great help.

g) Reliability:

The computers give very accurate results with predetermined values. They correct and modify the parameters automatically, giving suitable signals. They give formatted results with high degree of precisions.

Check Your Progress 1

Bring out any three characteristics of computer

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.8)

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1.3 HISTORY OF COMPUTERS

In the early days of mankind, man used to count the head of cattle by putting lines on trees. Slowly these lines changed to numbers. To do calculation on numbers he started inventing machines.

1. Abacus

Abacus was probably the earliest of counting devices. It consists of rectangular wooden frame with two compartments and beads sliding along the steel wires for counting. Multiplication and divisions are done using repeated additions and subtractions. Even today in which cross strings are fixed. Beads are inserted on to the strings. There are a number of rows of beads.

2. Napier's logs and bones:

John Napier, a Scottish mathematician invented logarithms. The use of logarithms enabled him to transform multiplications and division problems of addition and subtractions. In the beginning he called logarithms as artificial numbers. But later he named them logarithms.

Napier also invented a computing device consisting of sticks with numbers carved on them. These sticks are called bones as they were made of bones. These bones helped a lot in multiplication involving large numbers.

3. Slide rule

As the name indicates, the slide rule has one scale sliding within the other. Suppose you want to add two numbers 3 and 5, set 3 on the fixed scale and slide the moving scale. So that its "0' coincides with"5" of sliding scale. This is the sum of 3 and 5. The process of reading could be quick if you are trained in the use of slide rule.

4. Calculating machines and Pascal's calculator:

A French mathematician, Blaise Pascal invented a machine based on gear wheels. He was the son of tax collector who had to do lot of calculations as part of his job. Blaise Pascal wanted to make his job easier by inventing a calculator. You might be familiar with gear wheels in use in your bicycle which meshes with a driving chain. He used similar gear wheels with ten teeth for

each digit position. He fixed them together so that one wheel drives the other. When the wheel corresponding to units position rotated by ten teeth, it drove the wheel corresponding to the next higher position by one tooth. Thus one could make calculations. Pascal provided dials, which indicated numbers stored on each wheel. He also used suitable "dialing system" to operate the gear wheels. Other people also made a number of such calculators.

Computer scientists honoured Pascal by naming a programming language Pascal after him.

5. Babbage difference and analytical engines.

Babbage, a British National and the son of a wealthy banker wanted to correct the errors in the logarithm tables being used during his time. In 1822, he made a machine which calculated the successive difference of expressions ($X2 + ax + b$ is an example of an expression) and prepared table which helped him in his calculations. The royal Astronomical society awarded a gold medal to him for his invention and granted a large sum of money to carry out further work. He wanted to make an accurate calculating machine called "Babbage's Analytical Engine". The analytical Engine was supposed to be very accurate. So it needed lot of parts made with precision. Babbage could not make such parts. He conceived that his machine would use input devices, would have a processing part called "mill" where you can perform calculations, would also incorporate

It consists of rectangular frame in which cross strings are fixed. Beads are inserted on to the strings. There are a number of rows of beads .Since he was about 100 years ahead in his ideas, he could not get parts needed for his machine. This is because there were no tools to make such precision parts. He did lot of work related to making precision parts and spend all the grants (and lot of his money too) but failed in his attempt to make a machine. He ultimately died as a frustrated man.

6. Lady Ada Lovelace

Lovelace is the daughter of the famous English poet Lord Byron. She was a mathematician. She studied the works of Babbage and wrote about them. From her account only, we can see the close resemblance of the modern day computers and Babbage's work. Lady Ada Lovelace's contributions are very important. Since she predicted that computers can be programmed, a language, Ada used widely in America's Department of Defence Computers was named after her.

7. Herman Hollerith's Machine

Governments all over the world collect details about the number of people living in their countries. This information helps the Government in planning for the future, Sometimes you find enumerators (people taking such details) coming to your house with forms to collect such details. This operation is called "census" which is normally done once in 10 years.

In the United States a census was carried out in 1880 and the U S Government was processing the census data. Even as this was going on, the next census was due in 1890. To process the census of 1890 fast, the Government announced a competition.

Dr. Herman Hollerith Produced cards out of special paper pulp, designed punching machines to punch holes in the card to count census figures and invented sorting machines to

read such punched card and collect data. He could complete the job within three years, achieving a speedup of about three times.

8. ABC Computer:

In 1937, Dr. John Atanstoff with the help of his assistant Berry designed the Atanstoff Berry Computer (ABC). The machine laid the foundation for the development of electronic digital computer.

9. ENIAC- Electronic Numerical Integrator and Calculator

In 1947 john Mauchly and Eckart completed the first large scale Electronic Digital Computer, ENIAC. In this computer, each time a program was changed, the wiring had to be completely rearranged. It weighed 30 tons, contained 18,000 vacuum tubes and occupied a space of 30   50 feet.

10. EDSAC-Electronic Delay Storage Automatic Calculator:

Maurice V.Wilkes of Cambridge University completed EDSAC in 1949. EDSAC was the first computer to operate on the stored program concept.

11. UNIVAC-I – Universal Automatic Computers:

In 1947, after ENIAC became operational Mauchly and Eckart formed their own Company- The Eckart-Mauchly Computer Corporation". Immediately after this they started the design of UNIVAC-I. This was purchased by US bureau of Census. UNIVAC was the first computer dedicated to business applications

1.4 COMPUTER SYSTEM

A computer system is a combination of various components. It performs the system functions such as input, processing, output, storage and control. A computer system consists of the following components:
1. Hardware
2. Software
3. Human ware
4. Firmware
5. Bridge ware

1. Hardware

The physical components of the computer, such as electrical, electronics and mechanical unit are known as the hardware of the computer. That is, the input units, output units and CPU are called hardware. Thus hardware is the equipment involved in the function of a computer. It consists of the components that can be physically handled. The function of these components is typically divided into three main categories: input, output, and storage. Components in these categories connect to microprocessors, output and storage. Components in these categories connect to microprocessors, specifically, the computer's central processing unit (CPU), the electronic circuitry that provides the computational ability and control of the computer, via wires or circuitry called a bus.

2. Software:

The computer performs operations like addition, subtraction, multiplication and division only when the user instructs it to do so. The user issues instructions and the CPU acts in accordance with the instructions. The sets of instructions, which control the sequence of operations, are known as *programs*, and collectively programs are called **software.** The software can be broadly classified into two types. They are:

a. System Software

b. Application software

3. Human ware:

The man-machine interface is called a human ware. The people who work with the computer are collectively called the human ware or livewire.

4. Firmware:

The computer programs permanently stored in ROM or PROM are called firmware. These programs are provided by hardware manufacturer along with the computers. Generally these are booting programs which help in the starting of a computer. Such programs cannot be erased or overwritten.

5. Bridge ware:

The computer components and programs used to translate instructions and information written for one type of computer into a format that another type of computer can understand is called bridge ware. This is necessary because different computers are made by different manufacturers.

Check Your Progress 2

What is human ware?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.8)

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1.5 IMPORTANCE OF COMPUTERS IN BUSINESS

Computer plays an important role in business environment as every organisation adopts it in some form or the other to perform the tasks in effective manner. In the past few years' rapid development in IT, particularly in communications, electronic service networks, and multimedia have opened up new opportunities for corporates. All these are contributing towards new and effective ways of processing business transactions, integrating business processes, transferring payments and delivering services electronically. It has affected the business in the following ways:

1. Office Automation

Computers have helped automation of many industrial and business systems. They are used extensively in manufacturing and processing industries, power distribution systems, airline reservation systems, transportation systems, banking systems, and so on. Computer aided design

(CAP) and computer-aided manufacture (CAM) are becoming popular among the large industrial establishment.

2. Stores large amount of date and information

Business and commercial organizations need to store and maintain voluminous records and use them for various purposes such as inventory control, sales analysis, payroll accounting, resources scheduling and generation of management reports. Computers can store and maintain files and can sort, merge or update as and when necessary.

3. Improves Productivity

With the introduction of word processing software, Computers have recently been applied to the automation of office tasks and procedures. This is aimed at improving the productivity of both clerical & managerial staff.

4. Sharing of data and information

Due to networking of computers, where a number of computers are connected together to share the data and information, use of e-mail and internet has changed the ways of business operations.

5. Competitiveness

Computers offer a reliable and cost-effective means of doing business electronically. Routine tasks can be automated. The customers can be provided support round the clock, which is 24 hours a day. With advancement in IT sector, corporates are spreading business around the world thus, increasing their presence and entering new markets.

6. Security

To provide security to data and important computer programs, almost every organisation has some security programs to avoid the illegal access of the company's information by unauthorized persons. The three fundamental attributor of a security program are confidentially, integrity and availability which allow access to only authorized persons in an organization.

7. Cost Benefits

The extensive availability of internet based information means that companies have a wider choice of suppliers which leads to a more competitive pricing. Due to the presence of internet the role of the middleman becomes less important as companies can sell their product or services directly to the customer.

8. Marketing

Corporates engaged in e-business can take help of their respective websites to create brand awareness of their products, thus, creating new avenues of promotion of their products. In addition, companies' websites can also provide better services such as after sales service to the customer.

Check Your Progress 3

What is the role of computer in business?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.8)

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1.6 LET US SUM UP

1. Computer is an electronic device that performs diverse operations with the help of instructions to process the information in order to achieve desired results. Speed, accuracy, reliability, versatility, diligence etc characterize the computers.
2. Many devices which humans developed for their computing requirements preceded computers. Some of those devices are Abacus, Napier's bones, Slide rule, Analytical engine and Hollerith's Machine.
3. Computer system consists of the various components which perform the system functions such as input, processing, output, storage and control.
4. Role of computers in business environment is essential for processing business transactions, Office Automation, Improving productivity, Competitiveness and security.

1.7 LESSON END ACTIVITY

Visit a computer centre and list out the hardware components

1.8 POINTS FOR DICUSSION

1. List all types of secondary storage devices.
2. What is the difference between memory and storage? Why do we require both to function properly?
3. Explain the characteristics of a computers.
4. Explain in detail the history of computers.
5. Write notes on applications of computers in business.

1.9 CHECK YOUR PROGRESS

1. Your answer may include any of the following:
   i). Speed
   ii). Storage
   iii). Accuracy
   iv). Versatility
   v). Automation
   vi). Diligence
2. Human ware

The man-machine interface is called a human ware. The people who work with the computer are collectively called the human ware or livewire.

3. Role of computers in business
   i). Office Automation
   ii). Stores large amount of date and information
   iii). Improves Productivity
   iv). Sharing of data and information
   v). Competitiveness
   vi). Security:
   vii). Cost Benefits

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1.10 REFERENCES

1.   Parameswaran R., Computer Applications in Business, S.Chand and Sons company Ltd., New Delhi.
2.   Alexis Leon, Mathews Leon, Fundamentals of Information Technology, Leon Vikas, New Delhi.

LESSON- 2

HARDWARE AND SOFTWARE

2.0 Aims & Objectives

2.1 Introduction

2.2 Components of Hardware

2.3 Software

    2.3.1 Features of Software

2.4 Difference between Hardware & Software

2.5 Let Us Sum Up

2.6 Lesson End Activity

2.7 Points for Discussion

2.8 Check Your Progress

2.9 References

2.0 AIMS & OBJECTIVES

After reading this Lesson you will be able to understand:
1. Meaning of hardware and software.
2. Components of hardware.
3. Features of software.
4. Difference between hardware and software.

2.1 INTRODUCTION:

A computer system consists of **hardware**, the physical unit (parts) of the computer that are capable of computing and manipulating information and *software* (set of instructions or programs) that carries out predefined tasks to complete a given job. The computer performs operations like addition, subtraction, multiplication and division only when the user instructs it to do so. The user issues instructions and the CPU acts in accordance with the instructions. The sets of instructions, which control the sequence of operations, are known as *programs*, and collectively programs are called **software.**

We can equate hardware and software with human body and human intelligence, respectively. All human physical actions such as walking and eating are based on the thoughts and feelings, which is raised by the brain. If the brain does not raise thoughts and feelings, we do not perform any physical activity. Similarly, the actions and functioning of every hardware equipment is driven by software. The combination of physical equipment (hardware) and logical instructions (software) gives modern computing system their power and versatility.

2.2 COMPONENTS OF HARDWARE

  I.   Input unit: This unit accepts instructions and data.
 II.   Output unit: This unit communicates the results to the user.
III.   Storage unit: This unit stores temporary and final results.
IV.   Central Processing Unit (CPU): This unit performs processing of instructions and data inside the computer.

The CPU has three components:
   a)   The Control Unit
   b)   The Arithmetic Logic Unit (ALU) and
   c)   The Memory Unit.

a)   Control Unit:

It controls the overall operation of the computer system. It is considered as the heart of the computer system. It controls all the other units, directs them to operate in a proper way and co-ordinates various operations performed.

It instructs the input device to transfer the data and instructions to the main memory and then to the arithmetic and logic unit (ALU). Then, it sends the processed result from ALU to the memory unit for storage and transfers it to the visual display unit or to the ' printer.

The control unit coordinates the various parts of the computer system - the arithmetic logic unit, the memory unit and the peripheral units. Besides, it controls the flow of data into, from and within the main storage as per the program instructions.

To perform its control operations effectively and quickly, the control unit has four basic components. They are
   (a) Instruction Register
   (b) Decoder
   (c) Address Register and
   (d) Instruction Counter

The instruction register receives one by one the instructions to be executed in the required sequence. Then, the operation code of the instructions is transferred to decoder, which decodes the operation code. And it activates the appropriate circuits of the arithmetic and logic unit to perform the operation. The address register enables the data in the location specified in the instruction to be transferred to a specified accumulator for the arithmetic and logic unit.

b)   Arithmetic Logic Unit (ALU)

This unit performs two kinds of operations, the arithmetic processing and logical processing. In arithmetic processing it performs all mathematical operations such as addition, subtraction, multiplication and division. In logical processing, it performs the relational and logical operations such as comparing larger or smaller values, true or false statements, etc.

c) Memory Unit

This unit holds the intermediate results during the course of calculations and provides the data as and when required. This internal storage is also called primary memory or main memory. This memory takes the data from an input device and stores it until the computer is

ready to process it. It also stores processed data and intermediate results. When the processing is finished, it transfers the results to an output device.

2.3 SOFTWARE

Software is a generic term for organized collection of computer data and instructions. It is responsible for controlling, integrating, and managing the hardware components of a computer and to accomplish specific tasks. In other words, software tells the computer what to do and how to do it. For example, software instructs the hardware what to display on the user's screen, what kinds of input to take from the user, and what kinds of output to generate. Thus, software communicates with the hardware by organizing the control sequences, and the hardware carries out the instructions defined by the software.

A computer needs to be instructed to perform any task. These instructions are given in the form of *computer programs,* which are written in computer programming languages. A program controls the activity of the processor. The moment the hardware (processor, memory, etc.), acts as per the instructions of a program, the program is said to be in *running* or *executing* state.

A set of programs, which are specifically written to provide the user a precise functionality like solving a specific problem is termed as a *software package.* For example, word processing software package provides functionality to the computer so that it can be used to create text documents like letters and mailing lists. Similarly, an image processing software package assists a user in drawing and manipulating graphics.

2.3.1 FEATURES OF SOFTWARE

1. Ease of use
The software systems and applications are becoming more and more easy to use. In fact, software developers and system analysts go to great lengths to ensure that the products they develop are user-friendlier than their competitor's products.

2. Graphical user interface (GUI)
GUI or graphical user interface has now become the default standard for most of the software applications. Gone are the days of the crude character based interfaces of UNIX and DOS application. Today's software applications and products provide the users with perceptive, graphical and easy-to-use interfaces. Now the users do not have to remember the cryptic system commands or shortcut keys that were a must in the character based era. Now almost any task can be accomplished by a mouse click.

3. Multi-platform capability
Today's software applications are not developed for just one platform. Most of the software applications supports multiple platforms-both hardware and software platforms. There are software applications that support hardware platforms ranging from mainframes to PCs and different software platforms like MVS, Solaris, AIX, UNIX, Windows and so on. For example IBM's DB2 Universal database is available for a variety or hardware and software platforms.

Another important feature of today's software application is that they support multiple languages and multiple currencies. Many vendors are providing their applications in many languages like English, Arabic, Japanese, and Chinese and so on.

4. Compatibility with other software

Now the competition for each market segment in the software marketplace is rather fierce. We have many software vendors battling for the market share in the same segment. For example, Microsoft Word 2000 supports all previous versions of Work like Word 97, Word 6, Word and so on. The two features –compatibility with earlier versions and compatibility with other products make it easier for the users, as they can choose the application they want and still use the old files they have created using other applications or using older versions of the same application.

5. Mail enabling

Mail enabled applications are designed to take advantage of on e-mail. These are the familiar word processors, spreadsheets, and other individual desktop applications that have e-mail features built to them. There is another class of message-centered programs that are built specifically around e-mail functions.

6. Web enabling

With the ever-increasing popularity of internet and the amount of information that is available on the net, most software applications are now web-enabled. Web enabling helps the user in many different ways. Its use starts while the user is installing the application. During installation, most of the applications will automatically connect to the Internet and to the vendor's web site and will register their products (earlier one had to fill in a paper form and mail or fax it to the vendor).

2.4 DIFFERENCE BETWEEN HARDWARE & SOFTWARE

HARDWARE	SOFTWARE
1.It is the physical unit of the computer	1.It is a collection of programs to bring the hardware system into operation
2. It has permanent structure and cannot be altered	2. It has no permanent structure but can be altered and reused
3. It is normally affected by agent like dust, heat, humidity, etc	3. It is not affected by these agents to some extent
4. Hardware understands only machine language ,lower level language or binary	4. It is written by a well versed programmer and generally in higher level language which is readable by human being
5. It works with binary code, the presence or absence of Pulses as 1's or 0's.	5. It is represented by the Higher Level Languages such as BASIC, COBOL, Etc.,

Check Your Progress 4

A. Classify the following into hardware and software?

       i). Spread Sheet ii). Mouse iii). Data base iv). Scanner

B. What is hardware?

Notes: a) Write your answer in the space given below

      b) Check your answer with the one given at the end of this Lesson (pp. 13)

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2.5 LET US SUM UP

1. Hard ware is the physical component of the computer, and soft ware is the instruction given to the components to perform certain operations.
2. Soft ware consists of certain features like ease of use, Graphical user interface (GUI). Multi-platform capability, Compatibility with other software, Mail enabling, Web enabling
3. Certain differences existing between hard ware and soft ware have been discussed.

2.6 LESSON END ACTIVITY

1. Visit a computer service centre to know about the parts of a computer.
2. Make a visit to a computer centre to learn about the various software languages that are in use.

2.7 POINTS FOR DISCUSSION

    1. What are the functions performed by CPU?
    2. Discuss in detail about the features of software?.
    3. List out the differences between hardware & software.

2.8 CHECK YOUR PROGRESS

1 A. Spread sheet and Database - Software

      Mouse and Scanner   - Hardware

 B. Hard ware

The physical unit (parts) of the computers that are capable of computing and manipulating information

2.9 REFERENCES

1. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

LESSON -3

DATA PROCESSING

3.0 Aims & Objectives

3.1 Introduction

3.2 Data Processing Cycle

3.3 Data Types

3.4 Kinds of Data Processing

3.5 Objectives of Data Processing

3.6 Steps in Data Processing

3.7 Practical Data Processing Applications In Business

3.8 Data Processing Operations

3.9 Let Us Sum Up

3.10 Lesson End Activity

3.11 Points for Discussion

3.12 Check your Progress

3.13 References

3.0. AIMS & OBJECTIVES
After reading this Lesson you will be able to understand:
1. Concepts of data processing and data processing cycle
2. Objectives and steps in data processing.
3. Various types and kinds of data processing.
4. Applications of data processing in business.

3.1 INTRODUCTION

Data Processing Concepts
➢ **Data**

Data means any collection of raw hand figures facts. Data can be considered as the raw material of information. The data may be numerical such as payroll, employee Number, etc. or non-numerical like Student names, Product names, etc.

➢ **Data Processing**

As data is in its raw form it cannot solve any problem. The data needs some processing to make it useful. Data processing is the conversion of data into a more useful form. That is, transmission of data into meaningful information is called data processing.

➢ **Information**

The result obtained by data processing is called information. That is, the processed data is known as information. However, information produced in one data processing step may be used as data in the next data processing step.

DATA Vs INFORMATION	
Data	**Information**
Raw records	Completed One
Un ordered	Ordered
Unrefined Data	Refined Data
What prevails	What is necessary?

3.2 DATA PROCESSING CYCLE

Data Processing is viewed as a system that accepts data as input, processes it into information as output. This can be explained with the help of the following diagram.

INPUT   OUTPUT

| Data | — | PROCESSING | — | Information Data |

3.3 DATA TYPES

The data types may be as follows:
1. **Qualitative data**: It denotes the characteristics of things such as Average, Fair etc.
2. **Quantitative data**: It is expressed in terms of measurable quantities such as 10 KG, 40 degree Celsius etc.
3. **Numeric Types**: The data types may also be an integer (+, -) without any fractional part or real number which includes integers and fractions.
4. **Floating Point Representation**: These data types consist of 3 components namely:
    (1) Mantissa   (2) Radix or Base and (3) Exponent
Besides the above, the data types include alphabetic data and alphanumeric data.

3.4 KINDS OF DATA PROCESSING

The important kinds of data processing are as follows:
1. **Manual Data Processing**: Data is processed without the help of mechanical devices. Here the data is processed using manual things such as abacus, slide rule, Napier bones etc.

2. **Mechanical Data Processing**: In Mechanical Data Processing, mechanical devices like calculators, tabulators, etc, are used for processing.
3. **Electronic Data Processing**: In Electronic Data Processing, the data is processed by either analog or digital computer.

3.5 OBJECTIVES OF DATA PROCESSING

After the industrial revolution, the needs of the mankind increased. Man had to deal with large volume of data. He had to cope up with more and more information. The information collected is to be sorted out, stored and retrieved at short intervals. This necessitated the concept of data processing.

As the complexities of business increased, the number of functions to be performed also increased. The data processing system must be responsible to supply the information when it is needed, so as to make the performance of the organization optimum.

Let us have a look at the general objectives of Data Processing.

1. **Handle huge volume of Data:**
   The basic objective of data processing is to handle huge data in order to enable the organization to function efficiently.

2. **Qualitative and quantitative information:**
   The next important want of data processing is to provide qualitative and quantitative information.

3. **Proper and Timely Information**:
   Different kinds of information are needed in almost all organizations. Data processing provides correct and timely information.

4. **Storage and retrieval of data:**
   Through data processing, information can be stored and retrieved as and when necessary.

5. **Helps in Decision-making:**
   In every organization various decisions are taken at different levels. Such decisions can be more accurate if effective data processing system is used

6. **Improves Productivity:**
   To improve productivity, various measures are to be identified and implemented. It is possible through the properly designed data processing system.

7. **Maintaining Performance at Optimum Level:**
   To maintain the performance of the organization at best possible level various functions at different levels of the organization are to be coordinated. There should be a smooth flow of information among various functional departments. This can be easily achieved through data processing system.

8. Efficient Office Management:

In office management also data processing plays a very important role, through which office automation can be done.

3.6 STEPS IN DATA PROCESSING

1. Identifying the data
2. Input of Data.
3. Manipulation of Data.
4. Output of Information.
5. Storage of Information

1. Identifying the data

Accuracy of information depends on accurate data input. The first step in data processing therefore, is to locate necessary facts and figures from source documents. Accurate, relevant and adequate data must be used as input.

2. Input of data:

After extracting the necessary data from the source documents, they must be transposed in a suitable form acceptable to the computer. Great care should be taken to avoid wrong entries in the forms.

3. Manipulation of data:

It involves the process of shifting, sorting and rearranging the given input. Before processing, validation procedures may be built in to the code to so that input forms do not accept any incorrect data.

4. Output of information:

The main purpose of data processing is to provide meaningful information to the decision-maker. Hence, in data processing the person involved must be very careful about what information is needed and in what form he likes to have it.

5. Storage of information:

The data processed need to be kept for future use. All the processed data will need some form of secondary storage. When storing the data, it is always important to maintain a backup. It should be noted that at each and every step the storage might be done.

Check Your Progress 5

Bring out the steps in data processing

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp. 21)

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3.7 PRACTICAL DATA PROCESSING APPLICATIONS IN BUSINESS

The following are some data processing information undertaken by commercial organizations.

1. Process Control:

In the production process, a computer is directly connected to some plant to control and monitor it. Here, the computer receives the data directly from the plant. It analyses the input data and initiates action to control the on-going process.

2. Accounting:

The Data Processing System can be used to maintain the accounting records and in preparation of final accounts. The general ledger, Accounts Payable, Accounts Receivable, etc., are the examples for the computerized accounting systems followed in most business organizations.

3. Payroll preparation:

In personnel department the data processing system is used to record the operations of the number of employees of different departments in each shifts, leave taken, deductions such as ESI, PF and finally in the preparation of Pay Slips.

4. Sales Analysis:

The Data Processing system is highly useful in sales analysis. The sales manager can prepare the sales forecast on the basis of per month's sales reports and subsequent future actions can be taken.

5. Inventory Management:

Actually the Data Processing System is a boon to every organization, in respect of inventory management. Data Processing is used to maintain up-to-date information about stock, their costs and to initiate orders when the times are about to be exhausted.

6. Office Automation:

The modem offices and business organizations are dependent upon computer based office automation for their competitiveness and better management.

7. Banking and Insurance:

Data Processing Systems are highly needed in the Banking sector where the customer satisfaction is the main criteria. To provide quick and perfect service, data processing system is used. Automatic Teller machines are places in big cities and linked to central computers. Hence, the delay in processing is completely avoided.

8. Insurance and stock broking:

Insurance companies and stock broking firms also use the computerized data processing systems. Large volume of data have to be processed for the preparation of policy statements, interest calculations, renewal notices and in dealing with the securities.

9. Managerial aid:

The Data Processing System is used as a managerial aid in decision-making for solving business problems. It is also very useful in the areas of linear programming, PERT, CPM etc.

Today it appears that the computer is everywhere. Not only the business organization, the other institutions are also using data processing system for their regular use. We cannot think about a situation without a computer. Robotics and Artificial Intelligence are the two promising areas of applications.

Check Your Progress 6

Explain the various data processing applications in business.

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp. 21)

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3.8 DATA PROCESSING OPERATIONS

The data after some processing is transformed into information, which is organized and meaningful. It includes the following operations.

1. Data Generation

It involves the operation of collecting the original data. It implies that the raw data are collected and set out in the form of original document called a source document.

2. Recording

Here raw data is converted into an acceptable form. That is, the data is transcribed from the source documents on the cards or on some other specified forms and are made readable for the machines. This operation is performed throughout the IPO cycle. The punched cards and paper tapes, magnetic tapes, a magnetic disks, tape cassettes, floppy disks, magnetic drums, tape cassettes, floppy disks, RAM cartridge, charged coupled devices, etc., are used as data recording media.

3. Verification

After the data have been recorded, their accuracy has to be checked. This can be done with the help of another machine called verifier or by re-reading.

4. Classification

Classification of information is the next important operation in which the data is separated into various categories.

5. Sorting

Sorting involves sequencing the data in a pre-determined order to facilitate processing. The order may be either alphabetic or numeric.

6. Merging

It is the operation of combining two or more ordered (sorted) sets of data to form another single ordered set.

7. Calculating

Here calculation of greater magnitude can be processed. Calculation involves solving equations and manipulation of the source data such as addition, subtraction, etc.

8. Data Storage

The results of processing one set of data are retained in storage for future use of reference. The basic requirement for utilizing the computer in all business applications is the ability to store and access data. The data is stored in a location called memory referred by its address. In large organizations, huge volume of data is to be stored and accessed. Hence, some auxiliary storage devices are also needed for the effective data processing.

The memory is measured by the following units:

(a) BIT (Binary digit)

It is the smallest possible unit of information. It can be either 0 or 1.

(b) NIBBLE

Four bits form one nibble

(c) BYTE

It is a unit of information consisting of fixed number of bits. It is a combination of 8 bits

(d) CHARACTER

It is represented by one byte. It can be a letter, digit, punctuation mark or special characters.

(e) WORD

The combination of 2 bytes or 4 bytes or 8 bytes is a word.

The data measurement is as follows:

8 bits   - 1 byte
1024 bytes   - 1 kilobyte (KB)
1024 KB   - 1 Mega Byte (MB)
1024 MB   - 1 Giga Byte (GB)
1024 GB   - 1 Tetra Byte (TB)

(f) SECONDARY STORAGE (Backing/Auxiliary Storage):

(a) Magnetic disk - it includes the following:
Hard disk – Rigid, Floppy disk - Flexible
(b) Magnetic tape
(c) Magnetic drum
(d) Mass storage Device - cartridge
(e) Optical Disks - CD ROM (Compact Disk - ROM)

9. Data Retrieving:

Data retrieving is the process of searching or locating a data item from the storage. In EDP system, the data is retrieved from the storage device in sequential, indexed sequential or random access mode. The on-line data storage and retrieval is very useful for the proper functioning of a modern business establishment.

10. Reporting:

Generally in business data processing, the processing operation comes to an end with the reporting of data. In this operation the results of the data processing are made available to others. The processed information may be reported in a number of ways depending on the use of results. The results may be printed out in the form of pay slips, bills, etc. or in the form of reports as ESI Reports, PF Reports or Sales Reports, etc.,

3.9 LET US SUM UP

1. Data in its raw form cannot be used. It must be converted into information to make it useful.
2. To process the data various steps are involved such as identification of data, input and manipulation of data etc.
3. Data processing is useful for decision making and improving productivity in an organisation.

3.10 LESSON END ACTIVITY

Make a visit to a company in your locality to find how electronic data processing is performed.

3.11 POINTS FOR DISCUSSION

1) Write short notes on objective of data processing.
2) What are the steps involved in Data Processing? Explain.
3) Explain in detail about Data Processing Operations.

3.12 CHECK YOUR PROGRESS

1. Steps in data processing
   i. Identifying the data
   ii. Input of data
   iii. Manipulation of data
   iv. Output of information
   v. Storage of information

2.
   i. Process Control
   ii. Accounting
   iii. Payroll preparation
   iv. Sales Analysis
   v. Inventory Management Office Automation
   vi. Banking and Insurance
   vii. Insurance and stock broking Managerial aid

3.13 REFERENCES:

1. Parameswaran R., Computer Applications in Business, S.Chand and Sons company Ltd., New Delhi.

LESSON - 4

COMPUTER APPLICATIONS

4.0 AIMS AND OBJECTIVES

After reading this Lesson you will be able to understand:
1. Various computer applications in business.
2. Application of computers for real time processing and online processing

4.1 INTRODUCTION

Computer plays a very important role in each and every aspect of our life, be it banking, insurance or transportation, it is useful for preparing payroll of the employees, maintenance of optimum inventory level, sales order processing, reservation of tickets etc. It processes the transactions very quickly and accurately. So, it finds applications in various stages of business

4.2 BUSINESS APPLICATIONS

The following are some of the areas of business in which computers are applied:

1. **Payroll Processing:**
Business means selling goods and services. To carry out such activities, business management employs people. They have to be paid monthly salaries and the details regarding pay particulars of employees have to be kept track.

Business community employs computers for such payroll applications and runs a program consisting of a number of smaller programs or modules. Each module performs a particular function of the payroll. Sometimes we call this set of programs as payroll system.

To calculate the pay of an employee, management normally uses the following details of employees.

(1) Employee number (This is a unique number assigned to the employee to identify him just as your roll number in the school) (2) Name, (3) Basic pay, (4) Allowances (House rent allowance and other allowances), (5) deductions (Example Provident Fund deduction) and (6) Bank account number. These details above the employees do not change but they have to be used every month. So they are entered into a file in a computer storage medium and permanently stored. This file goes with the name master file. The file creation module of the payroll system creates this file once.

Before calculation of the pay of employees every month, some figures in the master need changes. For example, if an employee completes a year of service, he normally gets an increment. Such figures are updated using the master update module of the payroll system. After updating, another module of the payroll system reads details from master file and calculates net pay. The program also prints out pay slip for each employee to be handed over to him. A pay slip shows the employee number, name, basic pay, various allowances, various deductions and net pay.

The payroll system also generates a number of statements. It prints out the statement showing employee number, name, bank account number and net pay.   This statement is sent to the bank, which transfers the net pay from the company's account to the individual employee's account in the bank. Some companies copy this statement on to a floppy and send to the bank which processes this statement on its computer.

The payroll system generates a provident fund deduction statement. This statement shows the employee numbers, names and amount deducted. Another statement showing the names, employee numbers and tax deducted is printed. The company sends it to Income Tax office. Thus we see that a number of statements can be printed from the same master file.

2.   Inventory Control:

The second application is the use of computers to keep track of the purchase and issues of parts and raw materials needed in an organization. These parts and raw materials are called inventories and the set of programs used to keep track of the purchase and issue of these inventories constitute the inventory control system.

In business, a particularly quantity of each item or raw material has to be stocked. Too less a stock would result in non-availability of these items, when the manufacturing activity needs it. Too much of stock of these means, more money in terms of investment in buying the excess stock. Business pays interest on money invested, and the excess interest paid on cost of excess stock is a loss to business. So the business maintains an optimum quantity of material. The inventory control system maintains a file with part number, name, quantity on stock a level of stock at which the company orders for fresh quantity (called reorder level) and the suppliers' addresses. This file is the inventory master.

When an item is issued, the inventory update program updates the inventory master reducing the stock by the quantity issued. If the resultant stock falls below the reorder level, the inventory control program prints out an order to the supplier of the item automatically. It can be mailed to the supplier. When the supplier supplies the item, the inventory control program updates the stock on hand.

The inventory control system keeps track of the supplies and issues. So, it can tell the management of the company the usage of these items over a period of time quickly. It also maintains an optimum level of stock of these items.

3. Sales Order Processing

Real –time systems offer the possibility of a greatly prompt service to the customer. His order can be processed within virtually no time. The finished goods inventory file may have data terminals throughout the sales territory. So much that the CRT's can be made to display the invoice on a terminal for the salesman who is in the customer's plant and can input the particulars there and then! The customer would be made immediately in the general ledge. The invoice can also be posted to the accounts receivable file instantaneously. The selection of warehouse that is closest to the customer can also be made and a coy of the invoice could be displayed at the warehouse terminals. Beside, the following functions can be performed rapidly.

- ❖ The inquiries about the customer's accounts status can be answered by the salesman.
- ❖ Credit appraisal can be carried out on-line.
- ❖ Sales analysis master file can be updated online. This file provides a ready Information to the sales manager regarding sales trends, etc.,
- ❖ Inventory replenishment order can be determined as a part of the sales order processing.

Check Your Progress 7

List out any two application of computers in business?

Notes: a) Write your answer in the space given below
b) Check your answer with the one given at the end of this Lesson (pp. 28)

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4.3 ON-LINE APPLICATIONS

1. Banking:

In banks the customers, present cheques for withdrawing money. The clerk verifies from the register the signature of the customer. (The customer has signed in the application form while opening an account). Then he checks from a ledger the customer's balance. If the customer has sufficient balance to cover the cheque amount, the clerk passes the cheque for payment, and updates the balance
.

There are a number of operations that the bank carries out of which the above is an example. We will see how the above operation called personal banking is computerized.

Suppose you want to open a bank account. The bank official hands over a form to you. You fill up the details (such as name, address, profession etc.) and sign the application. The bank stores this information in a computer on which a banking software runs. The customer's signature is scanned by suitable devices and incorporated in the computer file.

If you present a cheque to the clerk in the bank, he can check the signature manually. If he is satisfied with the correctness, he can enter you account number and the cheque amount into the computer which checks your account and updates the amount. The clerk then pays you the money. In the method, the payment is manual and accounting is automatic. There is another way where the checking of you accounts as well as payment is made by computer using an automatic teller machine. Let us study this.

A machine similar to automatic coffee vending machine is installed at selected places. It is connected to the bank's computer. When you open an account, the bank gives you a special type of card. Your name, account number and address are suitably recorded. Your signature is magnetically recorded in that card. All these details are suitably converted and recorded in the computer also. When you want to withdraw money, you go to the teller counter and press a few buttons. You then insert your card in the slot provided in the machine. The machine reads you account number and signature from the card. It sends them to the computer which checks you account number and signature. If they tally, the computer sends a relevant message to the automatic teller machine. It asks you to enter the amount. You may enter the amount through the buttons on the machine. Again the computer checks if you have sufficient balance. If so, it instructs the machine to pay you. The ATM then delivers the cash on the tray fixed in it. You may collect the money.

This is only one example of application of computer in banks. Now large systems installed at the head office of a particular bank are connected to systems installed at its branches all over the country. The computers of different banks are also connected together. By sending suitable messages money can be transferred from one bank to the other. This is called Electronics Funds Transfer.

2. Railway Reservation System:

Application of computers in railway reservation has made tremendous impact in India. Before computerizing, there were a number of counters, each counter serving a particular train or a few trains. If you want to make a reservation to, say Delhi, you have to go to the particular counter and join the queue. The clerk had a register in which two or three pages are allotted to each date. He may have two or three more registers for other trains for which he is making reservation.

He puts seat numbers on a page one by one and keeps writing the names of passengers for whom he reserves seats against seat numbers. After some time, if somebody cancels his ticket, he strikes off the name. When the next person reserves for that time and date, the clerk

writes his name above the cancelled name. This gives rise to lot of confusions. In a number of situations, two persons used to be allotted the same seat.

With the increasing population the Government is increasing the number of trains. Thus the volume of data to be handled has also increased enormously. You can just imagine the confusion this will create if we are still following the manual system of reservation.

We just saw how manual system has become unsuitable in the present context. Now let us study how the computerized railway reservation system works.

There is a central computer with a number of terminals connected to it the details of all trains for which reservation is done at the region are stored in the computer. The railway reservation system runs on this computer. The terminals are situated in booking counters. It is possible to install the terminals in a far off place and connect them to the computer through cables.

When the passenger presents the reservation form to the booking clerk he enters the train number, date, name, age and other details of the passenger. The program checks availability of seats in that particular train on that particular date. If accommodation is available, the clerk presses a button on the key board and the computer prints out the ticket on the printer connected to the terminal. It also updates the computer file to reflect the new reservation position.

Suppose you wanted the ticket for train number 1, but you get only a waiting list. The clerk tells you your position in the waiting list. If you want you can get a wait listed ticket. If not, you tell the clerk to check for accommodation in a different train to your destination. The clerk only has to re-enter the train number. The computer checks availability, reserves you ticket on that train if a seat is available and prints the ticket.

Thus you can go to any booking counter and request for reservation in any train being operated on that station. Also the errors found in the manual reservation method are eliminated.

The reservation system is broader based as follows: Today computers in different cities are connected together. (It is called networking). Suppose you are in Coimbatore. You want to book your journey from Madras to Coimbatore. You can go to a booking counter (Railways have opened a number of booking counters in the same city) in Coimbatore and reserve your ticket from Madras to Coimbatore. Thus there is lot of flexibility in reservation.

We studied that computers are capable of storing lot of data on the hard disk. They are also capable of retrieving data fast. So the list of passengers for a particular day for a particular train is also printed out very fast.

The reservation data for a number of trains over a period of time is available. By suitable software, the railway authorities can prepare the data regarding passengers traveling in different trains to different places during different periods. This helps them plan for new trains, reschedule the running trains and make lot of analysis regarding passenger traffic.

3. Air Lines Reservation System:

We saw how computers handle the railway reservation and offer a number of advantages. They can be used also in Airlines reservation. Only difference will be that some booking counters in the reservation network may be situated in different countries.
This means that we have to connect computers across the countries. Such networks are operational now.

In the coming years, computerized reservation systems will become very common. Even hotel accommodation reservation systems for major hotels are coming up. If we integrate flight and hotel reservation, it is convenient for the passengers.

4.4 REAL-TIME APPLICATIONS

In real time applications, computers control an on going activity. Let us consider the example of a manufacturing process. A product C is made from raw materials A and B. The quality of C depends upon, among other things, the quality of A and B and their quantities. In big manufacturing processes, raw materials are fed by machineries. Due to problems in machineries, the performances may vary from machine to machine. This affects the quality of final product. Manual inspection of quality and operation of these machineries to control the quantity are slow. This slows the manufacture of C from raw materials A and B. Signals from C are fed to the computer. Suitable sensors are installed in the lines carrying raw materials as well as finished product. These generate signals. The values of these signals for correct proportion of raw materials are stored in the computer. When the process is on signals keep coming from the output line depending up the quality of finished product.

Let us see what happens if either A or B varies in quality. The quality of the finished product also suffers. The sensor in the finished product line senses this. The signals generated by it change in strength. They are sent to the computer. It compares the signals with already stored signals. The difference is used to change the quantity of raw materials A and B.

Manual control of this process is slow. Moreover, if people inspect quality and operate machineries feeding raw materials, they become tired after sometime. But computer does not. So the quality of product is uniform. Moreover, there may be processes where the presence of human beings continuously for hours together will be injurious to their health. In such places computer control avoids such ill-effects.

4.5 LET US SUM UP

1. Computer is useful in business processes like payroll processing for generating statements useful for various departments like provident office, ESI etc.
2. It is useful for inventory control activities such as maintaining optimum inventory level and re-order level.
3. Online applications in banking and reservation have brought about advantages like saving of time and money.
4. Car manufacturing industries and other production functions use real time applications effectively.

4.6 LESSON END ACTIVITY

Visit Indian railways website to know how online ticket reservation is made.

4.7 POINTS FOR DISCUSSION

1. Explain in detail about the application of computers in business.
2. Explain in detail about on-line applications.
3. Write short notes on Real-Time Applications.

4.8 CHECK YOUR PROGRESS
1. Your answer may include any of the following:
   i).   Sales order processing
   ii).   Inventory control
   iii).   Payroll processing

4.9 REFERENCES:
1. Parameswaran R., Computer Applications in Business, S.Chand and Sons company Ltd., New Delhi.

LESSON - 5

COMPUTER-RELATED JOBS

5.0 Aims and Objectives

5.1 Introduction

5.2 Computer-Related Jobs

5.3 Let Us Sum Up

5.4 Lesson End Activity

5.5 Points for Discussion

5.7 Check your Progress

5.8 References

5.0 AIMS AND OBJECTIVES

After reading this Lesson you will be able to understand:
1. Various job opportunities available in the computer field.
2. Nature of job of a programmer, system analysts, web designer
3. Information technology enabled services like BPO.

5.1 INTRODUCTION

The fast spread of IT has generated a need for highly trained workers to design and develop new information systems and to integrate new technologies in them. It is creating the need for professional workers who can fulfill the high performance standards in the technology-based industries. The IT professional plan, design, develops, support, and manage the strategies and adopt them to fulfill basic objectives of them firm. The rapidly changing technology requires the employees to have more skills and education. The companies look out for IT professionals who not only have sound technical knowledge of the subject but also have sound interpersonal and communication skills.

5.2 COMPUTER-RELATED JOBS

1. Programmer:
A programmer is a person who writes the code for a computer program. Computer programs are the instructions given to the computer, telling the computer what to do, which information to identify, access and process. The programmers write programs, depending on the specifications given by the systems' analysts and software engineers. After the completion of the design process, the programmer's job is to convert that design into a series of instructions that the computer can follow. These instructions are coded in a programming language such as C, C++, and Java, and then tested to ensure that the instructions are correct and produce the required result. Programmers perform functions such as system designing, and its related

services. They are involved in coding of a project and the successful implementation of the developed system.

There are tow types of programmers – application programmers and system programmers. The application programmers code programs for a specific task (application) in the organization. On the other hand, the systems programmers code programs for controlling and maintaining the computer system software.

2. System analyst:

A systems analyst plans, designs, develops, and implements new systems or applies the existing system resources to perform additional operations. Most of the systems analysts work with specific type of system like business, accounting, finance, science or engineering and so on. Some systems analysts are also known as system developers or system architects.

A system analyst determines the problem in the system by discussing it with the managers and users before starting an assignment. They study the information needs of the organization to determine the changes that are required to deliver a solution to the problems of users. To design a system, the systems analysts specify the inputs required by the system, plan the processing steps and finalize the output to meet the user's requirements. Next, the systems analyst determines the hardware and software needed to set up the system.

Systems analysts prepare the specifications, flowcharts, and process diagrams for the computer programmers to follow, and then work with the programmers to debut, and to rectify and errors in the system. They also check the initial use of the system and organize tests to check the working of the system to ensure that it works as required of planned. Systems analysts who perform more intricate testing of products are referred to as software equality assurance analysts. They not only perform tests but also diagnose the problems, suggest solutions and checks whether the program requirements have been met or not. The analysts, who design, test and evaluate the Internet, Intranet, local area network (LAN), wide area network (WAN) and other data communications system are called network and data communications analysts.

3. Network administrator

A network administrator is a person who installs, configures, and supports the local area network, wide area network, the Internet system or the segment of a network system in an organization. Every network in an organization requires at least one network administrator. Network administrators perform the functions such as installation, configuration, maintenance of computers, and networking of equipment. They also check and ensure the availability of network to all the users. They supervise the support of other networks and plan, coordinate and implement network security measures.

4. Database administrator

A database administrator (DBA) is an individual who is responsible for the storage of data, management of the database, and implementation of the database management system. They work with database management systems software and determine ways to organize and store data. They identify user requirements, set up the computer databases, and test and organize the modifications to the systems. They also ensure the performance of the system in the organization, understand the platform on which the database is running and adds new users to the

system. DBA is responsible for maintaining data integrity, back up systems and database security.

5. Web designers

A web designer is an individual who provides an architectural structure for the effective communication of clients' content by logically organizing the information and making it accessible. With the rapid growth of the Internet, many jobs relating to design, development, and maintenance of the web sites and servers have cropped up in the market. The web designer controls all aspects of design and programming of elements of text and visual design. They are responsible for maintaining all technical aspects of a web site, including its performance issues such as speed of access and approving the content of the web site. Web designers create the artistic feel of the web site, facilitate navigation, and make content on the web site accessible to the users.

6. Information security analyst

An information security analyst is an individual who performs highly complex analysis and technical tasks involving assignment and co-ordination of measures to provide information assurance, event detection, and rapid response across various environments of the enterprise. Information security analysts design, implement and support integration of information security solutions including security architectures, firewall administration, integrating security products, and developing and coordinating security implementation plans. They provide technical support on security projects that involve a wide range of issues including secure electronic data traffic, network security, platform and data security and privacy. They review and contribute to the security activities of business application and development project plans across all business units.

7. Business process outsourcing

Business Processing Outsourcing (BPO) refers to a decision to assign to another party some or all non-core processes. The main motive of BPO is to allow the company to invest more time, money, and human resources into core activities and building strategies, which helps in company growth. The BPO jobs include various sectors like finance, accounts, customer support, IT services, medicines, among other. Today, the global market is highly competitive and ever changing. A company must focus on improving productivity and even cut down costs. There fore, many tasks that use precious time, resources and energy, are being outsourced. BPOs, or the units to which work is being outsourced are flexible, quicker, and cheaper and very efficient in performance of the work.

Check Your Progress 8
Who is a programmer?

Notes: a) Write your answer in the space given below
b) Check your answer with the one given at the end of this unit (pp.31)

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5.3 LET US SUM UP

1. The vast spread of IT has generated versatile jobs such as programmer, Systems Analysts, network Administrator, Web designer, information security analyst, and many more.

5.4 LESSON END ACTIVITY

Plan to meet an employee of a BPO industry to know about the job and job opportunities in the ITES field.

5.5 POINT FOR DISCUSSION

1) Explain in detail about various computer related jobs in business.

5.6 CHECK YOUR PROGRESS

1. Programmer:

A programmer is a person who writes the code for a computer program. There are two types of programmers-application programmers and system programmer.

5.7 REFERENCES

1. Suresh K. Basandra, Computers Today, Galgotia Publications Pvt Ltd., New Delhi.
2. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

UNIT II

LESSON - 6

TYPES OF COMPUTER SYSTEMS

6.0 AIMS & OBJECTIVES

After reading this Lesson you will be able to understand:
1. The types of computer systems which are classified into Analog, digital, micro, mini, mainframe & super computers etc.
2. Differences between analog and digital computers.
3. Basic principles of operation of a digital computer.

6.1 INTRODUCTION

Our society is being reshaped by rapid advances in information technologies, Computer, Telecommunication networks and other digital systems that have vastly increased our capacity to know, achieve and collaborate. These technologies allow people to transmit information quickly and widely, linking distance places and to create communities that just a decade ago were unimaginable.

It is difficult to appreciate just how quickly information technology is evolving. Five decades ago ENIAC, one of the earliest computers stood ten feet tall and stretched eighty feed wide; while today, one can buy a musical greeting card with a silicon chip that is 100 times faster than ENIAC. This extraordinary phase of information technology is bringing people and cultures together and creating new social dynamics in the process. It is leading to the formation of closely bonded and widely dispersed community of people united by their interest in doing business or in sharing experiences and intellectual pursuits. New forms of knowledge accumulation are developing, as are computer based learning system that opened the way to innovate modes of instruction and learning.

A computer is an electronic machine, operating under the control instructions stored inside its memory. As an aid in problem solving, it accepts data, both numeric and non numeric, processes and presents it in the desired form.

The following are the various types of computer systems:

6.2 VARIOUS TYPES OF COMPUTER SYSTEMS

1. Analog Computers

Analog is the Greek word, which means similar. So, in analog computers, the similarities between any two quantities are measure by electrical voltages or current. The analog computers operate by measuring instead of counting.

The analog computer works on the supply of continuous electrical signals. The display is also continuous. Its output is in the form of graphs.

Analog Signal: An analog signal is a continuous variable electromagnetic wave. It can consume an infinite number of voltage or current values.

Characteristics of analog computer

The analog computer has the following important characteristics:
a) It operates by measuring.
b) It requires physical analog.
c) It functions on continuously varying quantities.
d) The output is usually represented in the form of graph.
e) In analog, the calculations are first converted in equation and later converted into electrical signals.
f) The accuracy of the output is poor.
g) It has limited memory space.
h) It is not versatile. i.e., it has limited application.
i) The speed of analog computer is low.
j) Not suitable for business and industry.

2. Digital Computers

These computers work with quantities represented as digits. They operate on discrete quantities. In digital computer, both numeric and non-numeric information are represented as strings of digits. These computers use binary codes, 0's and 1's, to represent the information. The information is given to the computer in the form of discrete electrical signals.

The basic operation performed by a digital computer is addition. Hence, the other operations such as multiplication, division, subtraction and exponentiation are first converted into "addition" and then computed.

Characteristics of digital computer

The digital computer has the following characteristics:
a) It operates by counting.
b) It functions on discrete numbers.
c) The calculations are converted into binary numbers i.e., 1s and 0s.
d) The output is represented in the form of discrete values.
e) Its accuracy is good.

    f)   It has large memory space
    g)   It is versatile in nature and is suitable for a number of applications
    h)   In digital computers , the numbers, words and symbols can be used.
    i)   Its processing speed is high.
   j)   It is highly suitable for business application.

Analog VS Digital computer

S. No	Analog computer	Digital computer
1	It operates by measuring	It operates by counting
2	It requires physical analog	It functions on discrete numbers
3	The calculations are first converted to equations and later converted into electrical signals	The calculations are converted into binary numbers(1s and 0s)
4	The output is in the form of graph	The output is in the form of discrete values
5	Less accurate	More accurate
6	Less speed	High speed
7	Limited memory is available	More memory is available
8	Lacks flexibility	Highly flexible
9	Cannot process alpha-numeric information	Can process alpha number information
10	Limited application	More number of applications
11	Not suitable for business applications	Highly suitable for business applications

3. Hybrid computers:

The computer which possess the features of both analog and digital computers are called hybrid computers. That is, the hybrid computers have the good qualities of both analog and digital computer.

With the hybrid computer the user can process both continuous and discrete data. This computer accepts either digital or analog or both types of input and gives the results as per requirements through special devices. In the hybrid computers a converter is fixed to convert the analog data into digital data and vice versa. These are special purpose devices and are not widely used.

Hybrid Computers
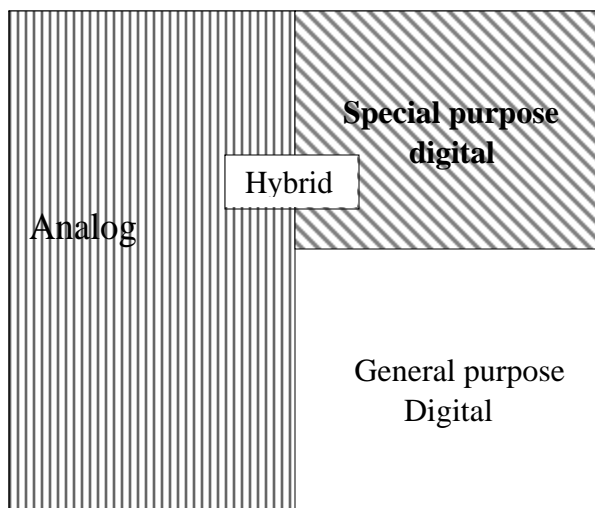
4. General Purpose Computer

These are designed and constructed to cater almost all the needs of the society. They can perform various operations. In fields of engineering, science, commerce and industry. They are able to perform according to the programs created to meet different needs. The general – purpose computer can be used to prepare stores reports, sales reports, payroll, etc. a general purpose computer can solve a much broader class problems specifically a general purpose digital computer is remarkably versatile.

5. Special Purpose Computers

These computers are designed to solve a particular problem or task, the computers are provided with limited memory and speed necessary for a particular job. The instructions needed to perform the particular task are incorporated into the internal memory of the computer. It does not posses unnecessary options, hence it is economical. E.g. Business purpose computers and scientific purpose computers.

6. Micro Computers

Because of its small size and the use of micro-processor, this computer is called micro computer. All the computers have three units namely input, output and central processing unit, (CPU). The entire CPU is contained in a single or a few microchips. When equipped with memory and input/output control circuitry, it is called micro computer. Its storage capacity is low when compared to mini and main frame computers. It is able to accept most of the high level languages. However, it uses an interpreter or complier for running high level languages.

Microchips contain micro electronic circuitries which are very tiny. Large numbers of these can be packed tightly on to a single tiny piece of silicon. Silicon is a material found in sand. The microchip is made by building up a series of very thin layers of silicon and of the tiny components which are held in it.

The Micro computers are small and portable. They are relatively inexpensive, the micro computers have excellent graphic capabilities. The maximum word length varies according to the configuration of the microcomputers.

Kinds of Microchips
The microchips can be classified as follows:
a) **Micro Processors:** These are the most powerful kind. They are almost tiny computers in themselves. Each one ahs a processing Unit, a memory and a special area to handle input and output. Microprocessors are the most important part of the CPU of a modern computer
b) **Memory Chips:** These are the common form of computer memory. They are used to hold information either temporarily or permanently.
c) **Input and Output Chips:** In these chip circuits the flow of information is the both directions.

Features of Micro Computers
a) Its storage capacity is low.
b) Its rate of acceptance and transfer of data is limited i.e., a maximum of 5 lack bytes / second.
c) It is able to accept most high level languages. However it uses an interpreter when running high level language because most micros do not have sufficiently large memory to support compliers.
d) The maximum word length it holds is 16-bits.

Advantages
a) They are small and portable.
b) They are relatively inexpensive.
c) They work as soon as they are switched on.
d) They have excellent graphic capabilities,
e) They do not occupy much space.
f) They do not consume much power.

Disadvantages
a) Micros have a limited storage capacity.
b) They are relatively slow.

7. Workstation
Workstation is a type of computer used for engineering applications (CAD/ CAM), desk top publishing, software development, and other types of applications that required a moderate amount of computing power and relatively high quality graphics capabilities. Workstations generally come with a large, high-resolution graphics screen, at least 64MB (Mega bytes) of RAM, built – in network support, and a graphical user interface. Most workstations also have a mass storage device such as a dish drive, but a special type of workstation, called a diskless workstation, comes without a disk drive. The most common operating systems for workstations are UNIX and Windows NT. In terms of computing power, workstations lie between personal computers and mini-computers, although the line is fuzzy on both ends high-end personal computers are equivalent to low-end workstations. And high-end workstations are equivalent to minicomputers.   Like personal computers, most workstations are single-user computers. However, workstations are typically liked together to form a local-area network, although they can also be used as stand-alone systems.

8. Mini Computers

The size of the mini-computer is in between the size of micro and main frame computers. It is more powerful than a micro computer. Mini computers are usually designed to serve multiple users. Today, mini-computers are the popular data processing systems in the field of business and industry. These computers accept all high level languages.

Characteristics

1. It is a general purpose machine with a smaller CPU than a main frame
2. Its storage capacity is about 2 mega words
3. Its word lengths are usually 12, 16, 24, 32 bits.
4. Its rate of acceptance and transfer of data is a maximum of 4 million bytes/seconds
5. It can support all high level languages.
6. It can support many terminals i.e., more than 20 terminals.

Advantages

a) It performs almost all the tasks that a mainframe computer does.
b) It is relatively inexpensive and is within the purchasing power of the small and medium sized business firms.

Disadvantages

a) They are very expensive
b) They required large room space.
c) Their consumption of electricity is very high.
d) Maintenance coast is also very high.

9. Super Computers

The super computers are very costly. Hence it is rarely used. Its capacity is abnormally high, it cannot be compared with any other computers in capacity, function, speed, accuracy, language etc., they have operations done in parallel, rather than sequential. They are employed for specialized applications that require immense amounts of mathematical calculations. The chief difference between a super computer and a main frame computer is that a super computer channels all its power into executing a few programs as fast as possible. But main frame uses its power to execute many programs concurrently. CRAY – 3, Cyber 205, and PARAM are some well known super computers.

Characteristics

a) They use several processors working simultaneously.
b) They process at a rapid speed.
c) The main memory ranges form 8 to 64 megabytes.
d) They have operations done in parallel, rather than sequentially. They are used in weather forecasting, supersonic aircrafts design and other works that require billions of calculations per second.
e) They can be used for animated graphics-fluid dynamic calculations etc.,

10. Laptop computer:

Laptop computer, simply laptop (notebook computer or notebook), is a small mobile computer, which usually weighs 2-18 pounds (1-6 kilograms), depending on size, materials, and other factors.

Laptops usually run on a single main battery or from an external AC/DC adapter which can charge the battery while also supplying power to the computer itself. Many computers also have a 3 volt cell to run the clock and other processes in the event of a power failure.

As personal computers, laptops are capable of the same tasks as a desktop computer, although they are typically less powerful for the same price. They contain components that are similar to their desktop counterparts and perform the same functions, but are miniaturized and optimized for mobile use and efficient power consumption. Laptops usually have liquid crystal displays and most of them use different memory modules for their random access memory (RAM), for instance, SO-DIMM in lieu of the larger DIMMs. In addition to a built-in keyboard, they may utilize a touchpad (also known as a trackpad) or a pointing stick for input, though an external keyboard or mouse can usually be attached.

Check Your Progress 1
A. Give some examples for super computers.
B. What is a micro computer?

Notes: a) Write your answer in the space given below
b) Check your answer with the one given at the end of this Lesson (pp. 40)

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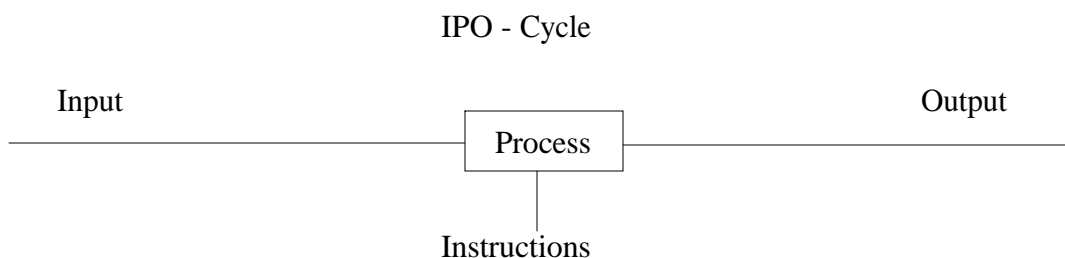……..…………………………………………………………………………………………

6.3 BASIC PRINCIPLES OF OPERATION OF DIGITAL COMPUTER

Today, the most commonly used computers in business are digital computers. Even though they ma differ in constructional details, the basic principles of operation are almost the same.

A computer is basically a device used for processing of data, it performs the following three operations in sequence:

a) Receives the data and instruction.

b) Processes the data as per the instructions.

c) Output the result i.e., information.

This cycle of operation of a computer is known as the input process – Output cycle. This can be explained in the following figure.

IPO - Cycle

Input   Output

```
                          ┌──────────┐
──────────────────────────│ Process  │──────────────────────────
                          └──────────┘
                               │
                          Instructions
```

The data are provided to the computer through the input devices. They are encoding such a way, which the computer can understand. The computer then processes the data with the help of instructions provided to it, then it produces a meaningful and desired output known as information.

The above functions are collectively known as the basic principles of operation of a digital computer. These can be expanded as follows:

a) Accepting inputs
b) Memory manipulation
c) Arithmetic operations
d) Decision making and
e) Giving output

Block diagram of a computer
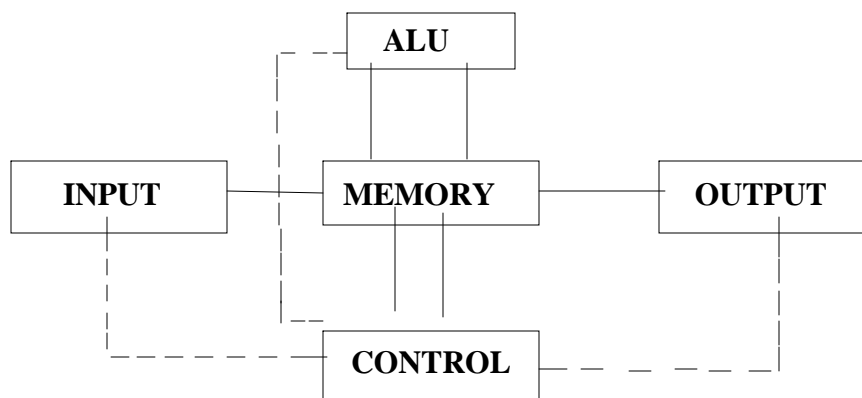
6.4 LET US SUM UP

1. Analog computers- calculations are converted to equations and then converted into electrical signals. Output is in the form of graph.
2. Digital computers- calculations are converted into binary numbers and output is in the form of discrete numbers.
3. Hybrid computers include the characteristics of both analog and digital computers.
4. A micro computer is a small, low cost digital computer, which usually consists of a microprocessor, a storage unit, an input and output channel, all of which maybe on one chip inserted into one or several PC boards. Micro computers include desktop, laptop and handheld models such as PDAs
5. A mini computer is a small digital computer, which is normally able to process and store less data than a mainframe but more than a micro computer.

6. A mainframe is an ultra high performance computer made for high volume, processor intensive computing. It is mainly used for large volumes of data processing, high performance online transaction processing systems.

7. A super computer is a special purpose machine. There are unique and parallel architectures in order to achieve high speed and being effective on a small range of problems.

6.5 LESSON END ACTIVITY

Visit a computer centre which have speech input device and know how input is given through that device.

6.6 POINTS FOR DISCUSSION

1) Explain in detail about various types of computers.

2) List out the characteristics of analog computers.

3) Write short notes on the characteristics & Digital Computers.

4) List out the differences between analog and Digital Computers.

5) Explain the basic principles of operation of Digital Computers..

6.7 CHECK YOUR PROGRESS

1. A. Your answer may include any of the following:

CRAY – 3, Cyber 205, and PARAM

B. A micro computer is a small, low cost digital computer, which usually consists of a microprocessor, a storage unit, an input and output channel, all of which maybe on one chip inserted into one or several PC boards. Micro computers include desktop, laptop and handheld models such as PDAs

6.8 REFERENCES:

1. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

LESSON – 7

GENERATIONS OF COMPUTERS

7.0 Aims & Objectives

7.1 Introduction

7.2 Generations of Computers

7.3 Let Us Sum Up

7.4. Lesson End Activity

7.5 Points for Discussion

7.6 Check your Progress

7.7 References

7.0 AIMS & OBJECTIVES

After reading this lesson you will be able to understand:
1. Various technologies used in different generations.
2. Characteristics of computers of each generation

7.1 INTRODUCTION

The history of computer development is often discussed with reference to different generations of computing devices. In computer terminology, the word generation is described as a stage of technological development or innovation. A major technological development that fundamentally changed the way computers operate resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable devices characterize each generation of computers.

7.2 GENERATIONS OF COMPUTERS

1. First Generation (1940-1956):Vacuum Tubes

First generation computers were vacuum tube / thermionic valves-based machines. These computers used vacuum tubes for circuitry and magnetic drums for memory. A magnetic drum is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored. Input was based on punched cards and paper tape, and output was displayed on printouts.

First generation computers relied on binary-coded language (language of 0s and 1s) to perform operations and were able to solve only one problem at a time. Each machine was fed with different binary codes and hence were difficult to program. This resulted in lack of versatility and speed. In addition, to run on different types of computers, instructions must be rewritten or recompiled.

Examples: ENIAC, EDVAC, and UNIVAC.

➢ **Characteristics of first generations computers:**

❖ These computers were based on vacuum tube technology.
❖ These were the fastest computing devices of their times. (computation time was in milliseconds)
❖ These computers were very large, and required a lot of space for installation.
❖ Since thousands of vacuum tubes were used, they generated a large amount of heat. Therefore, air conditioning was essential.
❖ These were non-portable and very slow equipments.
❖ The lacked in versatility and speed.
❖ They were very expensive to operate and used a large amount of electricity.
❖ These machines were unreliable and prone to frequent hardware failures. Hence, constant maintenance was required.
❖ Since machine language was used, these computers were difficult to program and use.
❖ Each individual component had to be assembled manually. Hence, commercial appeal of these computers was poor.

2. Second Generation Computers (1956-1963):Transistors

In the sixties, there was lot of development in semiconductor field - a field of materials. In vacuum tubes, a filament is heated to emit electrons,(the basic component of an atom)that carry current. In 1946,Willam Shockley and a few of his colleagues invented **transistors**, which do not need any heating to liberate electrons in addition to being smaller in size, they saved power due to the absence of heating and hence the cooling needed. the smaller size resulted in smaller distances that the electrons have to travel to transmit information from one part of the computer to another. Hence calculations became faster. The reliability also increased. Today you cannot see any second generation computers.

The smaller size of components saw mass production of computers which became cheaper. Many companies started buying and using them increasing the demand. Computer programming languages developed further to make programming easier and user friendly. yet if you compare today's computers, they were a lot behind. The increased use of computers and the consequent mass production sent the prices crashing down. Computer scientists and electronic engineers were developing more sophisticated computers.

➢ **Characteristics of second generation computers:**

❖ These machines were based on transistor technology.
❖ These were smaller as compared to the first generation computers.
❖ The computational time of these computers was reduced to microseconds form milliseconds.
❖ These were more reliable and less prone to hardware failure. Hence, such computers required less frequent maintenance.
❖ These were more portable and generated less amount of heat.
❖ Assemble language was used to program computers. Hence, programming became more time efficient and less cumbersome.
❖ Second generation computers still required air conditioning.
❖ Manual assembly of individual components into a functioning unit was still required.

3. **Third Generation Computers(1964 - early 1970s):Integrated circuits**

In second generation computers, one could recognize the circuit components such as transistors, resistors and capacitors distinctly. There were physically separate or "discreet". Slowly scientists started integrating these components together so that they are not separate. They were fused into the circuits. People called it large scale integrated circuits (LSI). Computers using such components were called third generation computers. Since components were packed together more densely, the size of computers became smaller. Programmers also developed more sophisticated software. By 1970, engineers developed a device called microprocessor. Lot of circuits was packed into it. Intel 4004 was one such chip.

➢ **Characteristics of third generations computers:**
❖ These computers were based on integrated circuit (IC) technology.
❖ They were able to reduce computational time from microseconds to nanoseconds.
❖ They were easily portable and more reliable than the second generation.
❖ These devices consumed less power and generated less heat. In some cases, air conditioning was still required.
❖ The size of these computers was smaller as compared to previous computers.
❖ Since hardware rarely failed, the maintenance cost was quite low.
❖ Extensive use of high-level languages became possible.
❖ Manual assembling of individual components was not required, so it reduced the large requirement of labour and cost. However, highly sophisticated technologies were required for the manufacture of IC chips.
❖ Commercial production became easier and cheaper.

4. **Fourth Generation Computers (Early 1970s – till date):Micro processors**

More and more circuits were packed in a microprocessor. The components were integrated further and very large scale integration (VLSI) technology revolutionized computer field further. Intel Corporation made chips such as 8080 and 8086 to be followed by 80286, 80386, 80486 and now the Pentium processor. These chips perform calculations faster. They are not only used in computers, but also in measuring devices and even in house hold devices such as washing machines.

Computers using such VLSI chips progressively shrunk in size. Computers using the microprocessors are termed as microcomputers. The software technology also developed further. Programmers developed more sophisticated and user friendly software. In course of time, the cost of these computers have come down so much that even individuals bought them so they came to be known as personal computers.

➢ **Characteristics of Fourth generation computers:**
❖ Fourth generation computers are microprocessor-based systems.
❖ These computers are very small.
❖ Fourth generation computers are the cheapest among all the other generations.
❖ They are portable and quite reliable.
❖ These machines generate negligible amount of heat, hence they do not require air conditioning.
❖ Hardware failure is negligible so minimum maintenance is required.
❖ The production cost is very low.
❖ GUI and pointing devices enable users to learn to use the computer quickly.
❖ Interconnection of computers leads to better communication and resource sharing.

5. Fifth Generation Computers (Present and beyond):Artificial Intelligence

Up to fourth generation, the classification was based purely on hardware. Fifth generation computers are classified based on software also. VLSI technology is used in fifth generation computers. They have large main memories. The speed is also high. In addition to all this, Fifth generation computers run software called 'expert systems'.

➤ **Characteristics of Fifth Generation computers:**

❖ **Mega Chips:**

Fifth generation computers will use Super large Scale integrated (SLSI) chips, which will result in the production of microprocessor having millions of electronic components on a single chip. In order to store instructions and information, fifth generation computers require a great amount of storage capacity. Mega chips may enable the computer to approximate the memory capacity of the human mind.

❖ **Parallel Processing:**

Most computers today access and execute only one instruction at a time. This is called serial processing. However, a computer using parallel processing accesses several instructions at once and works on them at the same time through use of multiple central processing units.

❖ **Artificial Intelligence (AI):**

It refers to a series of related technologies that tries to simulate and reproduce human behaviour, including thinking, speaking and reasoning. AI comprises a group of related technologies: expert systems (ES), natural language processing (NLP), speech recognition, vision recognition, and robotics.

Check Your Progress 2

In which generation the following were used.

i) Transistors (ii). Vacuum tubes   (iii). Microprocessors (IV). Integrated circuits

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.45)

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7.3 LET US SUM UP

1. Based on the type of processor installed in the computer, the generations of computers are classified into five.
2. In First generation, Vacuum tubes were used. So the computer were very large in size. It used binary coded language to write programs.
3. In second generation, transistors were used. So the computer became small in size. Computer programming languages were developed and programming also became easier.
4. In third generation, Integrated circuits were used. Sophisticated software was also developed. This helped to reduce computational time.

5. In fourth generation, microprocessors were used. Sophisticated and user friendly software was also developed. This helped to reduce computational time further and cost of computers also came down considerably.
6. VLSI technology is used in fifth generation computers. They have large main memories. The speed is also high. In addition to all this, Fifth generation computers run software called 'expert systems'.

7.4. LESSON END ACTIVITY

1. Explain in detail about the generation of computers.

7.5 POINTS FOR DISCUSSION

1. Discuss in detail about the various generations of computers.
2. List out the characteristics of First Generation Computers.
3. Write short notes on the characteristics of 2nd Generation Computers.
4. What are the characteristics of 4th Generation Computers?

7.6 CHECK YOUR PROGRESS

1. Transistors   -   Second Generation
    Vacuum tubes   -   First Generation
    Micro processors   -   Fourth Generation
    Integrated circuits -   Third Generation

7.7 REFERENCES

1. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

LESSON - 8

DATA PROCESSING SYSTEMS

8.0. Aims & Objectives

8.1 Introduction

8.2 Data Processing Systems

8.3 Let Us Sum Up

8.4 Lesson End Activity

8.5 Points for Discussion

8.6 Check your Progress

8.7 References

8.0. AIMS & OBJECTIVES

After reading this lesson, you will be able to understand:
1. Various methods of data processing.
2. Draw backs and special features of data processing

8.1 INTRODUCTION

The methods of data processing depend upon the following factors:
- (a)   Volume of data to be processed
- (b)   Complexity of data processing operations
- (c)   Computational demands
- (d)   Processing time constraints and
- (e)   Economic factors.

Various methods or modes of data processing are given below:
- *(i).*   The single user system
- *(ii).*   Batch processing
- *(iii).*   Multi-programming
- *(iv).*   On-line Processing
- *(v).*   Real-Time processing
- *(vi).*   Time sharing concept
- *(vii).*   Distributed processing

8.2 DATA PROCESSING SYSTEMS

The methods of data processing are explained below:

1.   The single user system

It is one-man show and is indicative of one of the earlier stages of computer development. Here only one person can work at a time. Hence, especially if the machine is meant for the use of many persons, much computer time is wasted waiting for one person to finish and debug his program on the machine.

2. Batch Processing

This is an old system but even today it is used for data processing in computing machines, in which the capacity of the CPU is limited. In this system, the data is collected for a predetermined period of time, after which it is accumulated in sequential manner.

In this system the source transaction documents are first collected before being sent to computer room. A batch of transactions is entered onto a computer media by data entry devices. The transactions are validated during data entry and verified with the source documents from the check lists. The validated and verified results on reports are returned to the user departments. In batch processing system the emphases is on maximizing the computer resource utilization.

In batch processing, the processing cycle called Batch processing cycle repeats itself at every regular intervals. The elements this cycle are given below:

    (i)   Data capture.
    (ii)   Data transmission.
    (iii)   Data transcription, verification and validation.
    (iv)   Job Processing.
    (v)   Job assembly putting together the batch for processing.
    (vi)   Job disassembly (separating out the reports after processing)
    (vii) Reports and distribution.

Features

    (a) Here, the data is accumulated into batches and processed periodically.
    (b) The jobs are processed one after the other without any user interaction.

The concept of Batch Processing is dearly explained with the help of the following diagram:

Concept of Batch Processing
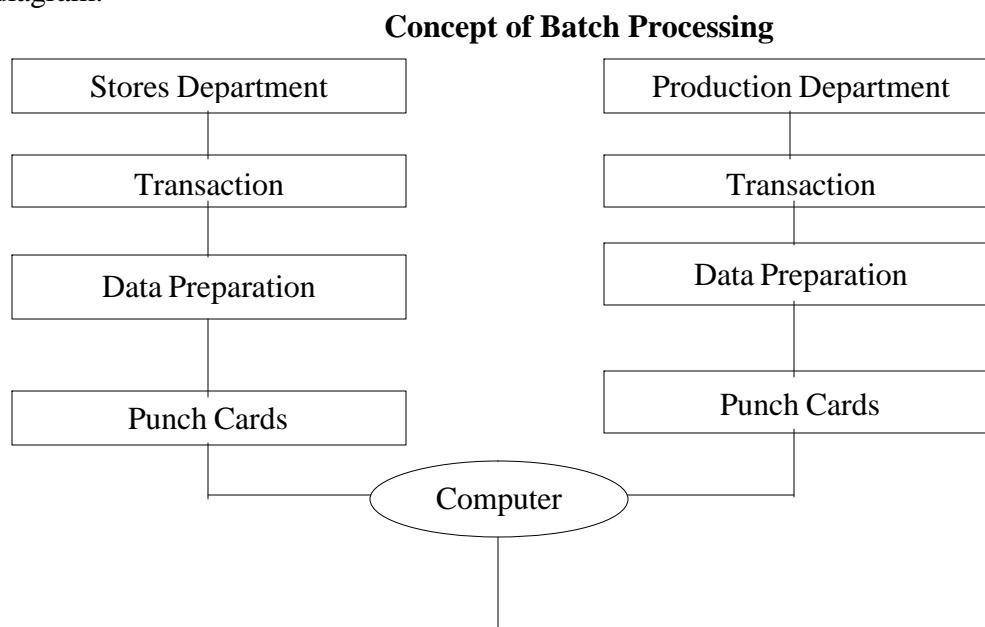
Reports

Examples of applications which can use batch processing are:

(1) Payroll Processing: In payroll processing the data are collected for a stipulated period of time usually one month and processed at regular intervals after which payments are distributed to all the employees.

(2) Telephone Billing: Here the subscriber does not get a bill for every call he makes. Instead, his calls are recorded at a centralized place and are processed on a predetermined period of time to prepare his bills.

(3) Financial accessing

(4) Budgeting and Budgeting control

(5) Production planning and control

(6) Project planning and control

(7) Project planning and control

Drawbacks in Batch Processing:

The following are the drawbacks of batch processing:

1. Time gap between capture of data

2. Time consuming to debug

3. Delay in generating reports

3. Multi-programming:

In batch processing, programs are executed one by one. The memory and ALU of the machine are not being fully utilized. To get the maximum use of the machine, multi-programming system is used. "Multi-programming enables to store and execute more than one program in the CPU at the same time". The multi-programming concept is event based. The purpose of multi-programming is to increase utilization of the computer system as whole.

Multi-programming is defined as execution of two or more program that all reside in primary storage. Since the CPU can execute only one instruction at a time, cannot simultaneously execute instructions from two or more program. However, it can execute instructions from one program then from second program then from first again, and so on. This type of processing is referred to as concurrent execution. Using concept of concurrent execution, multi-programming operate in the following way:

When processing is interrupted on our program, perhaps to attend an input or output transfer, the processor switches to another program. This enables all, parts of the system, the processor, input and output peripherals to be operated concurrently thereby utilizing the whole system more fully. When operating on one program at a time the processor or peripherals would be idle for a large proportion, if the total processing time, even though this would be reduced to some extent by buffering. Buffering enables the processor to execute another instruction while input or output is taking place rather than being idle while transfer was completed. Even then, when one program is being executed at a time, basic input and output peripherals such as floppy

disk drive and line printers are slow compared with the electronic speed of the processor and this causes an imbalance in the system as a whole. However, in a multi-programming environment the CPU can execute one program's instructions while a second program is waiting for I/O operations to take place.

In a system of multi-programming storage is allocated for each program. The areas of primary storage allocated for individual programs are called 'partitions'. Each partitions must have some form of storage protection and priority protection to ensure that a program must have some form of storage protection to ensure that a program is one portion will not accidentally write over and destroy the instructions of another partition and priority (when two or more programs are residing in primary storage) because both programs will need access to the CPU's facilities (e.g.; the arithmetic and logic section) A system of priority a method that will determine which program will have first call on the computer's facilities is normally determined by locating the program in specific partitions.

Programs that have the highest priority normally are stored in an area called the 'foreground partition'. Programmes with lowest priority are stored in an area called 'background partition'.

4. On-Line Processing

Definition of Online Processing:
Online processing refers to processing of individual transactions as they occur from their point of origin as opposed to accumulating them into batches. This is made possible by such direct access devices as Magnetic disk and Magnetic Drum and number of terminals connected to, and controlled by a central processor. In this way, various departments in a company can be connected to the process by cables. If operating companies are a number of miles away from the processor then they are linked by means of telegraph or telephone lines. This type of processing provides multi access to information files by terminal users and also enables them to update with transactions data.

It is a non-sequential process in which data is directly transmitted between input/ output device and a computer system via communication links. It is a method of processing where many users have direct access to the same system, and where the file is updated as soon as the transaction is completed.

Special Features
1. In this method data is not accumulated, instead it is entered and executed directly.
2. Quick Processing - By means of direct communication with the computer and continuous flow of input, the delay between transactions and their processing is avoided.
3. This method reduces the data entry errors, because the user who generates, the data is the one who keys it in.
4. This system validates data at various points and ensures that correct data is being entered.
5. Under this method the system performs the whole task in a conversational 'manner helping the data entry process.
6. In on line processing, one has the latest update immediately.

Online processing ensures that the records are in updated at any time whereas this is so with batch processing say once a week but the fact remains that online processing is usually more costly. Therefore in choosing one of the processing both updating of records and costs are to be considered.

CONCEPT OF ON-LINE PROCESSING
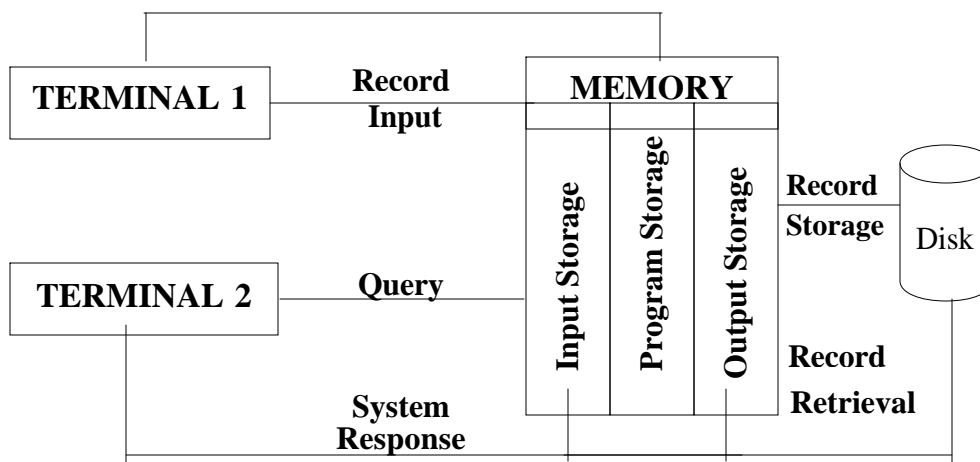
On-line Applications:

Systems are being developed and are already in use for a wide range of application in different type of industries described below:

a. Electricity and Gas Boards: By means of terminals situated in showroom it is possible to inform perspective customers of the availability of the appliances in response to their inquiries.
b. Banking: It is possible to inform bank customers of the status of their accounts in response to an inquiry by accessing relevant file using on online terminal.
c. Tour Operators Reservation Offices accept telephone inquiries from travel agents regarding the availability of holidays in respect of client's inquiries. By means of terminals, the availability of the required holidays can be checked and booked immediately.
d. Stock Exchange: Terminals located in major stock Exchange through out the country and the offices of participating brokerage from enable the speedy processing of share dealings.
e. Stock Control: Terminals located in warehouse provide the means for automatic recording of stocks, updating of stock records, reservations, follow-up of outstanding orders and the printing of picking list etc.,

Benefits provided by Online Systems: Online systems provide a number of benefits all of which assist in improving administrative efficiency which is essential in today's competitive business environment. A number of benefits are out-lined below:

a. Integration of clerical work with the computer:

On-line systems assist in harnessing activities of clerical staff to the computer by the use of terminals. They can have access to information which they require for the efficient performance of their jobs in dealing with customer enquiries and order processing.

b. Elimination of tedious tasks:

Routine clerical tasks are replaced by terminal operations providing a greater degree of job interest, operating efficiency and job satisfaction.

c. Reduction in paper work:

Volume of paper work generated by normal clerical system and batch processing system is relatively high. Online systems reduce the volume of print out required for management report since the information can be displayed on terminal screen on demand.

d. Improved accuracy:

As terminal messages are checked accuracy before being transmitted to the computer by data validation programs, the quality of formation in a system increases as the input errors are reduced. Hence, information is more reliable.

e. File updating improved:

Master files are more easily updated by terminal key board with regard to transaction data, as special runs do not require to be set up as is the case with batch processing applications.

f. Management Information more readily available:

Management information becomes more readily available by direct access facilities which enables mangers to obtain a greater degree of control to the operations for which they are responsible.

g. Improved customer services:

Improvements in the level of customers service can be expected in these systems concerned with appliances sales, booking systems and accounting enquiries.

h. Reduced data preparations cost:

On-line system dispense with the need to convert human sensible data into machine sensible data thereby eliminating punching and verifying operations. This saves time and the cost associated with such operations.

5. Real Time Processing

It is also called as interactive mode or Direct mode. This system makes the user to have direct contact with the computer through his terminal. It is an alternative approach to an on-line processing system. Here the data is processed, the instant it occurs. There is no delay between the time data is available, and the time it is processed.

The term real time refers to the technique of updating files transactions date immediately after the event to which it relates occurs. This is in distinction to batch processing which processes related data to batches of pre-defined periods of time. Real time systems are basically on-line systems with one specially in inquiry processing. The response of the system to the inquiry itself is used to control the activity. An on-line production data collection system that simply accepts input and utilities it for payroll and costing purposes cannot be termed real-time, but if, on the other hand, the system is designed to provide immediate information to monitor the production processes, it is a real time system.

Special Features

(a) Program is always under execution.

(b) It produces output to control, direct or affect the outcome of an ongoing activity or process.

(c) In this method, the control is exercise during the actual functioning.

(d) It is meant exclusively to perform one task.

(e) It is like an online system with; title constraints on response time availability.

(f) It is called a real time system because it has to give results based on dead lines which are imposed by the real world outside.

(g) The data which has to be produced by the systems has to be in such a less time, that they can influence the external events which are based on this data.

Thus the response of a real time system is one type of feedback control system. The response time would naturally differ from one activity to another. If the example, it is the launching of a space vehicle, the response time should be in split second whereas in business situation even a few minutes of response time may be alright. Online updating in real time usually leads to transaction as a by-product. For example, the updating in real time a customer's order may lead to such transactions as dispatch noted and purchase requests, etc. Real time systems offer accountants and others in business a chance to fulfill the potential of the computer as a tool of management.

Concept of Real Time Processing
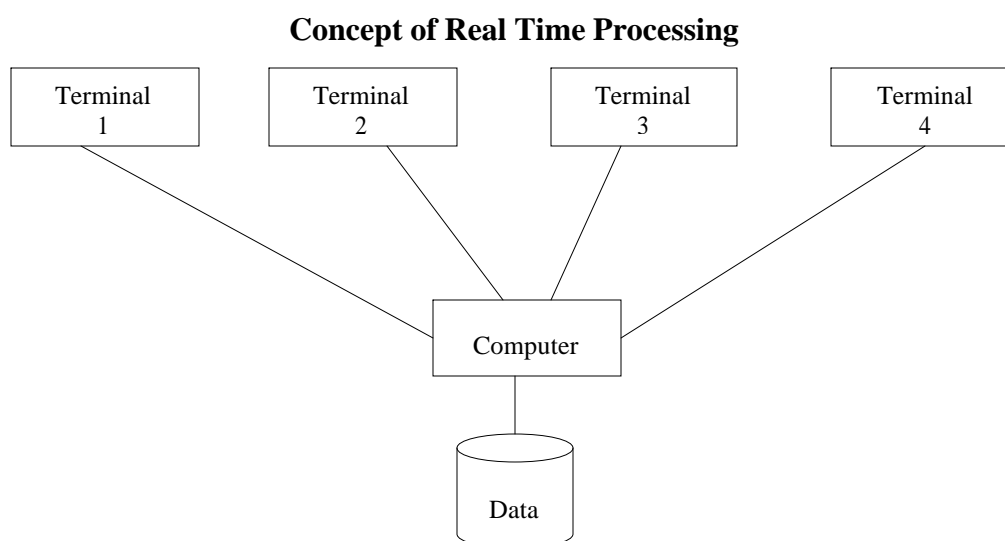
Guided Missile System

Real Time Processing is suitable in the following type of business operations:

- **i.** Wholesale supplier and manufacture - Availability of stocks.
- **j.** Airline - Flight seat availability.
- **k.** Manufacturing - Status of production orders.
- **l.** Process Control.
- **m.** Space Craft Control.

Real time systems usually operate in multi-programming and multi-processing: This increases both availability and reliability of the system. CPU's in real time system should possess the, capability of what is known as program interrupts. These are temporarily stoppage or halts in the execution of a program so that more urgent messages can be handled on priority. It may be worth noting that some computers systems are dedicated to real time operations and others are

designed to operate in both batch and real time modes so that they can also serve as stand by unit to each other.

6. Time Sharing

It is a special type of on-line processing in which several users share the resources of an on-line computer system to avoid turn about time, especially when results are needed quickly; another system is available i.e., time sharing system. In this method the individual user has an independent local terminal. The terminal is connected to a main computer, which does all the processing work.
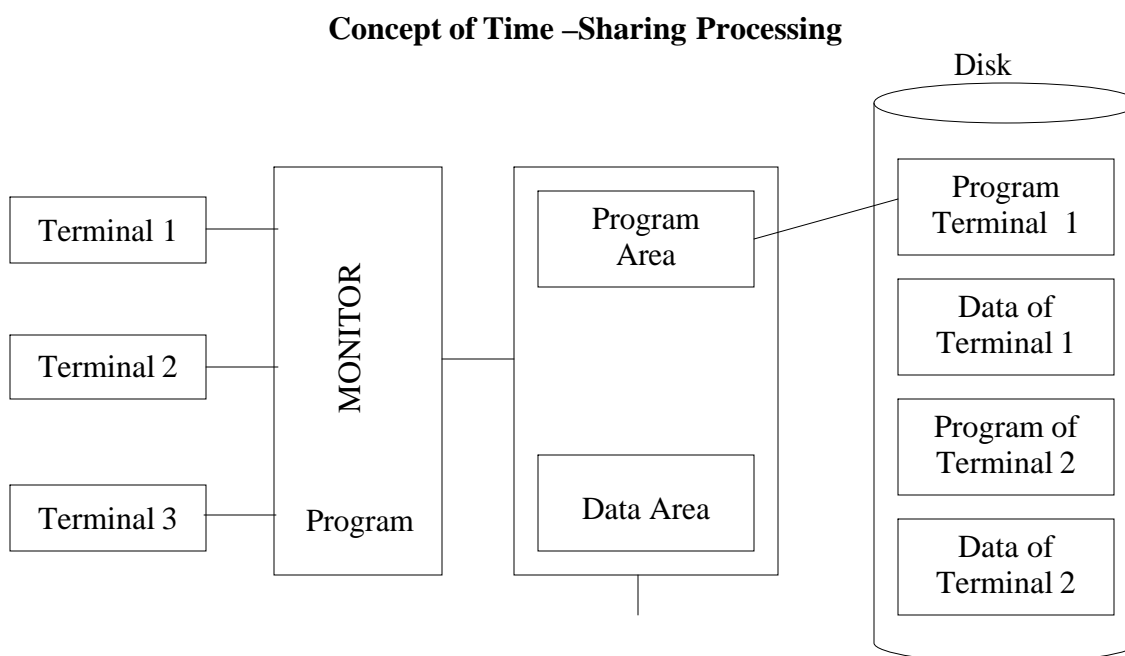
Under this system each person on a terminal has to log into the system. The system then lists him in the order in which he has logged on. Once everybody has logged on, the system will permit the first in the list to run his program. The time given for running the program is generally 10 milliseconds. It is called a time slice or a time slot or a quantum. Starting then, with the first to log on, each user is given his time slice. Once all have made use of it, the system starts all over again, repeating the cycle. The system maintained is called a polling system whereby each terminal is polled on a round robin basis.

All the instructions given by the users are carried to the centrally located main computer system and processed there and retrieve back by the user instantaneously. Since, the centrally located main computer has high-speed processor, users may feel that they are sharing the same computer resources.

Features

1. The processor time is shared between two or more persons.
2. The processor switches from one user's job to another at a rapid rate under the control of a monitor program.
3. This concept is time based.

The concept of time-sharing can be explained with the help of the following diagram.

Concept of Time –Sharing Processing

Printer

Let us suppose that there are three terminals, each person on a terminal has to log into the system. The system then lists him the order in which he has logged on. Once everyone has logged on, the system will permit the first on the list to run his program. The time given for writing a program is called a time slice or time slot. Starting from the first, each user is given his time slice. Once, all the three users have made use of it, the system starts all over again, repeating the cycle. The sequence maintained is called Polling System. Most time sharing systems respond to user's instructions in milli/micro seconds.

Advantages of Time-Sharing System
    (1) Simultaneously several users can be served.
    (2) All the users have the same priority.
    (3) All the users get equal amount of processor time.
    (4) The interaction with the running programs is possible.

Time-Sharing Vs Multi-programming
    The difference between these two methods is that in "time, sharing" the CPU links only one terminal at a time and its total time is shared uniformly by all the users. But in multiprogramming, the CPU links more than one terminal or other peripherals at a time. Therefore, multiprogramming more efficiently utilizes the main memory and the central resources than time sharing. Time sharing is employed only for multi terminal system whereas multi programming is meant both for single as well as the multi terminal system.

7. Distributed Processing
    In computer science, a form of information processing in which work is performed by separate computers that are linked through a communications network. Distributed processing is usually categorized as either plain distributed processing or true distributed processing. Plain distributed processing shares the workload among computers that can communicate with one another. True distributed processing has separate computers perform different tasks in such a way that their combined work can contribute to a larger goal, such as the transfer of funds from one bank to another. This latter type of processing requires a highly structured environment that allows hardware and software to communicate, share resources, and exchange information freely. At the highest (and most visible) levels, such distributed processing can also require data-transfer mechanisms that are relatively invisible to users but that enable different programs to use and share one another's data.

    Distributed data processing system is a network of several computers in remote stations, each of which is linked to a single host computer. The larger, central computer maintains the firm's master data base and system log. Each remote system is a fully independent computer that maintains its own local data base in addition to communication with the master computer. These individual computers are tied together through a high speed communication network. This allows individual computers to communicate with one another in a variety of ways depending on the CIS requirements.

Many small computers (called nodes) are employed as data collection points in several departments. They are connected to a main computer system (called File Server) in a centralised department, which controls the entire database. The processing involved here is known as distributed processing.

The distributed data processing system exists because of the need for large interactive installations with a high degree of reliability and accuracy. Moreover, large number of mini computers can be connected in this system which results in cost reduction.

Features
(a) Decentralized computer system
(b) Interconnected by communication network (c) More reliable
(d) Since more than one computer is used in the network, it is economical.

Advantages:
Distributed data processing system has many advantages:
a. Local computers on the network offer immediate response to local needs.
b. Systems can be expanded in modular fashion as needed because many small
c. Computers are used as the system is not dependant on large unit that could shut down the network if it failed.
d. Equipment operating and managing costs are often lower.
e. Minicomputers tend to be less complex than large systems; therefore, the system is more useful to local users.

Distributed data processing system a number of computer systems are linked together. So the facilities available-in one computer system can be shared by all. This link is called computer network.

Check Your Progress 3
Give some examples of online and Real-time processing.
Notes: a) Write your answer in the space given below
b) Check your answer with the one given at the end of this Lesson (pp.56)

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8.3 LET US SUM UP
1. There are various methods of data processing such as the single user system, Batch processing, Multi-programming, On-line Processing, Real-Time processing, Time sharing concept, Distributed processing.
2. In batch processing data is accumulated and then processed.
3. In online processing data is not accumulated, instead it is entered and executed immediately.
4. Real time processing is an interactive or direct mode. In this type of processing there is no delay in time between the availability of data and the time taken for processing.

8.4 LESSON END ACTIVITY
Visit a bank branch and know how online data processing is done.

8.5 POINTS FOR DISCUSSION
1) What are the different methods of Data Processing? Explain.
2) List out the applications in which batch processing can be used.

3) What are the features of online processing.

4) List out the various benefits of on-line processing.

8.6 CHECK YOUR PROGRESS

1. Online –   Railway reservation & Airline Reservation

Real time   -   Production process

875 REFERENCES

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LESSON - 9

NETWORKING

9.0 AIMS & OBJECTIVES

At the end of this lesson you will be able to know:
1. Computer networking
2. Types of networking
3. Advantages of Networking.
4. Various Topologies of LAN

9.1 INTRODUCTION

With standardized hardware and software, the microcomputers provide user-friendly environment. It meets the computing requirements of most users. But, the need for interaction with other computer users and with other computer systems for exchange of data etc., has increased over the years. Networks are increasingly meeting this need. From the users' point of view the networks may be of two types**: Local area network and Wide area network.**

Computer networking is the process of inter connecting two or more computers so that the users can communicate with each other, share resources and overcome other limitations of stand-alone systems. The network can be established with a variety of combinations of computers such as a net of only microcomputers, microcomputers and one or more minicomputers and a set of microcomputers connected to a mainframe computer. The computers in typical network are autonomous in the sense that they have processing capability independent of the network.

9.2 ADVANTAGES OF NETWORKING

The main advantages of networking are:

(i). Hardware resource sharing:

Network enables sharing of expensive resources such as processor, storage space and peripherals like modern, fax, and laser printer.

(ii). Sharing of databases:

The network permits concurrent access to the same data file by many users in the network. Thus, user in the sales department, production department, inventory department etc share corporate databases.

(iii). Sharing of Software:

Any user in a network can load and use the software installed on any of the computer of fileserver in the network.

(iv). Communication between users:

The Network users can communicate between them. E-mail facility can also be used for communication.

(v). Decentralized data processing:

In a network, the data processing can be decentralized by enabling local offices to capture and store data, and generate information to meet most of their requirements a local level itself.

(vi) Security of data:

In a networked environment the data is backed up with duplicate storage. Adequate security measures are also put in place to product the data.

9.3 TYPES OF NETWORK

The networks can be classified into three; local area network (LAN), metropolitan area network (MAN) and wide area network (WAN). They are explained in the following sections:

1. Wide Area Network (WAN)

WAN is made up of number of autonomous computers distributed over a wide geographical area. WANs were originally developed in the late 1960s to enable communication between computer centers and sharing of hardware, software and other communication facilities. WAN can be implemented using private or public networks. In a private network an organization takes on lease telephone lines to connect such sites into a network. It is also possible to connect computers in different locations using microwave or satellite transmission. Public networks are installed by the Government owned telecommunication agencies. WAN spans large geographic distances. It is also called long-haul network. WAN is usually operated at lower speeds then MAN and involves delay.

Most organizations use private networks for communication. Society for Worldwide Inter bank Financial Transactions (SWIFT), a non-profit organization of banks, owns a private

network. The network exchanges financial transactions between the participating financial institutions, about 3000 in number in over 60 countries. The terminals of these participating banks are hooked with SWIFT's access centers. The network offers data communication service 24 hours a day, 7 days a week.

INDONET, NICNET, SBINET and WELCOMENET are some of the private network in India. CMC's INDONET offers e-mail service to customers for a fee. NICNET is a network of National Informatics Center that connects all the district headquarters in the country. SBINET is a private network of State Bank of India and connects its branches across the country. WELCOMNET connects the hotels of the Welcome Group.

➢ **Features of Wide Area Network**

A wide area network (WAN) is used to connect LANs and nodes that are separated by great physical distance. Generally speaking it is larger version of LAN with several differences:

1. It operates by means of the international telephone network
2. Unlike LANs which owned by their users, WANs operate on public and leased telephone lines provided by licensed common carriers, or by other means such satellite and microwave, which are regulated by government agencies.
3. Data transmission is somewhere slower.
4. The WAN compose any of the following system configurations:
5. Single nodes
6. Clusters
7. LANs

Suppose a company has its central headquarters in Coimbatore and the Coimbatore site contains all departments and equipment for product manufacturing prod distribution, accounting, and sales. The information pertaining to these operations is tracked by a single centralized database system. As the company becomes more profitable and expands, it established additional sales offices on Mumbai and Delhi. Each sales office maintains its own system to record and track customer orders for its region. At the same time the two sites are linked to the mode at corporate headquarters and relay each order shipment and inventory and invoice processing.

➢ **Advantages of WAN**

The integration of the local nodes into the distributed database linked by the WAN provides the following advantages:

1. The WAN allows access to database at remote sites, enabling exchange of data.
2. If a remote node fails, remaining nodes on the network can still exchange data.
3. If the network fails, the local mode can still access its own database.
4. The data used on daily basis by the sales offices resides at the local site, making it easier to retrieve quickly.
5. The local offices can maintain the data more effectively. The corporate office can access the data as needed.
6. As a site's database grows larger, its system's storage capacity can be easily upgraded without affecting the transfer of data between other nodes on network.

One of the most significant aspects of a wide area network when comparing it with freedom of a local area network is the involvement of a public telecommunications authority. Regardless of whether the network is made up from system, the controlling authority is almost always the public authority. In order to protect their equipment and employees, the authority lays down rules, which must be observed by anyone connecting to their lines. In most countries stringent requirements are also imposed on the characteristics of the data transmissions.

2. Metropolitan Area Network (MAN)

Metropolitan area network covers a wider area than a local area network. Usually MAN covers a large metropolitan city and is a scaled down version of wide area network. It operates at high speeds over distances sufficient for a metropolitan area.

3. Local Area Network (LAN)

A LAN is a system of interconnected microcomputers, sharing common resources like disks, printers etc., and links a number of computers workstations) together to allow many people to use the same software and data files. Each user in such a multi-user environment accesses the resources through his microcomputer workstation. The network operating system integrates all the network components and makes operation smooth and transparent. LAN works in restricted geographical area such as within a large building or offices within a few kilometers.

The LAN is an interconnection of computers that need to communicate with each other in a limited geographical area. The network may have other sharable devices attached such as fax, laser printers and copiers. The network includes a central facility with huge storage capacity for the requirements of the organization. It also has a network operating system for managing the network.

➢ Types of LAN:

Local area networks are mainly of two types: Client/ Server LAN and Peer-to-Peer LAN.

a) Client / Server LAN

Client Server LAN has servers and clients. The server is a computer that manages shared resources: hardware as well as software and data. It is usually a powerful computer with large RAM and secondary storage capacity. The LAN has a number of microcomputers, called clients, the request the server for services. The LAN may have many servers each specializing in one area of service such as file server, printer server, database server etc. A file server stores program and data files. A database server stores data and a printer server controls printers on the local area network.

b) Peer-to-Peer LAN:

In a **Peer-to-Peer LAN** every computer is equal in status and functioning. All the computers on the network are capable of communicating independently with any other computer on the network without using a server. Thus, any computer on the network can access data and programs stored on any other computer. The peer-to-peer LAN is less expensive than client/server LAN. But at the same time this LAN may be slower than a client/server LAN.

Check Your Progress 4

What are the two types of LAN?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.65)

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> **LAN Topology**

The design of network requires selection of a particular topology and an architecture for the interconnection of network component.

Topology refers to the way the computers are physically connected into the network. The network architecture includes the specifications of the components that can be connected to the network. IBM's Systems Network Architecture (SNA) is an example of vendor developed network architecture. Such network architecture specifies network components such as terminals, workstations, printers, cluster controllers, host computer and communications controllers.

There area a number of network topologies. Of them ring, star and bus are popular network topologies.

a) Star Topology:

In star network the nodes are connected to a central computer called the host computer. The nodes cannot communicate directly. Each node can communicate with the host computer. The host computer takes the message and routes it to the other node or nodes.
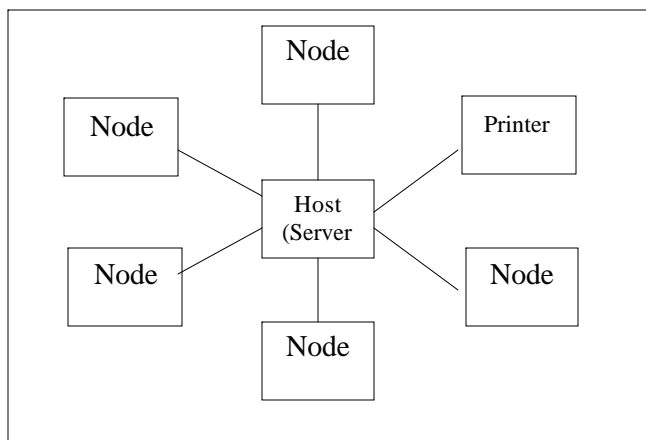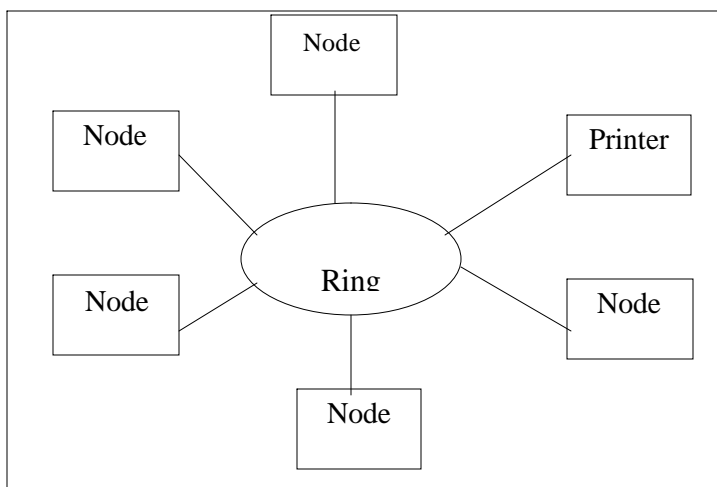

The host is the main computer to which other nodes are connected by communication links. The host computer is responsible for the overall functioning of the network. The node may be a microcomputer, terminal or any other device like storage device, printer etc.,

In a star network centralization of control over the network resources is easy. It is also possible to network minicomputer or mainframe with other microcomputers and dumb terminals. It eliminates single point failure of a common wire. If one of the host computers fails, it does not usually affect the others in the network. But the hub becomes a central point of failure in a ring network. If the host computer breaks down, the entire network breaks down.
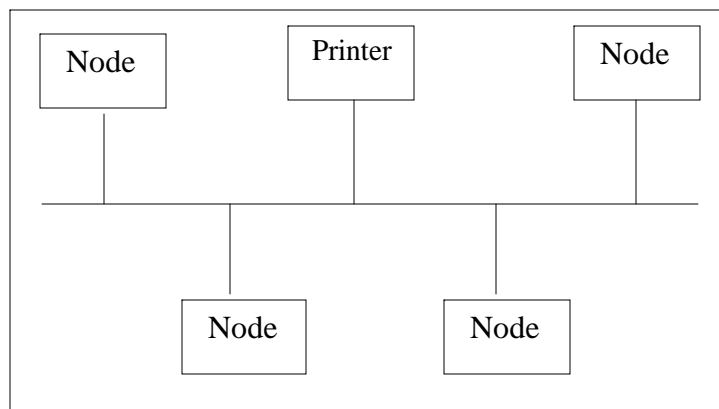
b) Ring Topology:

In a ring network the computers can communicate directly with each other and also with the central computer. The nodes are connected to a line that is closed like a loop. The ring network is more reliable than star network. Even if the central computer in the network fails, the other computers can continue to communicate with each other.

```
                    ┌────────┐
                    │  Node  │
                    └────────┘
   ┌────────┐                      ┌─────────┐
   │  Node  │                      │ Printer │
   └────────┘         ╭──────╮     └─────────┘
                     (  Ring  )
   ┌────────┐         ╰──────╯     ┌────────┐
   │  Node  │                      │  Node  │
   └────────┘                      └────────┘
                    ┌────────┐
                    │  Node  │
                    └────────┘
```

c) Bus Topology:

A bus network configures computers to a single non-looping channel. The computers connected to the network share the same bus or communication channel. Bus wiring is easy and needs much less wring for small segments.

```
   ┌────────┐      ┌─────────┐      ┌────────┐
   │  Node  │      │ Printer │      │  Node  │
   └───┬────┘      └────┬────┘      └───┬────┘
       │               │               │
   ────┴───────────────┴───────────────┴────
            │                   │
       ┌────┴───┐          ┌────┴───┐
       │  Node  │          │  Node  │
       └────────┘          └────────┘
```

Old Ethernet bus wiring is prone to cable failure. If the bus wiring connection is broken at any point, the entire network fails.

d) Hybrid Network:

In most cases, instead of a single topology, a combination of topologies may be used for greater flexibility and reliability. Hybrid network combines features of Star, Ring and Bus network:

➢ Features of LAN

The features of LAN include the following

a) Limited geographical area say within a few kilometers.
b) Common communication link for sharing information, software and peripheral devices without regard to proximity of user to such resources on the network.
c) High transmission capability.
d) Low error rate as the network contains built-in component for detecting for system errors.
e) Private ownership by the user.
f) Not subject to regulation by the telecom service.

LAN interconnects computers and computers and components within a limited geographical area. Such LANs are normally set up within a single site can have one or more business complex, a hospital, an office- building etc. The site can have one or more buildings but they should not be too for a way, say less then5 kilometers. A LAN can also include a variety of computer systems and devices such as workstations, microcomputer, file servers, plotters, scanners, graphic terminals and printers.

A large personal computer or mini computer serves as the LAN's hub. A high capacity hand disk is attached to the hub as data files and software are stored on the network file server. The users can load the software on the file server and retrieve data files for processing. The output can be directed to the printer attached to the LAN.

Any the communication network that meets most or all of the following characteristics can be classified as LAN,:

a) All the devices on the network share a common transmission medium, that is, the cable and/ or the controller.
b) The devices connected to the network can operate independent of the network.
c) Any device connected to it can communicate with any other device on the network, and
d) The network is capable of supporting heavy data traffic over short distances compared to telecommunication network.
e) The network covers a limited area usually a few kilometers in radius or a single site like a university campus, an office or a factory.
f)

➢ LAN Components

The components of LAN are File server, workstation, network operating system, LAN cable, Active and Passive hubs etc.

a) Workstation

It is a single-user microcomputer with high power communication facilities. It can exchange message with other workstations or fileserver.

Workstations can be of two types: user workstation and server workstation. User workstation is a microcomputer on the network, which is used to access the network. Service workstation performs service to process other workstations on the network. User workstation normally does not process requests from other workstations. Server workstation makes available all sharable network resources to other workstations. More than one server workstations may be added to the network such as printer server and fileserver. Normally the server workstation is the most powerful workstation. Server workstation may be dedicated or non-dedicated. In case of dedicated workstation, it is not available for other user applications. Non-dedicated server workstation doubles as an individual workstation and at the same time performs network-related functions.

b) File Server

File server is actually a process running on a computer that provides the clients access to files on that computer. The term is loosely applied to mean computer that runs file server software. In this sense, it is a powerful computer with special software to serve files to other workstations on the network. The files, which may be program files or data files, are simultaneously shared by a number of workstations. Novell Netware is a popular network operating system.

c) Gateway

The gateway assists in communicating between LANs. A workstation may be dedicated to serve as gateway. This is required particularly when two networks with different technologies have to communicate with each other. Gateway may also be used to connect LAN with a mainframe computer.

d) Network Interface Unit

The network interface is a printed circuit board installed in the microcomputer. It may be called network card, network adapter or network interface unit. It connects the workstations functionally and physically with the network.

e) Active Hub

Hub is an electronic device to which multiple computers are attached usually using twisted pair cables. Active hub is a powered distribution point with active devices that drive distant nodes up to one kilometer away. It can connect up to eight nodes on the network. The maximum distance carried by an active hub is about 2000 ft.

f) Passive Hub

This hub is a distribution point that does not use power or active devices in a network to connect up to four nodes within a short distance. The maximum distance covered by a passive hub is nearly 300 ft.

g) LAN Cable

LAN requires superior cable capable of transferring data at high speed. Coaxial cables or fibre optic cables may be used for networking computer.

h) Network Operating System (NOS)

The NOS integrates all the network components. The NOS facilitates file and print serving along with other functions like communications and e-mail between workstations. In most LANs the NOS exists along with the computer's operating system.. The computer's operating system processes the system requests first and processes them if they can be done with the workstation resources. If it is not a local request, meaning that the network resources have to be used, the request is transferred to NOS for carrying out. Thus, the NOS is responsible for controlling access to data, storage space and sharing of other peripheral resources.

i) Applications Software

Another component of LAN is application software. It has to be ensured that the application software works in the multi-user environment.

j) Protocols

Data transmission between devices requires protocol. Protocols are sets of rules and procedures to control the data transmission between computer and other devices. They are common technical guidelines for communication between devices. They specify the order in which signals will be transferred, the signal for completion of transfer etc. Only Devices using the same protocol can communicate directly. Both the sending and receiving devices must use the same protocol for effecting communication. For communication between devices using different protocols requires intermediate interpretation device or software.

The protocol performs the following functions:

a) Set up a link with the other device in the communication.
b) Identify the component to other components in the communication (sending device's channel ID)
c) Send and interpret the data
d) Provide a continuous feedback on data transmission like data is not being received and understood.
e) Request for retransmission of garbled data.
f) Engage recovery procedure when error occurs.
g) Provide an acceptable way of terminating transmission so that all devices have completed the process.

The protocol is embedded in communication software designed to use a particular protocol. The user need not bother about the protocol as the components involved in the communication perform the protocol matching. The data communication protocols are of two main types: asynchronous and synchronous. The synchronous protocol permits continuous data transmission. The devices in communication must be synchronized with the other. The transmission is governed by a time interval and not by start-stop bits. For example, clock, in the modern, sets the time interval.

9.4 LET US SUM UP

1. Computer networking is the process of inter connecting two or more computers so that the users can communicate with each other, share resources and overcome other limitations of stand-alone systems.
2. A wide area network (WAN) is used to connect LANs and nodes that are separated by great physical distance.
3. The LAN is an interconnection of computers that need to communicate with each other in a limited geographical area.

9.5 LESSON END ACTIVITY

Visit a computer centre and try to learn about LAN connections

9.6 POINTS FOR DISCUSSION

1) Discuss the various advantageous of computer network.
2) Explain in detail the different types of network.
3) List out the features of   a) WAN; b) LAN
4) Explain in detail about various LAN Topology.
5) Discuss in detail about the different computers of LAN.

9.7 CHECK YOUR PROGRESS

1. Peer-to-Peer LAN:
   Client / Server LAN

9.8 REFERENCES

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2.   Suresh K. Basandra, Computers Today, Galgotia Publications Pvt Ltd., New Delhi.
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UNIT III

LESSON - 10

COMPONENTS OF COMPUTER AND THEIR FUNCTIONS

10.0 Aims & Objectives

10.1 Introduction

10.2 Input Unit

10.3 Output Unit

10.4 Let Us Sum Up

10.5 Lesson End Activity

10.6 Points for Discussion

10.7 Check your Progress

10.8 References

10.0 AIMS & OBJECTIVES

After reading this lesson you will be able to understand:
1. The basic concepts & various types of input devices
2. The basic concepts & various types of output devices

10.1 INTRODUCTION

We generally refer to a computer as a system [Computer System) since computer is made up of integrated components: input and output devices, storage, Central Processing Unit etc that work together.

The main components of a computer system are:
(1) Input Unit
(2) Output Unit
(3) Storage Unit(discussed in lesson 3.2)
(4) Central Processing Unit [CPU] { the Control Unit and Arithmetic Logic Unit of a Computer System are jointly known as Central Processing Unit(discussed in lesson 3.2)

10.2 INPUT UNIT

The input unit is used for entering the data and instruction into the computer for performing computation of the data. The input unit accepts or reads the list of instructions and data and converts these instructions and data in computer acceptable form. It supplies the

converted instructions and data to the computer for further processing. The devices used for this purpose are called as Input Devices. Key Board and Mouse are the important input devices used in our offices. Light pen, Joy stick, tracker ball, Touch pad, Scanner and Pointing stick are some of the Input Devices.

a) Key Board:

The keys in Computer keyboards are almost similar to the keys in a typewriter but in addition there are some special operational keys carrying special symbols that help us in giving instructions to computer.

b) Mouse:

Mouse is an essential component in the modern computers which use Windows and other Graphical Use Interface [GUI] applications. Mouse is a small service in which a small ball is kept inside and the ball touches the pad through a hole at the bottom of the mouse. When the mouse is held in hand pushed along a flat surface [mouse pad], the ball inside the mouse rolls and this movement of the ball is converted into electronic signals and sent to the computer, now we get advanced versions of mouse like optical mouse, scroll mouse cordless mouse etc. using the mouse the cursor [the small blinking vertical line we see in the monitor] can be moved in any direction. The mouse is used for selecting part or full text or object, and also for dragging and dropping the selected text or object.

How to handle the mouse?

When we slide the mouse left across the mouse pad the mouse pointer of the screen moves left on the screen. When we slide it right the pointer moves right. When the mouse is moved forward or backward, it causes the pointer to move up and down.
The following actions are performed with the mouse:

Clicking:

Keeping the mouse pointer at any position, if we click the mouse button the cursor will move to that position.

Selecting:

To select a text for copying or deleting, keeping the mouse pointer at the beginning of the text, click the mouse button [left button] and without releasing the finger move the mouse till the end of the text and then release the finger. The text thus selected is highlighted and can be copied or deleted.

Dragging:

After selecting the text as above, bring the mouse pointer at the selected text, press the left mouse button with the finger and without releasing the finger drag the selected text to any desired position.

Right clicking:

By pressing and releasing the right mouse button, the short cut menu is activated.

c) Scanner:

Scanner is an image acquisition device connected to the computer, which captures either an image of a text document or a picture and transfers it into bits of information, which a computer can understand and manipulate.

How does a scanner work?

The scanner uses a light source, typically a cold cathode lamp to illuminate the scanned object. The light is then reflected off the object and into Charged Coupled Device [CCD]. The Charged Coupled Device collects the information, and through a series of electronic devices converts the analog signal into as series of digital signals which can then be read and processed by a computer.

Uses of scanners:

Optical Character Recognition OCR – We can convert text based document images into text that can be edited by a word – processing software. Enrich our presentations and documents by adding images. Convert hard-copy images or documents into a fax format for faxing or for record purpose. Add scanned images to our e-mil to enrich the content.

Type of scanners: Flatbed Scanner, Sheet fed, Handheld, Card scan.

▪ **Flatbed Scanner:**

The flat bed scanner as shown in the illustration is one of the most commonly used and most recommended scanners. This scanner allows the user to place a full piece of paper, book, magazine, photo or any other object onto the bed of the scanner and have the capability to scan that object.

Flatbed scanner

A sheet containing text can be scanned using the scanner and saved as an image file. There is software to convert the image file once again into a text file.

▪ **Sheet fed scanner:**

This scanner allows us to scan pieces of paper. The sheet fed scanner is a less expensive solution when compared to the flatbed scanner.

Sheet fed scanner

- **Handheld Scanner:**

The handheld scanner allows the user to drag over select sections of pages, books, magazines, and other objects scanning only sections. However it can be tedious to drag the handheld correctly which can cause distortion in the image being scanned.

Hand held scanner

- **Card scan Scanner:**

This scanner is mainly used to scan visiting cards for creating data base of the addresses.

Card scan Scanner

d) Punched cards

Punched cards are still in use as medium for recording data and instructions in the form of punched holes to denote and then they are sequentially read by the card Reader. The card Reader sends the data and instructions to the CPU to process them. The punched cards used for data processing are made generally of 80 columns and 12 rows. Today 96 columns cards are available. In these cards a hole in punched to represent the binary l. The absence of a hole represents binary 0. If a card is punched wrongly, it cannot be corrected. Further, the punched cards are not reusable, i.e., cannot be used for any other data. Many numbers of cards are required for the computer programs. Such a collection of cards is called a deck. Each card has the left top corner cut to identify the arrangement of the cards is correct or not. The cards are read by a Unit called a card Reader. The punched cards are placed in the Read Hopper after verification. On receiving the command from the control unit the device moves the cards one by one over two sub-devices. One of which, sense the punched holes (0s and 1s) and transcribes the pulses to the CPU. Then the output is given as per user specification.

Advantages
1. It is very easy to read data on the cards
2. The cards are less expensive than other storage media.
3. It is much simple to operate.
4. After inserting a card, if an error is detected, the whole system stops functioning.

Disadvantages
1. Punched cards are bulky when put together, so they require large space to store them.
2. The cards are easily damaged and perishable.
3. Transfer of data is relatively very slow.
4. An incorrectly punched card cannot be corrected, it must be replaced.
5. Unit Record machines require manual intervention at every stage.
6. Data is not processed in ordinary language. It has to be translated into something we can understand.

e) Paper Tapes

The punched paper tape is a continuous strip of a paper about one inch wide and up to 300 meters long. The characters are recorded on tape, which may be 5 or 8 as per the design of the tape. These punched positions are called as channels. It is the oldest media, of input and output media. Her also, a hole represent 1 and its absence represents 0. Data from the tape is read through a Tape Recorder per second. The tape comes in various forms viz., Oil paper, dry paper, metalized paper and laminated paper.

Advantages
1. Compared to the punched card, it is more compact and economic on storage.
2. It is less in weight and easy for mailing etc.

Disadvantages
1. Since the roll is so long, correcting or inserting data can be very tedious process and time consuming.
2. The life of the paper tape is short. This makes it inconvenient for storing over a long period. It is not durable.
3. Moreover, it is sequential data processing medium.

f) Magnetic Tape

Because of the problems faced in the paper media, magnetic substances have come. First among these was the magnetic tape. This is also a sequential media for normally between 1.25-2cms. Wide and up to 900 meters long. It is made of plastic with a metallic magnetic oxide coating on one side. Generally, data is recorded on either a 7 parallel-rack-tape or on a 9 parallel-track-tape. Writing on and reading from the tape is done with the assistance of READ/WRITE head. The number of characters per inch length of tape stored is called the 'density' of the tape. This varies from 550 to 1600 or even 16K. The 9 Track tapes have the higher densities. Then comparing with the punched card and punched tape, the magnetic tape has certain advantages and disadvantages.

Advantages
1. Data are stored very compactly.
2. It is very easy to handle the Magnetic Tape than the Deck of Cards.
3. The Magnetic tape costs less than the cards.
4. It requires less storage space for data and therefore has a large capacity.
5. It is reusable i.e., the old data can be wiped out and fresh information could be recorded on it.
6. The speed of transferring the data is very high comparing to paper devices.

Disadvantages
1. In magnetic tapes, the data has to be accessed sequentially. This makes the retrieval of data slow.
2. The punched cards can be read visually, whereas to read the magnetic tape a I machine is needed.
3. The tape is subject to the usual wear and tear of time.
4. Data will be erased if the tape is exposed or placed nearby any Magnetic field or high voltage circuits.

g. Magnetic Disk

It is yet another step in the evolution of Input/Output devices. The Magnetic Disk has an advantage over the punched cards and Magnetic Tapes i.e., the data stored on a disk can be read randomly while in the magnetic tape, the data are read sequentially. Random access is that the particular record in the file can be detected directly and the access time is saved. In Magnetic disk the record is accessed in a fraction of second i.e., less than 0.01 sec. The disk varying in diameter are generally coated on both sides with magnetic oxide. Each surface of the disk is divided into a number of sectors, called storage segments. The storage segment is a specific portion of a specific side of the disk. A segment can store one or more record of a file, which will vary according to the size of the record. While searching, a particular record can randomly be selected and directly accessed, because, each storage segment is uniquely marked by an address with side number, track number, sector number etc.

h. Joysticks and Trackballs

Joysticks provide an alternative method for feeding the computer visually interesting data. When you move the joystick, cursor on the screen moves in a corresponding way. A trackball is a plastic sphere mounted in a socket so that it is free to rotate in any direction.

i. Touch Screens

Touch Screens are another favorite "user friendly" method for feeding data into computer. User can command the computer to perform various useful tasks simply by touching specific sectors of the screen with their forefingers. The computer senses the Location of the finger in various ways.

10.3 OUTPUT UNIT

The results of the data processed by the computer are available in electronic signals. The output unit converts these signals into a form which could be easily understood by us. The output is usually given either on the screen by visual display unit/monitor or in a printed form by printers.

a) Monitor (Visual Display Unit or Screen)

The monitor is made up of cathode-ray tube CRT due to which it also called C.R.T terminal. The screen consists of horizontal and vertical sweep circuits similar to T.V. sets. The screen's inside is coated with dots of phosphor called pixel and can be used for games or graphics or displaying the
results of a calculation done by computer. The more the number of pixel or dots in a screen, the better will be the capability of computer to display an information.

This capability is known as resolution. The characters typed with the keyboard are displayed on the screen. We can thus verify whether the programs we enter into computer is corrector not.

Tips for avoiding computer vision syndrome:

Long hours of staring at a computer screen causes dryness and reduces the blinking rate of the eyes. Burning, itchiness and watering of eyes are the common visible syndromes of computer vision syndrome. Often headache is a direct consequence of the glare emitted by the screen.

- To avoid the syndrome the following measures are to be taken:
- Make sure that the computer screen is not too close to your face.
- Position the screen so that it is either at eye level, or slightly lower.
- Tilt the monitor slightly to eliminate reflection or glare.
- Make sure that primary light source [such as windows] is not shining into your face or directly on the monitor.
- Frequently look away from the screen and focus on far away objects.
- Reduce the contrast and brightness of the screen by adjusting the controls on the monitor.

b. Printer

Printer is the most commonly used output device. It is used to prepare permanent documents in human – readable form [hard copy]. The are several types of printers that are designed for different types of applications.

Printers are of two types-impact and non impact. Impact printers use the familiar typewriter approach of hammering a typeface against paper and inked ribbon. Non-impact printers do not hit or impact a ribbon to print. They use thermal, electrostatic, chemical and inkjet technologies.

Depending on their speed and approach of printing, printers are also classified as character printers, and page printers.

Types of Printers:
1. Dot Matrix Printer:

In this printer characters to print are made up of a finite number of dots and so, the print head consists of an array of pins. Characters to be printed are made up of a finite number of dots and so, the printer. The character code is decoded by the printer electronics and activates the appropriate pins in the print head. Many dot matrix printers are bi-directional. i.e., they print from left to right as well as from right to left on return. This enhances the speed of printing. The printing speed is around 300 characters per second.

Dot Matrix Printer

2. Line Printer:

Unlike a dot matrix printer, line printer prints a complete line at a time. Two types of line printers are available.

3. Drum Printer

It consists of cylindrical drum. The characters to be printed are embossed on its surface.

Line Printer

4. Chain Printer:

It has a steel band on which the character sets are embossed. Printing speed varies from 150 lines to 2500 lines per minute with 96 to 160 characters on a 15 inch line. Six to eight lines per vertical inch are printed. Usually 64 and 96 character sets are used with English letters.

5. Inkjet Printer:

It consists of print heard, which has a number of small holes of nozzles. Individual holes are heated very rapidly by an integrated circuit resistor. When the resistor heats up, the ink near it vaporizes and is ejected through the nozzle and makes a dot on paper placed near the head. A high – resolution inkjet printer has around 50 nozzles within a height of 7mm and can print with a resolution of more than 300 dots per inch. Latest inkjet printers have multimedia heads, one per color , which allow color printing. The printing speed is around 120 characters per second.

Inkjet Printer

6. Laser Printers:

- In laser printer an electronically controlled laser beam traces out the desired character to be printed on a photo conductive drum
- The drum attracts an ink toner on to the exposed areas. This image is transferred to the paper, which comes in contract with the drum.
- Very fast printers print 10,000 lines per minute. These printers give excellent outputs and can print a variety of fonts.
- Low speed laser printers, which can print 4 to 16 pages per minute, are now very popular.

Laser Printer

Check Your Progress 1

A. Bring out any two input devices

B. Classify the following into input and output devices

     (a). Monitor   (b). Mouse   (c). Keyboard (d). Printer

     (e). Scanner

Notes: a) Write your answer in the space given below

     b) Check your answer with the one given at the end of this Lesson (pp.75)

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10.4 LET US SUM UP

1. The input unit is used for entering the data and instruction into the computer for performing computation of the data.

2. Key Board and Mouse are the important input devices used in our offices. Light pen, Joy stick, tracker ball, Touch pad, Scanner and Pointing stick are some of the other Input Devices.

3. The results of the data processed by the computer are available in electronic signals. The output unit converts these signals into a form which could be easily understood by us.

4. Monitor (Visual Display Unit or Screen) and printers are the most frequently used output devices.

10.5 LESSON END ACTIVITY

     Visit a computer centre and list out the various kinds of input and output devices available there.

10.6 POINTS FOR DISCUSSION

     1) Explain in detail about various types of Input Devices.

     2) Write short notes on output devices.

     3) Explain in detail the various types of printers.

10.7 CHECK YOUR PROGRESS

1. A. Your answer may include any of the following:

    i).Key Board

    ii).Mouse

    iii).Scanner

    iv).Punched cards

    v).Paper Tapes
   vi).Magnetic Tape
  vii).Magnetic Disk
 viii).Joysticks and Trackballs
  ix).Touch Screens

B.   a). Monitor   -   Output
    b). Mouse   -   Input
    c). Keyboard   -   Input
    d). Printer   -   Output
    e). Scanner   -   Input

10.8 REFERENCES

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2. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

LESSON - 11

STORAGE UNIT AND CPU

11.0 Aims and Objectives

11.1 Introduction

11.2 Storage Unit

11.3 Central Processing Unit [CPU]

11.4. Let Us Sum Up

11.5 Lesson End Activity

11.6 Points for Discussion

11.7 Check your Progress

11.8 References

11.0 AIMS AND OBJECTIVES

After studying this lesson, you will be able to understand:
1. Types of storage devices available and its uses.
2. Central processing unit and its functions.

11.1 INTRODUCTION

The purpose of the storage unit of the computer is to store the data entered before processing and also to store the results after processing. The Central Processing Unit [CPU] is the brain of any computer system. In a computer system all major calculations and comparisons are made inside the CPU. The CPU is also responsible for activating and controlling the operations of other units of a computer system.

11.2 STORAGE UNIT

➢ **There are two types of storage devices.**
   a. Primary storage device
   b. Secondary Storage device.

a. PRIMARY STORAGE DEVICE OR RANDOM ACCESS MEMORY [RAM]:

Primary storage is usually referred to as Random Access Memory [RAM] because it is possible to randomly select and use any location of this memory to directly store and retrieve data and instructions. It is also referred to as read/write memory because information can be 'read' from a RAM chip also be 'written' into it. The Random Access Memory requires some times for accessing data and is considered to be the fastest memory. Each bit in a RAM stores

RAM

information by means of electric charge, where the presence of an
electric charge indicates '1' and the absence of an '0'. RAM is called
Temporary storage, because data persists until the machine is on.

ROM

A Read Only Memory [ROM] is one in which information is permanently stored. The information from the memory can only be read and it is not possible to write fresh information into it. This is the reason why it is called ROM. When the power supply is switched off, the information stored inside ROM is not lost as it is in the case of a RAM chip. ROMs are mainly used by computer manufacturers for storing the micro programs so that they cannot be modified by the users.

b. SECONDARY STORAGE DEVICES

This section of the memory is also referred to as backup storage because it is used to store large volume of data on a permanent basis which can be partially transferred to the primary storage as and when required for processing.

The storage capacity of the primary storage of today's computers is not sufficient to store the large volume of time handled by most data processing centres. As a result, additional memory, called auxiliary memory or secondary storage, is used with most computer systems. Hard Disk, Floppy Disk, Tape and Compact Disc are the main secondary storage devices.

i). Hard Disk:

The hard disk used in the PC is permanently fixed, hard disks with storage capacities of 8 GB, 10GB, 20GB, 40GB, are quite common, the CPU can use the hard disk to load programs and data as well as to store data We should operate the PC within a dust-free and cool room   (Preferably air-conditioned) to prevent hard disk crash.

ii). Floppy Disk:

Floppy disk is flexible circular disk of diameter 3.inches made of plastic coated with a magnetic material. This is housed in a square plastic jacket. The floppy disk can store 1.4 Mbytes of data [also called 1.44Mnytes, since it holds 1440Kytes]. Data recorded on a floppy disk is read and stored in a computer's memory by a device called a floppy disk drive[FDD]. A floppy disk is inserted in a slot of the FDD. Some of the floppies have limited life time. The floppies have to be recycled periodically to keep them alive. A frequently recycled floppy. [i.e used] will have a life time of 3to 4 years to do recycling take out old floppies occasionally and try to read them once, at least the directory.

iii). Compact Disk:

CD-ROM [Compact Read Only Memory] uses a laser beam to record and read data along spiral tracks on a 51/4'' disk. A disk can store around 650/00MB of information. CD-ROMs are normally used to store data as back up. Using a CD Writer, lot of information can be written on CD-ROM and stored for future reference.

iv). Tape Drives:

Even though tape drives are one of the oldest of storage technologies, they can still hold the most data on a single cartridge. A computer tape drive works similar to a tape recorder or a VCR. A plastic tape ribbon is coated with magnetic particles which are polarized by a magnetic field generated by the read/write head.

Since tape is a sequential, and not a random- access media, a tape drive has to wind through a tape to locate a specific bit of data. This makes accessing data slow so tape is mainly used for system backups and regular archiving of files and records.

Tape dives allow users to backup large amounts of data. Tape drives are capable of backing up a couple hundred megabytes to several gigabytes of information without having to spend large sums of money on disks.

iv). DLT [Digital Linear Tape]

DLT drives are a robust and durable medium. The DLT segments the tape into parallel horizontal tracks and records data by streaming the tape across a single stationary head. Released in 1991 DLT drives are very reliable, high-speed, and high-capacity making the DLT drives an excellent use for Network backups.

❖ DAT [Digital Audio Tape]

The popular choice for tape drives is DAT. This format is best known for digital audio recording although DAT drives can't play DAT audio. These drives use a recording technique called helical scanning which is used in VCRs. The 4mm tape is wrapped round a spinning read/write head that records data in overlapping diagonal tracks. These overlapping tracks allow for high data density and faster data transfer speeds. There are a few DAT standards but the most common is Digital Data Storage [DDS]. DAT tapes can hold 2GB [SSS] to 40GB [DDS-4] of compressed data.

DAT

v). Micro Vault USB Storage Media

Micro Vault media plugs directly into the computer's SB port – and acts just like another drive. It is small, light, Shock-proof and moisture – proof. This nifty flash memory storage device is compact and durable enough to carry in any pocket. The device is recognized automatically when we connect it to the computer. By connecting it via USB, the files can be transferred by dragging and dropping. There are no cables or adaptors needed, no power cord and no driver software to install. It's compatible with both Macintosh and Windows operating systems, and even comes with software that password protects the contents of the device.

Micro Vault

They are perfect for sharing PowerPoint presentations, digital photos, MPEG video and MP3s, transporting files between work and home, or sharing files with friends and colleagues.

## 11.3 CENTRAL PROCESSING UNIT [CPU]

The Central Processing Unit [CPU] is the brain of any computer system. In a computer system all major calculations and comparisons are made inside the CPU. The CPU is also responsible for activating and controlling the operations of other units of a computer system.

The control unit and the arithmetic logic unit of a computer system are jointly known as the Central Processing Unit. While the control unit takes care of the flow of data from input unit to storage unit and the flow of final results to the output unit, the arithmetic logic unit is the place where the actual execution of instructions taking place during the processing operation.

The Central processing Unit consists of the following main components:

Switched Mode Power Supply [SMPS] - for converting the current voltage, Mother Board [ROM]. Arithmetic Logic Unit [ALU], Control Unit[Ram],Hard Disk – Storage unit, Floppy Disk – storage Unit, CD ROM – Storage Unit

SYSTEM UNIT CPU BOX

| SMPS | MotherBoard | ROM |

Chip-486, Pentium-iii, iv
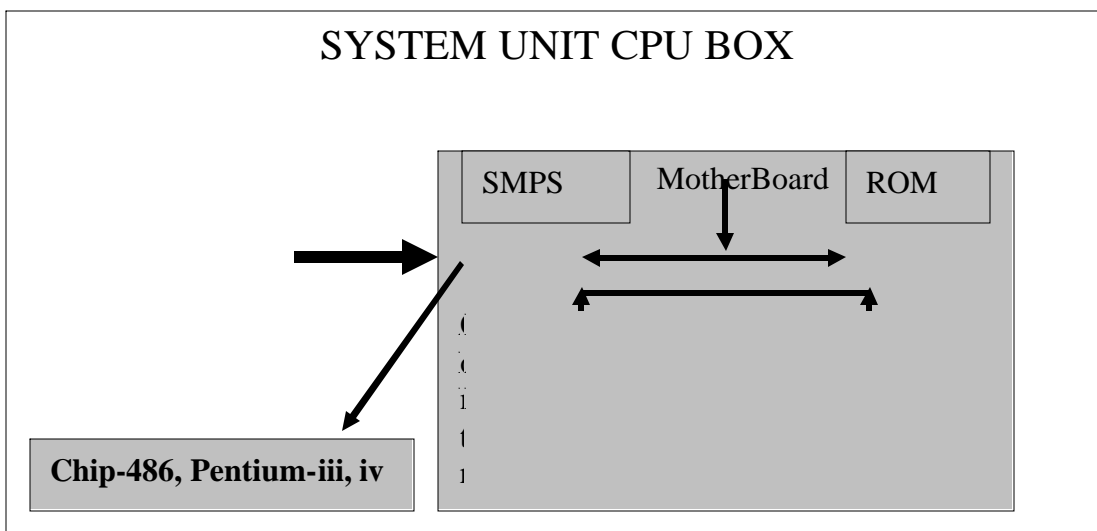
Check Your Progress 2
Mention any three storage devices.

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.80)

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11.4 LET US SUM UP

1. There are two types of storage devices: primary and secondary storage devices.
2. Primary memory is used to directly store and retrieve data and instructions. It is also known as temporary storage device.
3. Secondary memory also known as backup storage as it is used to store large volume of data on a permanent basis which can be partially transferred to the primary storage as and when required for processing.

11.5 LESSON END ACTIVITY

Type a document in MS- Word and try to copy it in Compact Disk (CD) or in pen drive

11.6 POINTS FOR DISCUSSION

1) Write short notes on Primary Storage Devices and Secondary Storage Devices.
2) What do you mean by DAT? Explain.

11.7 CHECK YOUR PROGRESS

1. Your answer may include any of the following:

i). Floppy Disk
ii). Compact Disk
iii). Tape Drives
iv). DAT [Digital Audio Tape]
v). Micro Vault USB Storage Media

11.8 REFERENCES

1. Alexis Leon, Mathews Leon, Fundamentals of Information Technology, Leon Vikas, New Delhi.
2. Suresh K. Basandra, Computers Today, Galgotia Publications Pvt Ltd., New Delhi.

LESSON - 12

SOFTWARE

12.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Software and its types
2. System software which manages the hardware components of the computer.
3. Application software which is useful for accomplishing a particular task.

12.1 INTRODUCTION

The computer being a machine cannot perform on its own. It needs to be instructed to perform even a simple task like adding two numbers. Computers work on a set of instructions called computer software (programs), which clearly specify the ways to carry out a task.

Software can be categorized as **system software and application software**.   System software is a generic term for referring to any computer program whose purpose is to help the user to run the computer system, whereas application software employees the capabilities of a computer directly to a task that the user wishes to perform.

12.2 CATEGORIES OF SOFTWARE

12.2.1 SYSTEM SOFTWARE:

System software consists of several programs, which are directly responsible for controlling, integrating, and managing the individual hardware components of a computer system. You must have noticed that a new computer system is always accompanied by some

software, either stored in a floppy or CD, which is supplied by the manufacturer. This software manages and supports the computer system and its information processing activities.

System software is more transparent and less noticed by the users, they usually interact with the hardware or the applications this software provides a programming environment in which programmers can create applications to accommodate their needs. This environment provides functions that are not available at the hardware level and performs the tasks related to the execution of an application program. Hence, system software acts as an interface between the hardware of the computer and the software application.

In simple terms, system software makes the computer functional. They provide basic functionality like file management, visual display, and keyboard input are used by application software to accomplish these functions. Some examples of system software are:
1. Operating system
2. Device drivers
3. Language translators
4. System utilities.

1. Operating System:
It is the first layer of software loaded into computer memory when it starts up. As the first software layer, all other software that gets loaded after it depends on it for various common core services. These common core services include disk access, memory management, takes scheduling, and user interfacing. In addition the operating system ensures that different programs executing at the same time do not interfere with each other. It provides a software platform on top of which other programs can run. In simple words, the operating system organizes and controls the hardware. Examples of operating systems are Windows XP, UNIX, and Linux. The basic functions of an operating systems are:

a) Process Management:
It handles the creation, deletion, suspension, resumption, and synchronization of process.

b) Memory Management:
It handles allocation and de-allocation of memory space as required by various programs.

c) File Management:
It is responsible for creation and deletion of files and directories. It also organizes, stores, retrieves, names, and protects all the files.

d) Device Management:
It manages all the devices of the computer system such as printers and modems. If any device fails, it detects the device failure and notifies the same to the user.

e) Security Management:
Protects system resources and information against destruction and unauthorized use.

f) User interface:

Provides the interface between the user and the hardware.

2. Device Drivers:

Device drivers are system programs, which are responsible for proper functioning of devices. Every device, whether it is a printer, monitor, mouse or keyboard, has a driver program associated with it for its proper functioning. Whenever a new device is added to the computer system, a new device driver must be installed before the device is used. A device driver is not an independent program; it assists and is assisted by the operating system for the proper functioning of the device.

3. Language translators:

Computers only understand a language consisting of 0s and 1s called machine language. To ease the burden of programming entirely in 0s and 1s, special programming languages called high-level programming languages were developed that resembled natural languages like English. Language translators help in converting programming languages into machine language. To be precise, they convert programming statements into the 0s and 1s that the computer is able to process.

Depending on the programming language used, language translators are divided into three major categories: compilers, interpreter, and assembler.

a) Compiler:

The programs written in any high-level programming language (C or Pascal) needs to be converted into machine language. This is achieved by using a complier.

b) Interpreter:

An interpreter analyses and executes the source code in line-by-line manner, without looking at the entire program. In other words, an interpreter translates a statement in a program and executes the statement immediately, before translating the next source language statement.

c) Assembler:

Compared to all the types of programming languages, assembly language is closest to the machine code. It is fundamentally a symbolic representation of machine code. The assembly language program must be translated into machine code by a separate program called an assembler. The assembler program recognizes the character strings that make up the symbolic names of the various machine operations, and substitutes the required machine code for each instruction. In short, an assembler converts the assembly codes into machine codes, making the assembly program ready for execution.

Typical software generally comprises millions of lines of programming statements or code. The code is divided into logical groups and stored in different independent modules so that the debugging and maintenance of the code becomes easier. Before execution, different object codes resulting from the independent modules have to be linked together to create and executable program. A linker is a system program that links together several objects modules and libraries to form a single, coherent, program (executable program). The part of the operating system that brings an executable file residing on disk into memory and executes it is known as

loader. Being responsible for tasks like loading, linking and relocation, loader performs the function of a linked program and then immediately schedules the executable for execution without creating an executable file as an output.

4. System Utility:

System utility programs perform day-to-day tasks related to the maintenance of the computer system. They are used to support, enhance, and secure existing programs and data in the computer system. They are generally small programs, having specific tasks to perform:

a) File Management:

These utilities make it easier to manage data files. Many programs are written to help users to find the files, create and organize directions, copy, move, and remove files.

b) Backup:

It may happen that sometime data files are corrupted, or accidentally deleted. In such a case, data backups become very useful. A backup system utility is essential for those organizations, which want to keep their data intact.

c) Data Recovery:

It is the process of retrieving deleted or inaccessible data from failed electronic storage media such as computer hard disk drives, removable media, optical devices, and tape cartridges.

d) Virus Protection:

Anti-virus programs are essential system utilities for a computer system functioning in a network. They provide the security to the system form viruses that can damage the computer system.

e) Disk Management:

Disk management program includes various system softwares like disk defragmenter, data compressor and disk formatting tools. De-fragmentation implies putting fragments of files in a sequential order onto the disk which reduces the time to access the file.

f) Firewall:

It is commonly used to protect information such as e-mail and data files within a physical building or organization. Essentially, a firewall is designed to protect a computer from unauthorized access, especially via network.

g) Disk Cleanup:

To keep a computer running smoothly, regular maintenance is vital. Therefore, one should use the disk cleanup utility, which easily determines which files on hard drive are no longer needed, then delete those files.

12.2.2 APPLICATION SOFTWARE:

The most often seen software by a user is the application software. It used to accomplish specific tasks rather than just managing a computer system. For a user, the computer system has no specific use without application software. Application software may consist of a single program, such as Microsoft's Note pad (for writing and editing simple text). It may also consist of a collection of programs, often called a software package, which work together to accomplish

a task, such as database management software. Application software may also include a larger collection of related but independent programs and packages (a software suite), which have a common user interface or shared data format, such as Microsoft Office suite.

Applications softwares are dependent on system softwares. A system software (like operating system) acts as an interface between the user and the computer hardware, while application software performs specific tasks. Applications are pieces of software that perform tasks for the user besides helping the computer operate, which is the tasks of system software. Applications softwares are controlled by system software, which manages hardware devices and performs background tasks for them. The distinction between the two is important. Without system software, the computer will not run, and without application software, the computer, no matter how powerful, will not be helpful in meeting user requirements. Think of it this way-applications apply the computer's thinking power to business tasks such as tracking the general ledger or billing your customers.

Application software ranges from games, calculators, and word processors (document creating programs), to programs that "paint" images on screen (image editors). Applications represent real world tasks. They can be easily divided by looking at exactly what function they serve. Some of the most commonly used application software is discussed below:

1. Word processor:
A word processor is software used to compose, format, edit, and print electronic documents. Word processing is one of the earliest applications for office productivity and the personal computer. It involves not only typing, but also checking the spelling and grammar of the text and arranging it correctly on the page. A variety of different typefaces is available for a verity of effects. It is possible to include pictures, graphs, charts and many other things within the text of the document. It also allows for changes in margins, fonts, and colour. Nowadays, virtually all personal computers are equipped with a word processing program, which has the same function as a typewriter for writing letters, reports or other documents, and printing. Examples of some well-known word processors are Microsoft Word and Word Perfect.

2. Spreadsheets:
One of the first commercial uses of computers was in processing payroll and other financial records, so the programs were designed to generate reports in the standard "spreadsheet" format bookkeepers and accountants used. A spreadsheet application is a rectangular grid, which allows text, numbers, and complex functions to be entered into a matrix of thousands of individual cells. The spreadsheet provides sheets containing cells each of which may contain text and / or numbers. Cells may also contain equations that calculate results from data placed in other cells or series of cells. A simple example might be a column of numbers totaled in a single cell containing an equation relating to that column.

Spreadsheet software are used predominantly for accounting a other numerically-based tasks, because financial and mathematical data and analysis are often managed in a tabular style, with columns of financial figures being manipulated and then influencing other data computations. Microsoft Excel and Lotus 1-2-3 are examples of spreadsheet applications.

3. Image Editors:

Image editor programs are designed specifically for capturing, creating, editing, and manipulating images. These graphics programs provide a variety of special features for creating and altering images. In addition to offering a host of filters and image transformation algorithms, some image editors also enable the user to create and superimpose layers. Most graphic programs have the ability to import and export one or more graphic file formats. These computer programs enable the user to adjust an image to improve its appearance. With image editing software, one can darken or lighten an image, rotate it, adjust it contrast, crop out extraneous detail, and much more. Examples of these programs are Adobe Photoshop, Adobe Illustrator and CorelDraw.

4. Database management systems:

Database management software is a collection of computer programs that allow storage, modification, and extraction of information from a database in an efficient manner. It supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation. When such software is used, information systems can be changed much more easily as the organization's information requirements change. New categories of data can be added to the database without disrupting the existing system. It also controls the security and integrity of the database from unauthorized access. FoxPro and Oracle are database management systems.

5. Presentation applications:

A presentation is a means of assessment, which requires presentation providers to present their work orally in the presence of an audience. It combines both visual and verbal elements. Presentation software allows the user to create presentations by producing slides or handouts for presentation of projects. Essentially, such computer programs allow users to create a variety of visually appealing electronic slides for presentation. Microsoft PowerPoint is one of the most famous presentation application.

6. Desktop publishing software:

The term desktop publishing is usually used to describe the creations of printed documents using a desktop computer. It is a technique of using a personal computer to design images and pages, and assemble type and graphics, then using a laser printer or image-setter to output the assembled pages onto paper, film, or printing plate. These softwares are used for creating magazines, books, newsletters, and so on. Such software assist in creating sophisticated documents including complicated page designs, detailed illustrations, and camera-ready types faces. Quark Express and Adobe PageMaker are desktop publishing software.

Check Your Progress 3

What is a word processor?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.87)

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12.3 LET US SUM UP

1. Software is divided into two categories: System software and Application software.
2. System software is used to integrate, control and manage all the hardware components of the computer system. Examples of system software include Operating system, Device drivers, Language translators, System utilities.
3. Application software is used to perform specific tasks of a computer system. Application software is dependent on system software for its functioning.

12.4 LESSON END ACTIVITY

Visit a printing press and know about the various desktop publishing softwares used.

12.5 POINTS FOR DISCUSSION

1) Explain in detail the various categories of software.
2) Write short notes of the basic functions of Operating System.
3) What are language translators? Explain.
4) State and explain the functions of system utility software.
5) What are application software? Explain the most commonly used application software.

12.6 CHECK YOUR PROGRESS

1. Word processor is software used to compose, format, edit, and print electronic documents.

12.7 REFERENCES:

1. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

LESSON - 13

PROGRAMMING LANGUAGES

13.0 Aims and Objectives

13.1 Introduction

13.2 Programming Languages

        13.2.1 Machine Language

        13.2.2 Assembly Language

        13.2.3 High Level Language

13.3 Let Us Sum Up

13.4 Lesson End Activity

13.5 Points for Discussion

13.6 Check your Progress

13.7 References

13.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Machine language- its advantages and disadvantages
2. Assembly language- its advantages and disadvantages
3. High level language- its advantages and disadvantages

13.1 INTRODUCTION

Computers are machines. Unfortunately they cannot understand natural languages, such as Hindi, English, Tamil, etc. that human beings speak and understand. Therefore, to give instructions to computers, different languages have been developed. These languages are called computer languages. To get a particular work done by computers, programmers write instructions using these computer languages. Each computer language has its own vocabulary of a natural language that we speak. Each natural language has its rules and grammar. Similarly, each computer language too has its set of rules that are called as syntax. As computers are not intelligent, we have to use the exact syntax rules of the computer language whenever we write any computer program. Otherwise, the computer will not be able to understand our instructions.

Over the last few decades, several computer languages have developed. Different computer languages are suitable for different applications. For example, COBOL (Common business oriented Language) may be more suitable for business applications, whereas

FORTRAN may be more suitable for scientific or engineering applications. We can classify all computer languages into three categories.

13.2 PROGRAMMING LANGUAGES
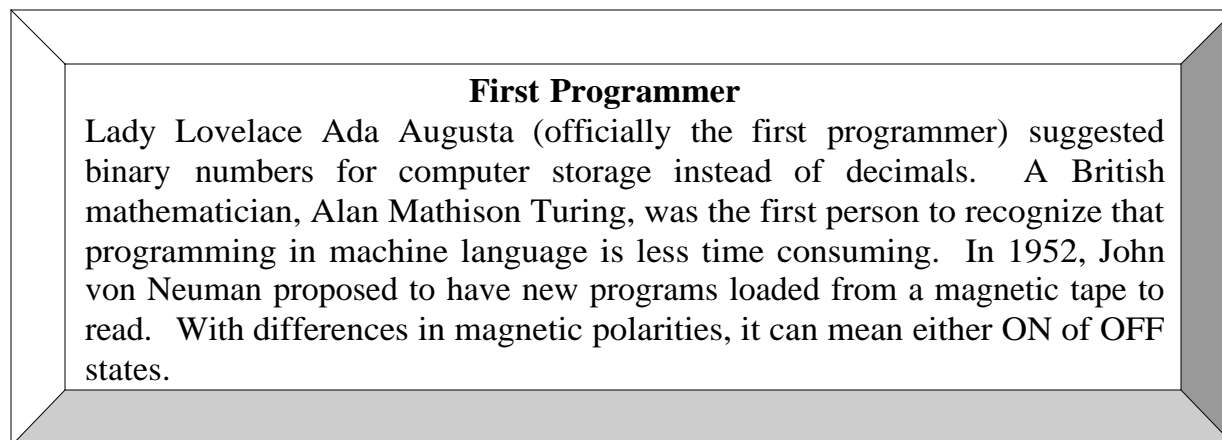
Computer languages are classified into three categories:
1. Machine language
2. Assembly language:
3. High level languages:

13.2.1 MACHINE LANGUAGE

The form in which information is denoted or represented by a combination of "1" and "0"s is called machine language. Programs and data are ultimately represented in machine language in memory and other hardware of the computer.

To start with computer programmers used machine language for programming. It was tedious since each operation that the computer has to perform is denoted by a particular combination of"1" s and"0"s.Also each computer had its own machine language code. One has to remember all these codes to write a program.

While machine language had the drawbacks mentioned above, it was very efficient in using computer circuits. There was no necessity for software to convert since we can directly represent the machine language in the computer circuits without the necessity of conversion.

First Programmer

Lady Lovelace Ada Augusta (officially the first programmer) suggested binary numbers for computer storage instead of decimals. A British mathematician, Alan Mathison Turing, was the first person to recognize that programming in machine language is less time consuming. In 1952, John von Neuman proposed to have new programs loaded from a magnetic tape to read. With differences in magnetic polarities, it can mean either ON of OFF states.

➢ **Advantages of Machine Language:**
Even though machine languages are not a human friendly language, it offers following advantages.

a) Translation Free:
Machine language is the only language that computers can directly execute without the need for conversion. Even an application using high-level languages, has to be converted into machine-readable form so that the computer can understand the instructions.

b) High Speed:
Since no conversion is needed, the applications developed using machine language are extremely fast. It is usually used for complex applications such as space control system, nuclear reactors, and chemical processing.

➢ **Disadvantages of Machine Language:**
There are many disadvantages in using machine language to develop programs. Some of these are

a) Machine Dependent:
Every computer type differs from the other, based on its architecture. Hence, an application developed for a particular type of computer may not run on the other type of computer. This any prove costly as well as difficult for the organizations.

b) Complex Language:
Machine language is very difficult to read and write. Since all the data and instructions must be converted to binary code, it is almost impossible to remember the instructions. A programmer must specify each operation, and the specific locations for each piece of data and instructions to be stored. It means that a programmer practically needs to be hardware expert to have proper control over the machine language.

c) Error Prone:
Since the programmer has to remember all the opcodes and the memory locations, machine language is bound to be error prone. It requires a super human effort to keep track of the logic of an problem and, therefore, results in frequent programming errors.

d) Tedious:
Machine language poses real problems while modifying and correcting a program. Sometimes the programming becomes too complex to modify and the programmer has to rewrite the entire logic again. Therefore, it is very tedious and time-consuming, and since time is a precious commodity, programming using the machine language tends to be costly. Due to its overwhelming limitations, machine language is rarely used nowadays.

13.2.2 ASSEMBLY LANGUAGE:
As computer field advanced, computer scientists felt the necessity of making computer programming easier. They invented computer languages that are easy to remember and use. These languages called assembly language uses mnemonic codes. for Example: For adding two quantities X and Y, You may code as follows.

ADD X Y
ADD is called operation code that tells the computer what operation it has to perform. X and Y are called operation addresses. These refer to the memory addresses where the quantities you want to add are stored. X refers to the location of first quantity and Y the second quantity. These are called symbolic address, since they do not refer to any fixed address. Software called assembler translates this assembly language program into machine language program which you can load into computer memory and execute.

When the program is loaded into memory for execution the symbolic addresses are automatically converted into actual physical addresses of operands involved in an instruction.

➢ **Assembly language offers the following advantages:**
a) The assembly language uses mnemonic codes, for programming. So it is easier for the programmer to use assembly language than machine language for programming.
b) The assemblers, in addition to translating the assembler language program into machine language, list the program statements (called source code) and also the syntax errors that the programmer committed.

➢ **Assembly language has certain disadvantages too:**
a) One has to spend considerable time in writing the assembly language program.
b) An assembly language program has to be converted into machine language program using assembly.
c) While it is easier to use than the machine language one still has to remember the operation codes for various operations.

13.2.3 HIGH LEVEL LANGUAGES:

During 1960s computers started to gain popularity and it became necessary to develop languages that were more like natural languages such as English so that a common user could use the computer efficiently. Since assembly language required deep knowledge of computer architecture, it demanded programming as well as hardware skills to use computers. Due to computer's widespread usage, early 1960s saw the emergence of the third generations programming languages (3GL). Languages such as COBOL, FORTRAN, BASIC, and C are examples of 3GLs and are considered high-level languages.

High level languages are similar to English language. Programs written using these languages can be machine independent. A single high-level statement can substitute several instructions in machine or assembly language. Unlike assembly and machine programs, high-level programs may be used with different types of computers with little or no modification, thus reducing the re-programming time.

In high-level language, programs are written in a sequence of statements to solve a problem. For example, the following BASIC code snippet will calculate the sum of two numbers

```
LET X      =      10
LET  Y     =      20
LET  SUM   =      X + Y          PRINT SUM
```

The first two statements store 10 in variable X (memory locations name) and 20 in variable, Y, respectively. The third statement again creates a variable named SUM, which will store the summation of X and Y value. Finally, the output is printed, that is, the value stored in SUM is printed on the screen.

➢ **Translating High-level Language to machine language:**
Since computers understand only machine language, it is necessary to convert the high-level language programs into machine language codes. This is achieved by using language translators or language processors, generally known as compliers, interpreters or other routines that accepts statements in one language and produces equivalent statements in another language.

a) Compiler:

A compiler is a kind of translator that translates a program into another program, known as target language. Usually, the term compiler is used for language translator of high-level language into machine language. The complier replaces single high-level statement with a series of machine language instruction. A compiler usually resides on a disk or the storage media. When a program is to be complied, its complier is loaded into main memory. The compiler stores the entire high-level program, scans it and translates the whole program into an equivalent machine language program. During the translation process, the compiler reads the source program and checks the syntax (grammatical) errors. If there is any error, the compiler generates an error message, which is usually displayed on the screen. In case of errors, the compiler will not create the object code until all the errors are rectified.

Once the program has been compiled, the resulting machine code is saved in an executable file, which can be run on its own at any time. To be precise, once the executable is generated, there is no need for the actual source code file. Anyway, it is worthwhile to keep the source file(s) because if the source code is modified, it is necessary to recompile the program again to regenerate the executable file containing amendments.

Compilers

Compiler is a program which translates source code written in a particular programming language into computer-readable machine code that can be directly loaded and executed. For each high-level language, a separate compiler is required. For example, a complier for C language cannot translate a program written in FORTRAN. Hence, to execute both language programs, the host computer must have the compilers of both languages.

b) Interpreter:

Unlike compilers, an interpreter translates a statement in a program and executes the statement immediately, before translating the next source language statement. When an error is encountered in the program, the execution of the program is halted and an error message is displayed. Similar to compilers, every interpreted language such as BASIC and LISP has its own interpreters.

➢ **Advantages of high-level languages:**

High-level languages (HLL) are useful in developing complex software, as they support complex data structures. It increases the programmer's productivity (the number of lines of code generated per hour). Unlike assembly language, the programmer does not need to learn the instructions set of each computer being worked with. The various advantages of using high-level languages are discussed below:

a) Readability:

Since high-level languages are closer to natural languages, they are easier to learn and understand. In addition, a programmer does not need to be aware of computer architecture; even a common man can use it without much difficulty. This is the main reason of HLL's popularity.

b) Machine Independent:

High-level language are machine independent in the sense that a program created using HLL can be used on different platforms with very little or no change at all.

c) Easy Debugging:

High-level languages include the support for ideas of abstraction so that programmers can concentrate on finding the solution to the problem rapidly, rather than on low-level details of data representation, which results in fewer errors. Moreover, the compilers and interpreters are designed in such a way that they detect and point out the errors instantaneously.

d) Easier to Maintain:

As compared to low-level languages, the programs written in HLL are easy to modify and maintain because HLL programs are easier to understand.

e) Low Development Cost:

High-level languages permit faster development of programs. Although a high-level program may not be as efficient as an equivalent low-level program, but the savings in programmer's time generally outweighs the inefficiencies of the application. This is because the cost of writing a program is nearly constant for each line of code, regardless of the language. Thus, a high-level language, where each line of code translates to 10 machine instructions, costs only a fraction as compared to program developed in a low-level language.

f) Easy Documentation: Since the statements written in HLL are similar to natural languages they are easier to understand as compared to low-level languages.

➢ **Disadvantages of high-level languages:**
   The main disadvantages of this language are:

a) Poor Control on Hardware:

High-level languages are developed to ease the pressure on programmers so that they do not have to know the intricacies of hardware. As a result, sometimes the applications written in high-level languages cannot completely harness the total power available at hardware level.

b) Less Efficient:

The HLL applications are less efficient as far as computation time is concerned. This is because, unlike low-level languages, high-level languages must be created and sent through another processing program known as a complier. This process of translation increases the execution time of an application. Programs written in high-level languages take more time to execute, an require more memory space. Hence, critical applications are generally written in low-level languages.

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Check Your Progress 4
List out the disadvantages of machine language.
Notes: a) Write your answer in the space given below
b) Check your answer with the one given at the end of this Lesson (pp.94)

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13.3 LET US SUM UP

1. In machine language, information is represented in the form of binary numbers '0's and '1's. Due to its disadvantages like machine dependability, complex language and Prone to errors, it is not widely used.
2. Due to the disadvantages of machine language, Assembly language came into being. The Assembly language is written in the form of mnemonic codes.
3. High level languages are similar to English language. Programs written using these languages are machine independent. As it is machine independent, translators like compilers and interpreters are available to translate high level language to machine language.

13.4 LESSON END ACTIVITY

Visit a computer centre and see how interpreters and compilers work**.**

13.5 POINTS FOR DISCUSSION
1) Explain the different classification of programming languages.
2) State and explain the advantages of machine language.
3) Write short notes on High Level Programming Languages.
4) Briefly explain the advantages of High Level Languages.

13.6 CHECK YOUR PROGRESS
1. Disadvantages of Machine Language:
   i).   Translation Free
  ii).   High Speed
 iii).   Machine Dependent
 iv).   Complex Language
  v).   Error Prone
 vi).   Tedious

13.7 REFERENCES
1. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.

LESSON – 14

PROGRAM DEVELOPMENT

14.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Steps in development of a program.
2. Algorithm and its properties.
3. Flow chart- its benefits and symbols used in program flowchart.

14.1 INTRODUCTION

The computer has emerged as the most useful machine in recent times. It can perform a variety of tasks like receiving data, processing it, and producing useful results. However, being a machine, the computer cannot perform on its own. A computer needs to be instructed to perform even a simple task like adding two numbers. Computers work on a set of instructions called computer program, which clearly specify the ways to carry out a task. An analogy of this may be thought of as the instructions given by the manager or team leader to its team. The team members follow those instructions and accordingly perform their duties. Similarly, a computer also takes instructions, in the form of computer programs, and carries out the requested task.

Now the questions arises how human beings instruct computers. We, as human beings, use natural languages such as English, Spanish, or French to communicate. Similarly, a user communicates with the computer in a language understood by it. Note that human beings cannot interact directly with the computer using natural languages because thus far we have not developed such computers that can comprehend natural languages. Rather the instructions, provided in the form of computer programs, are developed using computer or programming
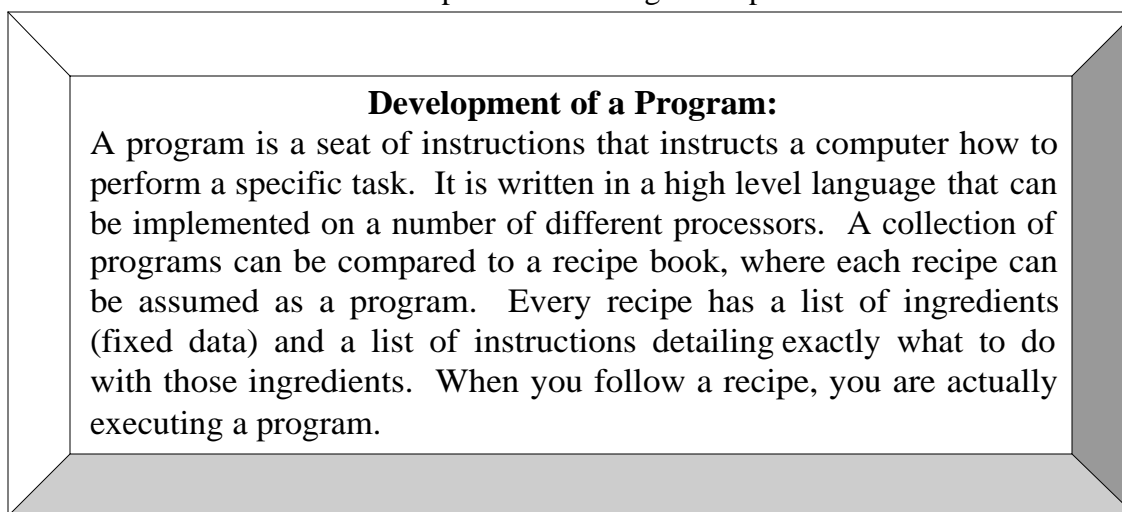
languages. This chapter will provide some of the most prominent concepts related to computer programming and languages.

14.2 DEVELOPING A PROGRAM

A program consists of a series of instructions that a computer processes to perform the required operation. In addition, it also includes some fixed data, required to perform the instructions, and the process of defining those instructions and data. Thus, in order to design a program, a programmer must determine three basic rudiments:

- ❖ The instructions to be performed.
- ❖ The order in which those instructions are to be performed.
- ❖ The data required to perform those instructions.

To perform a task using a program, a programmer has to consider various inputs of the program along with the process, which is required to convert the input into desired output. Suppose we want to calculate the sum of two numbers, A and B, and store the sum in C, here A and B are the inputs addition is the process, and C is the output of the program.

$$AB \rightarrow \quad C = A + B \quad \rightarrow \quad C$$
Input   Processing   output

Development of a Program:
A program is a seat of instructions that instructs a computer how to perform a specific task. It is written in a high level language that can be implemented on a number of different processors. A collection of programs can be compared to a recipe book, where each recipe can be assumed as a program. Every recipe has a list of ingredients (fixed data) and a list of instructions detailing exactly what to do with those ingredients. When you follow a recipe, you are actually executing a program.

14.2.1 Program Development Cycle (Steps In Developing a Program)

Before starting the process of writing a program (coding), the programmer has to determine the problem that needs to be solved. There are different approaches to problem solving. Most require breaking the problem into a series of smaller steps, independent of the programming languages. One common technique is to use the program development cycle, with the number of steps the may vary according to the person who has formalized the development. Often the process runs in a loop, for example, as the current process is completed, new demands appear and the development process commences again. Development cycle of a program includes the following phases:

a) Analyse/Define the problem:

Firstly, the problem is analyzed precisely and completely. Based on understanding, the developer knows about the scope within which the problem needs to be developed.

b) Task Analysis:

After analyzing the problem, the developer needs to develop various solutions to solve the given problem. From these solutions, the optimum solution (by experimenting with all the solutions) is chosen, which can solve the problem comfortably and economically.

c) Developing Algorithm:

After selecting the appropriate solution, algorithm is developed to depict the basic logic of the selected solution. An algorithm depicts the solution in logical steps (sequence of instructions). Further, algorithm is represented by flowcharts and pseudo codes. These tools make program logic clear and they eventually help in coding.

d) Testing the Algorithm for Accuracy:

Before converting the algorithms into actual code, it should be checked for accuracy. The main purpose of checking algorithm is to identify major logical errors at an early stage, because logical errors are often difficult to detect and correct at later stages. The testing also ensures that the algorithm is a "true" one and it should work for both normal as well as unusual data.

e) Coding:

After meeting all the design considerations, the actual coding of the program takes place in the chosen programming language. Depending upon application domain and available resources, a program can be written by using computer languages of different levels such as machine, assemble or high-level languages.

f) Test and Debug the Program:

It is common for the initial program code to contain errors. A program compiler and programmer-designed test data machine tests the code for syntax errors. The results obtained an compared with results calculated manually from this test data. Depending upon the complexity of the program, several rounds of testing may be required.

g) Documentation:

Once the program is free from all the errors, it is the duty of the program developers to ensure that the program is supported by suitable documentation. These documents should be supplied to the program users. Documenting a program enables the user to operate the program correctly. It also enables other persons to understand the program clearly so that it may, if necessary, be modified, or corrected by someone other than the original programmer.

h) Implementation:

After performing all the above-mentioned steps, the program is installed on the end user's machine. In this stage, users are also provided with all the essential documents so that they can understand how the program works. The implementation can be viewed as the final testing because only after using the program, the user can point out the drawbacks, if any to the developers. Based on the feedback, the programmers can modify or enhance the program.

i) Maintenance and Enhancement:

After the program is implemented, it should be properly maintained taking care of the changing requirements of its users and system. The program should be regularly enhanced by

adding additional capabilities. This phase is also concerned with detecting and fixing the errors, which were missed in testing phase. Since this step generates user feedback, the programming cycle continues as the program modified or reconstructed to meet the changing needs.

Check Your Progress 5

 What are the steps involved in developing a program?

 Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this unit (pp.104)

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14.2.2 ALGORITHM

Algorithms are one of the most basic tools that are used to develop the problem solving logic. An **algorithm** is defined as a sequence of clear instructions that, when provided with a set of input values produces an output and then terminates. To be an algorithm, the steps must be unambiguous and after a finite number of steps, the solution of the problem is achieved. However, algorithms can have steps that repeat (iterate0 or require decisions (logic and comparison) until the task is completed.

Different algorithms may accomplish the same task, with a different set of instructions, in more or less the same time, space, and efforts. For example, two different recipes for preparing tea, one 'add the sugar' while 'boiling the water' and the other 'after boiling the water' produce the same result. However, performing an algorithm correctly does not guarantee a solution, if the algorithm is flawed or not appropriate to the context. For example, preparing the tea algorithm will fail if there are no tea leaves present; even if all the motions of preparing the tea are performed as if the tea leaves were there. We use algorithms in our daily life. For example, to determine the largest number out of three numbers A, B, and C, the following algorithm may be used.

Step 1 : Start

Step 2 : Read three numbers say A,B,C

Step 3 : Find the larger number between A and B and store it in
          MAX_AB.

Step 4 : Find the larger number between MAX_AB and C and store it
          in MAX.

Step 5 : Display MAX

Step 6 : Stop

The above-mentioned algorithm terminates after six steps. This explains the feature of finiteness. Once the solution is properly designed, the only job left is to code that logic into a

---

Algorithm Properties

Properties of Algorithm are:

There must be no ambiguity in any instruction.

There should not be an uncertainty about which instruction is to be executed next.

The description of the algorithm must be finite. An algorithm cannot be open-ended.

The execution of the algorithm should conclude after a finite number of steps.
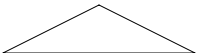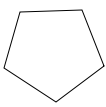
The algorithm must be general enough to deal with any contingency.

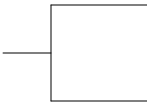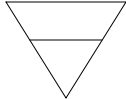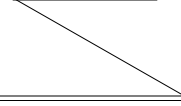104

14.2.3 FLOWCHART

A flowchart is a pictorial representation of an algorithm in which the steps are drawn in the form of different shapes of boxes and the logical flow is indicated by interconnecting arrows. The boxes represent operations and the arrows represent the sequence in which the operations are implemented. The primary purpose of the flowchart is to help the programmer in understanding the logic of the program. Therefore, it is always not necessary to include all the required steps in detail. Flowcharts outline the general procedure. Since they provide an alternative, visual way of representing the information flow in a program, program developers often find them very valuable.

Flow charts can be compared within the blueprint of a building. Just as an architect draws a blueprint before starting the construction of a building, a programmer draws a flowchart before writing a computer program. As in the case of the drawing of a blueprint, the flowchart is drawn according to defined rules and using standard flowchart symbols prescribed by American National Standard institute (ANSI). Some standard symbols that are frequently required for flowcharts are shown:

Table Flowchart symbols

Symbol	Symbol Name	Description
	Flow Lines	Flow lines are used to connect symbols. These lines indicate the sequence of steps and the direction of flow.
	Terminal	The symbol is used to represent the beginning(start), the termination(end) or halt (pause) in the program logic.
	Processing	Process symbol is used for representing arithmetic and data movement instructions. It can represent a single step ('add two cups of flour), or an entire sub-process ('make bread') within a larger process.
	Decision	Decision symbol denotes a decision (or branch) to be made. The program should continue along one of the two routes (IF/ELSE) This symbol has one entry and two exit paths. The path chosen depends on whether the answer to a question is yes or no.
	Connector	Connector symbol is used to join different flow lines.
	Off-page Connecter	This symbol is used to indicate the flowchart continues on the next page
	Document	Document is used to represent a paper document produced during the flowchart process.

	Annotation	It is used to provide additional information about another flowchart symbol. The content may be in the form of descriptive comments, remarks or explanatory notes.
	Manual Input	Manual input symbol represents input to be given by a developer / programmer.
	Manual Operation	Manual operation symbol shows that the process has to be done by a developer/ programmer.
	Online storage	This symbol represents the online data storage such as hard disks, magnetic drums, or other storage devices.
	Offline Storage	This symbol represents the offline data storage such as sales on OCR and data on punched cards.
	Communication Link	Communication link symbol is used to represent data received or to be transmitted from an external system.
	Magnetic Disk	This is used to represent data input or output from and to a magnetic disk.

➢ **Benefits of Flowcharts:**
A flowchart helps to clarify how things are currently working and how they could be improved. It also assists in finding the key elements of a process by drawing clear lines between the end of one process and the start of next one.

a) Makes Logic Clear:
The main advantage of using a flowchart is to plan a task is that it provides a pictorial representation of the task, which makes the logic easier to follow. The symbols are connected in such a way that they show the movement (flow) of information through the system visible. Even less experienced personnel can trace the actions represented by a flowchart, that is, flowcharts are ideal for visualizing fundamental control structures employed in computer programming.

b) Communication:
Being a graphical representation of a problem-solving logic, flowcharts are better way of communicating the logic of a system to all concerned. The diagrammatical representation of logic is easier to communicate to all the interested parties as compared to actual program code as the user may not be aware of all the programming techniques and jargons.

c) Effective Analysis:

       With the help of a flowchart, the problem can be analysed in an effective way. This is because the analyzing duties of the programmers can be delegated to other persons, who may or may not know the programming techniques, as they have a broad idea about the logic. Being outsiders, they often tend to test and analyse the logic in an unbiased manner.

d) Useful in Coding:

       The flowcharts act as a guide or blueprint during the analysis and program development phase. Once the flowcharts are ready, the programmers can plan the coding process effectively as they know where to begin and where to end, making sure that no steps are omitted. As a result, error free programs are developed in high- level languages and that too at a faster rate.

e) Proper Testing and Debugging:

       By nature, a flowchart helps in detecting the errors in a program, as the developers known exactly what the logic should do. Developers can test various data for a process so that the program can handle every contingency.

f) Appropriate Documentation:

       Flowcharts serve as a good program documentation tool. Since normally they programs are developed for novice users, they can take the help of the program documentation to know what the program actually does and how to use the program.

Flowcharting: Examples

1. Draw a flowchart to find the sum of first 50 natural numbers.

107
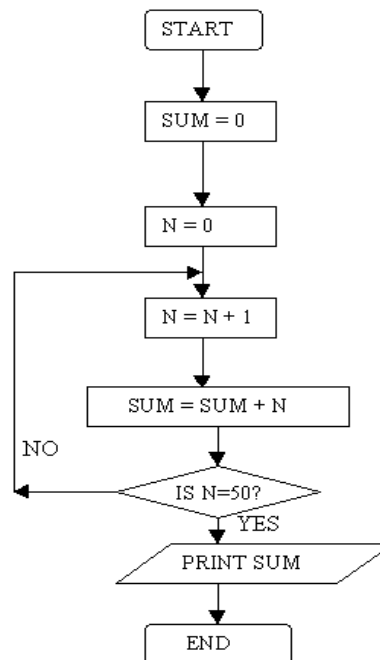
2. Draw a flowchart to find the largest of three numbers A, B, and C.
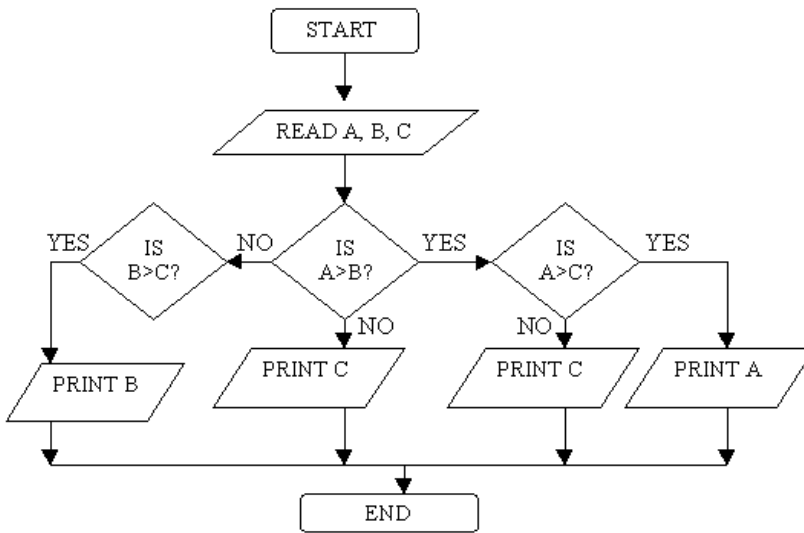
3. Draw a flowchart for computing factorial N (N!)

Where N! = 1 ´ 2 ´ 3 ´ …… N.
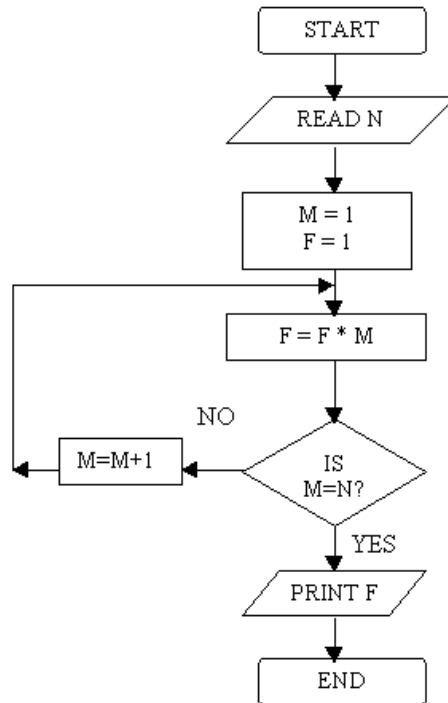
Check Your Progress 6

. Define flowchart.

Notes: a) Write your answer in the space given below

   b) Check your answer with the one given at the end of this unit (pp.104)

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14.3 LET US SUM UP

1. Program development involves several steps like: Analyzing/Defining the problem, Task Analysis, Developing Algorithm, Testing the Algorithm for Accuracy, Coding, Test and Debug the Program, Implementation, Maintenance and Enhancement.
2. Algorithm is developed to depict the basic logic of the selected solution. An algorithm depicts the solution in logical steps (sequence of instructions).
3. A flowchart helps to clarify how things are currently working and how they could be improved. It also assists in finding the key elements of a process by drawing clear lines between the end of one process and the start of next one.

14.4 LESSON END ACTIVITY

Prepare a flowchart to find the smallest of three numbers.

11.5 POINTS FOR DISCUSSION

   1) Explain in detail about program development cycle.
      (or)
      What are the steps involved in developing a program?
   2) What do you mean by a Algorithm? Explain with an example.
   3) List out the various properties of algorithm.
   4) What do you mean by a Flow-chart? Explain with an example.
   5) Explain the various symbols used in a flow chart.
   6) What are the benefits of Flow chart? Explain.

11.6 CHECK YOUR PROGRESS

   1. Steps in developing a program:
   i).   Analyse/Define the problem
   ii).   Task Analysis
   iii).   Developing Algorithm
   iv).   Testing the Algorithm for Accuracy
   v).   Coding
   vi).   Test and Debug the Program:
   vii).   Documentation
   viii). Implementation
   ix).   Maintenance and Enhancement

6. Flowchart is a pictorial representation of an algorithm in which the steps are drawn in the form of different shapes of boxes and the logical flow is indicated by interconnecting arrows.

14.6 REFERENCES

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2. ITL Education Solutions Limited, Introduction to Information Technology,Pearson Education, New Delhi.
3. Andrew S. Tanenbaum, Computer Networks, Pearson Education, New Delhi.

UNIT IV

LESSON – 15

OPERATING SYSTEM

15.0 Aims and Objectives

15.1 Introduction

15.2 Operating System

      15.2.1 Functions of an Operating System

15.3 Types of Operating System

      15.3.1 Dos (Disk Operating System)

      15.3.2 Windows Operating System

      15.3.3 The UNIX Operating System

15.4 Let Us Sum Up

15.5 Lesson End Activity

15.6 Points for Discussion

15.7 Check your Progress

15.8 References

15.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. What is an operating system, features and types of operating system and features of operating system.
2. Major functions of operating system.

15.1 INTRODUCTION

It is the first layer of software loaded into computer memory when it starts up. As the first software layer, all other software that gets loaded after it depends on it for various common core services. These common core services include disk access, memory management, takes scheduling, and user interfacing. In addition the operating system ensures that different programs executing at the same time do not interfere with each other. It provides a software platform on top of which other programs can run. In simple words, the operating system organizes and controls the hardware. Examples of operating systems are Windows XP, UNIX, and Linux.

15.2 OPERATING SYSTEM

The operating system is a software program that acts as an interface between the user and the computer. It is used to control and manage the hardware components such as keyboard, monitor, printer, scanner etc.

15.2.1 FUNCTIONS OF AN OPERATING SYSTEM

a) Process Management:
It handles the creation, deletion, suspension, resumption, and synchronization of process.

b) Memory Management:
It handles allocation and de-allocation of memory space as required by various programs.

c) File Management:
It is responsible for creation and deletion of files and directories. It also organizes, stores, retrieves, names, and protects all the files.

d) Device Management:
It manages all the devices of the computer system such as printers and modems. If any device fails, it detects the device failure and notifies the same to the user.

e) Security Management:
Protects system resources and information against destruction and unauthorized use.

f) User interface:
Provides the interface between the user and the hardware.

Check Your Progress 1
What is an operating system?

Notes: a) Write your answer in the space given below
   b) Check your answer with the one given at the end of this Lesson (pp.114)

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15.3 TYPES OF OPERATING SYSTEM
These are the different types of operating system :

15.3.1 DOS (Disk Operating System)
MS-DOS was the widely used operating system before the introduction of the Windows operating system. Even now the MS-DOS commands are used for carrying out many jobs like copying the files, deleting the files etc. The DOS is a set of computer programs. The main

functions of DOS are to manage files, allocate system resources according to the requirement. It provides essential features to control hardware devices such a keyboard, screen, disk drives, printers, modems etc. Thus, DOS is a medium through which the user and external devices attached to the system communicate the command with the system. DOS translate communication issued by the computer in the format that is understandable by the computer and instruct computer to work accordingly. It is also translates the result and any error message in the format for the user to understand.

➤ **DOS Commands**

We can type all DOS commands in either upper or lower case letters. There are two basic types of DOS commands:

❖ **Internal commands**

These commands, like COPY, DEL, and TYPE, are stored in computers memory. Many DOS commands fall into this category.

❖ **External commands**

This group of commands is stored on the disk. To use them, either insert the DOS floppy disk, or change to the directory on hard disk which contains DOS external commands. Examples of external commands include FORMAT, DISKCOPY, and CHKDSK.

Some commands can take several forms. These separate forms are used by including various parameters with the command. Parameters, which will be discussed with each command, are indicate by a / mark. Here is an example of command with an attached parameter:

C:\>DIR/W
[DOS command DIR is attached with parameter W]
All DOS commands must be activated by pressing the <Enter> key after typing the command.

➤ **Features of DOS**
  ❖ Single user system
  ❖ Machine independence
  ❖ Program control
  ❖ Peripheral management
  ❖ Operating with Directories
  ❖ Managing files
  ❖ Processing commands
  ❖ Managing input and output
  ❖ Data securing
  ❖ Using Batch files
  ❖ Managing memory
  ❖ Setting up environment
  ❖ Command processing - DOS shell(a set of commands which is used to create the programs)
  ❖ Operating with Assembler.

> **Advantages of DOS**

The DOS provides the following advantages:

❖ Machine independence
❖ More security
❖ User friendly environment
❖ More useful in commercial applications.
❖ Error finding and recovery is more efficient
❖ Facilities more graphical user interfaces.
❖ Easy debugging

Check Your Progress 2

Mention any five features of DOS.

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.114)

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15.3.2 WINDOWS OPERATING SYSTEM

Microsoft Windows is the most popular operating system around the world. Even those who are new to computers can use it with a little practice. With the help of Windows, we can operate the computer just by clicking the mouse buttons, Windows95, Windows98, Windows 2000 and Windows XP are the various versions of Windows.

Windows is an operating system. It is the extension of the disk operating system. Windows is system software. It requires DOS to run the application programs. The DOS should be loaded into the memory before the window is executed. After the windows is loaded into the memory the windows environment takes all the device controls. It also takes care of the memory management of the programs run by the windows software".

Types of windows

There are two types of windows. They are

(a) Application windows - displays the executable program in graphical user interface mode.

(b) Document window - generated by executable or application program.

1. Windows 98

Windows 98 is the upgraded version of Windows 95. it offers bug fixture and minor enhancements.

> **Features of Windows:**

The important features of Windows 98 are as follows:

(a) Graphical User Interface

Windows 98 provides user-friendlier interface to work on. Its improved graphical user interface makes learning and using windows 98 more natural and easier for all types of users. It is more powerful, customizable and efficient.

(b) Type of icons (Small Pictures):

There are three types of icons. They are

i) Applications icons - the minimized version of the currently running application programs. It appears at the bottom of the desktop and can be maximized.

ii) Document icons - the reduced document windows.

iii) Program icons - appear with in program manager and clicking on these icons activate the associated applications and also load the related documents or files.

(c) Start Button

Introduction of START button by windows 98 made life much simpler while there is a need to access multiple programs. It is the gateway of accessing most of the functionality available in the computer loaded with windows 98. Just Click on the start button anytime to start any programs, open or find documents, change windows settings, get Help, manage Files, maintain System, much more.

(d) Taskbar

The Task bar provides information and access to the entire task that has been currently activated by windows 98. Using this one can keep a track of what all programs have been activated and switched between them.

(e) Windows Explorer

Windows Explorer more or less acts as File Manager for windows 98, but with lots of new features. It is more efficient, faster and user friendly. Using Explorer one can easily browse through all the drives and network resources available and manage files.

(f) Right Mouse Button

Clicking on the right mouse button activates a pop-up menu in any program so as to help in completing a task efficiently.

(g) Long File Names

As the MS-DOS convention follows, none-of the file used in DOS environment should be more than 8 character of primary name and optimal secondary name (extension) of three characters. However Windows 98 has broken this barrier. Windows 98 supports long file names maximum of 225 characters. It also allowed space to be used in between file name. This helps to make files and folders (directory/subdirectory) easier to organize and find.

h) Shortcuts

As the name suggests, SHORTCUTS are the shortest way to access programs, files other resources in Windows 98. Instead of going through the structural process of accessing a program, one can create "shortcuts" to access them. It creates links for easy access to file, programs, folders and more.

i) Multitasking

Multitasking allows the user to activate and accomplish more than one task at a time. For example, work on a document file WORD programs, which copies file from other computer available in time on the network. With Windows 98, 32 - bit computing environment, the user can do more than one task a time.

j) Easy Internet Access

Integration of Internet Explorer 4.0 and Active Desktop, which coupled the Internet html hypertext links more tightly to the Windows 98 user interface.

k) Software Compatibility

Windows 98 provides complete backward compatibility. It is easily compatible with other applications developed for MS-DOS and Windows 3.x environment. It also supports latest 32-bit technology. Most of the latest software packages are now built on Windows 98, operating environment.

l) Great Gaming Platform

Windows 98 supports rich graphics, high quality audio and video. Software to take advantage of Intel's Multimedia Extensions (MMX) to the IA - 32 instruction set, which are designed to improve the performance of multimedia applications and games developed for windows 98 that uses MMX technology.

m) Hardware Compatibility

Windows 98 provides greater Hardware compatibility as compared to any other operating environment. It has flexibility of supporting hardware from different vendors.

n) Find utility

Find Utility of windows 98 allows the user to do searches by partial name, last modified date, or full text. In addition we can save, rename or view files from within the result pane.

(o) Help

Windows 98 provides online help to accomplish a task. If the user is not sure how to perform a task, windows 98 Help will provide structured process how to accomplish the task. Simply right-click on any object in the user interface (icon) and he can get relevant description about that object.

(p) Manage more numbers of PC's

Windows 98 can manage up to eight monitors on a- single PC. The user can drag and drop resize and move desktop items such as windows, folders, icons, and applications, from one monitor to the next.

(q) Additional facilities

Windows 98 includes additional enhancement of Windows 95 that includes new backup utilities and disk defragmenter capabilities.

2.   Windows NT workstation

Windows NT is a single user; multitasking operating system designed to run on PC workstations and incorporates all latest developments in operating system technology. It was introduced in 1993. It includes the following:
(a) Windows NT workstation
(b) Windows NT server, and
(c) Windows NT enterprise edition

➢ **Features**

a) Single User Multitasking

The main feature is that even through it is meant for a single user environment, provides multitasking. For e.g., a user may use a word processor, a drawing program, a spreadsheet application to produce a document. Without multitasking, simultaneous use of this will not be possible. They must process with the s/w one by one; provide alignment making changes will be a tedious process. In a multitasking environment, the user may keep all the applications open, prepare the documentation and make necessary change. All of these are possible with increased speed and memory capacity of microprocessors together with the support for virtual memory.

b) Ability to support all applications

The power of Windows NT comes form its ability to support applications written for other operating systems. This ability is provided through protected subsystems. The protected subsystems are those parts of NT that interact with the end user.

c) Client server computing model

The way in which the executive, the protected subsystems, and the applications structured in NT is by using the client/ server computing model, each server implemented as one or more process. Such process waits for a request from a client for of its services, eg. memory services. A client, which may be an applications program or another operating system module, requests a service by sending a message. The message routed through the executive to the appropriate server. The server performs the operation and returns the results or status information by means of another message, which is routed through the executive back to the client.

Client/server architecture has the following advantages:
(i)   It simplifies the base operating system, the NT executive
(ii)   It improves reliability. Each server runs on a separate process with its partition of memory, protected from other servers. Also, the servers cannot directly access hardware or modify memory in which the executive the rest, the operating system.
(iii)   It provides a natural base for distributed computing.

d) Support for Threads

An important feature of Windows NT is its support for threads within process. A thread is a dispatchable unit of work. It is executed sequentially and may be interrupted so that the processor can turn to other threads. A process is a collection of one or more areas and associated system resources. This is similar to a program in execution. By checking an application into multiple threads, the modularity and the timing of application related events could be maintained.

e) Support of Symmetric Multiprocessing (SMP)

In a multiprocessor system, to achieve maximum efficiency and reliability a mode of operation known as symmetric multiprocessing (SMP) is desirable. With SMP, any process or Thread can be assigned to any processor.

f) Windows NT uses concepts of object oriented design

Windows NT uses some concepts of object oriented design. This approach facilitates the sharing of resources and data among processes and the protection of resources and data among processes and the protection of resources from unauthorized access.

➢ **Advantages of Windows NT**
a) It simplifies the base operating system
b) It improves reliability
c) It provides a natural base of distributed computing
d) Operating-system routines can run on any available processor and different routines can be executed simultaneously on different processors.
e) NT supports the use of multiple threads of execution within a single process.
f) NT processes convenient mechanisms for sharing data and resources between processes.
g) NT provides flexible inter process communication capabilities.
g) Functionality-NT can communicate with many different types of computers.

15.3.3 THE UNIX OPERATING SYSTEM

Like DOS and windows, there's another operating system called UNIX. It arrived earlier then the other two, and stayed back like enough to give us the internet. UNIX is a giant operating system and is way ahead of them in sheer power. It has practically everything an operating system should have, and several features which other operating systems never had. Its richness and elegance go beyond the commands and tolls that constitute it, while simplicity permeates the entire system. It runs on practically every hardware and provided motivation to the open source movement.

However, UNIX also makes many demands of the user. In requires a different type of commitment to understand the subject, even when the user is an experienced computer professional. It introduces certain concepts not known to the computing community before, and user numerous symbols whose meaning is anything but clear. It achieves unusual tasks with a few keystrokes, but it takes time to devices a sequence of them for a specific task. Often, it doesn't tell you whether you are right or wrong, and doesn't warn you of the consequences of your actions. That is probably the reason why many people still prefer to stay away from UNIX.

➢ **Features of UNIX**

UNIX is an operating system, so it is has all the features an operating system is expected to have. However UNIX also looks at a few things differently and possesses features unique to it. The following section gives a clear idea of the major features of this operating system.

a) UNIX: A Multi user System

From the fundamental point of view, UNIX is a multiprogramming system; it permits multiple programs to run. This can happen in two ways

Multiple users can run separate jobs
A single user can also run multiple jobs.

b) UNIX: A Multi tasking System Too

A single user can also run multiple tasks at the same time as UNIX is a multitasking system. It is usual for a user to edit a file, print another one on printer, send email to a friend and browse the Word Wide Web - all without leaving any of the application. This kernel is designed to handle a user's multiple needs.

c) The UNIX Toolkit

By one definition, UNIX represents the kernel, but the kernel by itself doesn't do much that can benefit the user. To properly exploit the power of UNIX, you need to use the host of applications that are shipped with every UNIX system. These applications are quite varied in scope. There are general – purpose tools, text manipulation utilities (called filters), compilers and interpreters, networked applications and system administration tools.

d) Pattern Matching

UNIX features very sophisticated pattern matching features. UNIX features elaborate pattern matching schemes that use several characters from the Meta character set. The matching isn't confined to filenames only. Some of the most advanced and useful tools also use a special expression called a regular expression that is framed with characters from the set.

e) Programming Facility

The UNIX shell is also a programming language; it was designed for a programmer, not a casual end user. It has all the necessary ingredients, like control structures, loops and variables, that establish it as a powerful programming language in its own right.

f) Documentation

UNIX documentation is no longer the sore point it once was. Even though it is sometimes uneven at most times the treatment is quite. The principal online help facility available is the man command, which remains the most important reference for commands and their configuration files. Thanks to O'Reilly & Associates, one can safely say that there's no feature of UNIX on which a separate textbook is not available.

Apart from the online documentation, there's a vast ocean of UNIX resources available on the internet. There are several newsgroups on UNIX where you can fire your queries in case you are stuck with a problem – be it a problem related to shell programming or a network configuration issue. The FAQ (Frequently Asked Questions) a document that addresses common problems is also widely available on the Net. Then there are numerous articles published in magazines and journals and lecture notes available by universities on their Web sites. UNIX is easily tamed Operating System.

15.4 LET US SUM UP

1. There are different types of operating system: DOS (Disk Operating System), Windows Operating System, The UNIX Operating System.
2. An operating system performs various functions like Process Management, Memory Management, File Management, Device Management, Security Management, User interface,

3. The main functions of DOS are to manage files, allocate system resources according to the requirement. There are two basic types of DOS commands: Internal commands and External commands

4. Windows is an operating system. It is the extension of the disk operating system. It requires DOS to run the application programs. The DOS should be loaded into the memory before the windows is executed.

5. UNIX is a giant operating system and is way ahead of them in sheer power. It has practically everything an operating system should have, and several features which other operating systems never had.

15.5 LESSON END ACTIVITY

Work in windows and UNIX operating system and know the difference between the two.

15.6 POINTS FOR DISCUSSION

1) List and explain the functions of an Operating System.
2) Write short notes on different types of Operating System.
3) List out the features of DOS.
4) Write short notes on types of DOS commands.
5) Explain in detail about the features of WINDOWS.
6) Explain the various features of WINDOWS NT Work Station.
7) What are the advantages of WINDOWS NT..

15.7 CHECK YOUR PROGRESS

1 The operating system is a software program that acts as an interface between the user and the computer. It is used to control and manage the hardware components such as keyboard, monitor, printer, scanner etc.

2. Your answer may include any of the following:
i).   Single user system
ii).   Machine independence
iii).   Program control
iv).   Peripheral management
v).   Operating with Directories
vi).   Managing files
vii).   Processing commands
viii). Managing input and output
ix).   Data securing
x).   Using Batch files
xi).   Managing memory
xii).   Setting up environment
xiii). Command processing - DOS shell(a set of commands which is used to create the programs)
xiv).   Operating with Assembler.

15.7 References

1. Silbertz Galvin, Operating System Concepts

LESSON - 16

ELECTRONIC COMMERCE

Contents:

16.0 Aims and Objectives

16.1 Introduction

16.2 Electronic Commerce

   16.2.1 Features Of E-Commerce

   16.2.2 Importance Of E-Commerce

   16.2.3 Types of Electronic Commerce

   16.2.4 E-Commerce Activities

16.3 Let Us Sum Up

16.4 Lesson End Activity

16.5. Points for Discussion

16.6 Check your Progress

16.7 References

16.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. What is meant by electronic commerce.
2. Features and importance of E-Commerce.
3. Types of E-Commerce and E-Commerce activities.

16.1 INTRODUCTION

The growth of Internet into a global market place attracts more business firms to use this media for commerce. Business firms may use the Internet initially for communication. Websites are set up to provide information about its products and services. Business firms offer corporate information, product information, marketing related services etc,.

The Internet has integrated the fragment markets words over though in a modest way. But this interaction is growing rapidly. The most important advantage of the internet for business firms is that it allows reaching customers at very low costs.

16.2 ELECTRONIC COMMERCE

Electronic commerce is the process of searching, choosing, buying and selling of product or service on the electronic network; it uses the computer and communication networks for promoting products, selling, delivery, collection and delivery service**.**

➢ **Electronic Commerce includes**:
a) Buying and selling on the internet
b) Making payments electronically
c) Business transaction in which there is no physical exchange or physical contact.
d) It is transacting a business over am electronic network without physical contact.

The problems connected with electronic commerce are:
a) Identity
b) Authentication
c) Protection of data
d) Confidentiality

These problems can be solved by using:
a) Secure socket layer and hypertext transfer protocol
b) Digital signatures
c) Using public key cryptography
d) Using digital certificates.

In E- commerce, the parties to a transaction interact electronically. They may be separated by long distances physically, yet the electronic network bring them together not only to complete a transaction but also to get after sales support, E-commerce is not just doing transaction over the Internet, it aims at few other things as well like :

❖ Web enabling an organization's business so that it can facilitate better customer interaction, handing customer enquiries receiving customer order and payments online.
❖ Improving customer service capabilities by allowing customers by providing Inert access to its databases containing customer interest information.
❖ Use the web to gather customer need information and thus to reducing cycle time by responding to customer needs quickly. It enables the firm in coming out with new available new product information to customers.
❖ Raising productivity of all activities in the organization by improving the flow of information in the organization.

16.2.1 FEATURES OF E-COMMERCE:
E-Commerce has the following general features:
a) It is a business strategy to cut down costs, while improving quality and increasing the speed of delivery of goods/services.
b) It has ability to sell and purchase products/services/information on computer networks.
c) It is a solution for office automation and quick business transactions.
d) It is a tool to improve intra business functioning like business re-engineering.
e) It is tools to improve inter business communication through easy and accurate interaction and information interchange.

16.2.2 IMPORTANCE OF E-COMMERCE

E-Commerce becomes inevitable because of the following:

a) Low setup cost:

Any body can easily set up a website. In fact there are many organizations and training institutes who help customers in developing and launching websites. To market a product large retail showrooms are not required, just a web site showing the characteristics of the product including cost details are sufficient.

b) Global Free Market:

Nobody can dominate the global market as presence on the internet is easy not only for global giants, but even small organisations can participate actively at low costs and compete with stiff competition.

c) Global Access:

Since more than 200 countries are hooked onto the Internet, anybody who can afford a TV and a telephone can fully access the Internet and gain the information required.

d) Availability of Technology:

Since the same technology like web servers, browsers, engines, internet, etc., is used throughout the world therefore business can be easily conducted.

e) Multiple Opportunities:

By using E-Commerce multiple activities like selling, renting, purchasing etc. can be performed. In fact a whole variety of transactions can be provided all under one roof.

f) Others:

E-commerce systems are being established for automating and enhancing many aspects of communications, publishing, marketing, sales and customer service such as:

- ❖ Customer Research;
- ❖ Pre-Sales Enquiries;
- ❖ Information Publishing and Dissemination;
- ❖ Sales;
- ❖ Advertising;
- ❖ Promotions;
- ❖ Public Relations;
- ❖ Purchasing;
- ❖ Transactions;
- ❖ Funds Transfer;
- ❖ Production; ` Delivery;
- ❖ After-Sales Service;
- ❖ Ongoing Relationship Management; and
- ❖ Customer Support.

The benefits of electronic commerce are not just available to large corporations and government departments, and many small to medium businesses are discovering new cost - effective opportunities to use Internet-related technology to help their business operations locally and internationally

16.2.3 TYPES OF ELECTRONIC COMMERCE

Based on the parties involved in electronic transactions, the e-commerce can be classified into the following types.

a) Business –to- Business (B2B)
b) Business –to- Consumer (B2C)
c) Consumer –to- Consumer (C2C)

a) Business –to-Business E-Commerce

This is done between business firms. For example, electronic transactions between a manufacturing firm and its supplier firms are B2B transactions. This segment is the largest and the fastest growing one in electronic, commerce. Here firm use the electronic network for purchasing products, consulting services and paying for them.

b) Business –to- Consumer E-Commerce

Consumers check electronic catalogues to learn about products and compare prices of products sold. They purchase products at the firm's website and may pay electronic cash or other means like credit card.

c) Consumer –to- Consumer E-Commerce

Some sites offer consumers to deal directly with each other. Auction sites are examples. At these auction sites consumers can buy and sell products.

Electronic commerce is useful to both producers and consumers as it helps them overcome the traditional barriers of distance from markets and lack of information about market opportunities. Producers and traders no longer need to maintain physical establishments requiring large capital outlays. Virtual shops and contact points on the Internet may enable storage close to the production site and distribution can be made directly to the consumer. Increased advertising possibilities world wide may help small and medium industries and businesses that traditionally find it difficult to reach the consumer abroad. E- Commerce may also enable such firms to eliminate middlemen while trying to sell their products abroad.

Check Your Progress 3

What are the various types of E-commerce?
Notes: a) Write your answer in the space given below
      b) Check your answer with the one given at the end of this Lesson (pp.119)

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16.2.4 E-COMMERCE ACTIVITIES

Business firms use the internet platform for communication and commerce. The e-commerce activities can be discussed as follows:

a) Direct marketing and selling

Business firms set up websites for direct marketing and selling. Direct selling was one of the earliest forms of e-commerce. For example, Amazon.com, Barnes and noble and Dell computers engaged in direct selling. Gradually firm moved on to one or more complex operations on the web.

b) Value chain integration

E- Commerce does not tolerate any kind of delay. Delay in inventory tracking and management can cripple the business. E- Commerce firm use EDI for exchanging transaction data among them so that transactions are automatically processed. Thus suppliers, customers and service providers will use open EDI for integrating their processing systems leading to mare efficient operations.

c) Corporate purchasing:

Internet provides opportunities for business firms to reduce cost of purchasing. Suppliers keep their electronic catalogs updated. Comparative price information is also available.

Ordering can be electronically done to reduce the laborious paper work in purchasing. Officers can approve purchase orders electronically. The firm can enforce policies; provide greater services to customers and suppliers.

d) Financial and information services

A wide range of financial services are offered on the internet. They include:
- ❖ Online banking
- ❖ Online billing
- ❖ Online securities transactions
- ❖ Secure information distribution

e) Mobile commerce:

Mobile commerce is a part of e-commerce and differs from the latter on the use of mobile telecommunication communication network in place of telecommunication network. M-commerce includes only transactions with a monetary value and it excludes short message services. One condition essential for the success of mobile commerce is large user base of mobile phones. Adequate security for mobile transactions is another condition for its adoption in a big way.

16.3 LET US SUM UP

1. Electronic commerce is the process of searching, choosing, buying and selling of product or service on the electronic network.
2. Electronic commerce uses the computer and communication networks for promoting products, selling, delivery collection and delivery service**.**
3. The e-commerce can be classified into Business –to- Business (B2B),Business –to- Consumer (B2C),Consumer –to- Consumer (C2C).

16.4 LESSON END ACTIVITY

Try to see how goods are purchased and sold through internet.

16.5 POINTS FOR DISCUSSION
1) List out the features of E-Commerce.
2) Explain in detail the Importance of E-Commerce.
3) Write short notes on the types of E-Commerce.
4) What are the E-Commerce activities? Explain.

16.6 CHECK YOUR PROGRESS
1. Types of E-Commerce
   i). Business –to-Business E-Commerce
   ii). Business –to- Consumer E-Commerce
   iii). Consumer –to- Consumer E-Commerce

16.7 REFERENCES
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LESSON - 17

INTERNET

Contents:

17.0 Aims and Objectives

17.1 Introduction

17.2 Internet

17.2.1 Core Features of the Internet

17.2.2 Internet Software

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17.5 Points for Discussion

17.6 Check your Progress

17.7 References

17.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Applications of Internet
2. Internet software
3. Features of the Internet

17.1 INTRODUCTION

Internet is a communication network which bridges all the small computer networks worldwide as a whole. Internet is based upon Internet technology, in particular World Wide Web (WWW), to build Information System within organization or enterprise to accomplish standardization and automation. Fundamentally, it means network computing environments which let the users share the information through the Internet and Web browsers. Ultimately, it allows a certain organization to build a Groupware within Web environment at low cost on top of existing network infrastructure. By doing this, closed organization network would be interconnected with existing worldwide Internet, which results in diverse information that strengthens competitive advantages of the organization. Basically, it runs on top TCP/IP and HTTP and filters out any illegal access through firewall.

Where the Internet connects people and organizations and information sources by using common protocols to link computers on a public and open – to – all basis, an Internet uses the same common protocols for internal company or group purposes. Instead of adopting a common

proprietary standard for its communications, information storage and presentation, etc., the company (or any group of people or companies) decides to use Internet standards and methods.

17.2 INTERNET

An Internet can be defined as a network connecting an affiliated set of clients using standard Internet protocols, esp. TCP / IP and HTTP or as an IP – based network of nodes behind a firewall, or behind several firewalls connected by secure, possibly virtual, networks.

In general, a web is an unstructured client / server network that uses HTTP as its transaction protocol. The World Wide Web comprises all HTTP nodes on the public Internet .An internal web comprises all HTTP nodes on a private network, such as an organization's LAN or WAN. If the organization is a corporation, the internal web is also a corporate web.

If a corporate web connects two or more trading partners, it is often referred to as a business – to – business web, or an extranet.

Note that internal webs – also known as intranets – are only logically "internal " to an organization. Physically they can span the globe, as long as access is limited to a defined community of interest

17.2.1 CORE FEATURES OF THE INTERNET

There are some characteristics of the internet that gave it the potential to deliver a special set of business benefits over and above existing IT technologies.

a) Simplicity of Use

The software that is used access the Internet (the web browser software) is comparatively easy to learn and simple to use. It can operate on wide range of operating system platforms and can access any mainstream application like SAP and oracle. The flexibility of the web combined with the simplicity of the browser software has resulted in reduced staff training costs, lower development costs and an increase in the range of users who can have access to the organization.

b) Breadth of Access

The internet is a global network like the telephone network. Its access is not conditioned by geographic boundaries. Unlike the telephone network the cost involved in global connection is not related to the distance involved. No other communication medium has had access to such a large audience and range of people which increases the ability to leverage the value of information to a scale that has never before been possible.

c) Synergy with other media

Apart from using the existing telecommunication technology, it supports or complements other media. Internet services have demonstrated a high degree of synergy with other media as can be seen from the following

Example:

Book, magazine and newspaper publishers have used the web to supplement and extend their written products.

Publishers of CD-ROMs have used the web to maintain the currency of the information they can deliver. Microsoft's encyclopedias CD-ROM, Encarta, allows seamless interface to information accessed from the company's web site.

Publishers of software and games now deliver their products directly over the internet. Entertainment companies regularly provide extracts of their films and music recordings to promote the real products.

d) Low Relative Cost

The costs involved in conducting a process using internet technology is less than those involving other methods. The internet access requires telephone line for most individual users. The pricing of telephone service is one which is independent of distance. The charge for the usage of telecommunication line is based on local charge rate irrespective of what is sent over the line or how distant the recipient is.

e) Extension of Existing IT Resources

Resource sharing was underlying rationale for the development of the internet. It allows the IT resources to be shared by multiple users in organizations and also with others related to the organization such as trading partners.

f) Flexibility of Communication

The web browsers greatly extend the ways in which individuals can communicate. They support text, voice and multimedia formats and can provide immediate access to shared information. These facilities are available for intra-company communications as those between individuals in separate organizations.

g) Security

Security has been a major issue in internet as any security breach can cause financial loss, leak of sensitive information, etc. standards for secure electronic transactions have been developed and reasonable security is in place now.

h) Speed and Availability

The transmission speed is very low and it takes a bit too long for downloading files. However, compared to other means of communication, it is indeed fast. It also provides a wide range of communication services that are inexpensive and relatively easy to access for millions of users through a standard set of protocols.
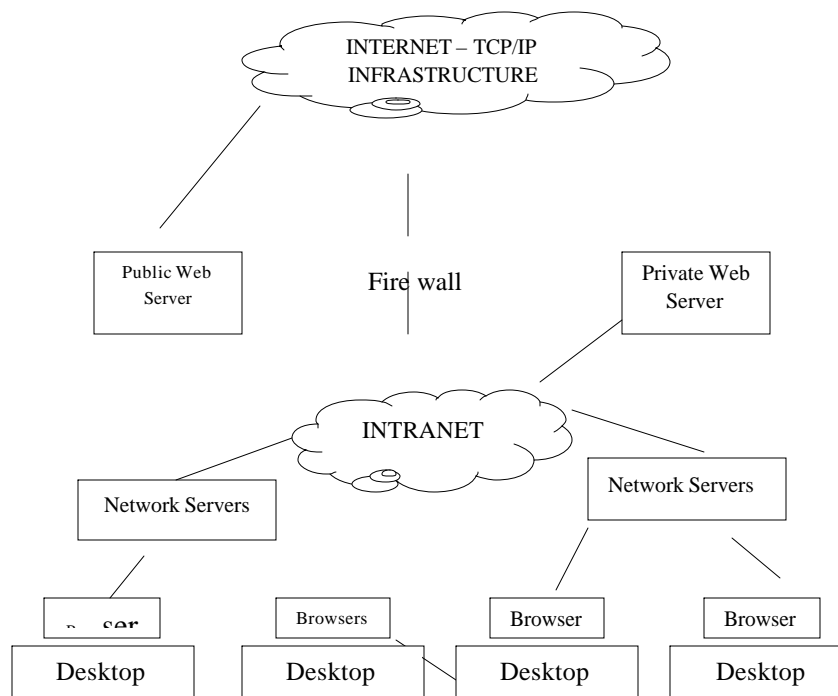
An internet can be as big as a community of interest. Scale is an important factor in web implementation, but it has no bearing on the logical association of clients that make up an intranet. For example, a workgroup with one web server, a company with several hundred web servers, and a professional organization with ten thousand web servers can be considered an intranet.

17.2.2 INTERNET SOFTWARE:
To connect to the Internet, a computer requires mainly three different kinds of software:

1. TCP/IP: TCP/IP, or Transmission Control Protocol / Internet Protocol, is the basic communication protocol of the Internet. It allows programs on user's computer to communicate properly over the internet. Usually, when you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program. Similarly, every other computer that you may send messages to or get information from also has a copy of TCP/IP.

2. Dialer Software: This software is provided by the ISP to instruct the modem to dial the phone number, and identify the user's machine to the access provider's system for access to the network.

3. Browser: To use the Internet, a web browser is essential. This program allows the user to view the information available on the world wide web.

17.3 Internet Applications
The Internet has grown from a small project to today's biggest network of computers. Due to this colossal growth, the Internet has become the biggest domain of information. Nowadays, an Internet user has access to a wide variety of services such as electronic mail, file

transfer, vast information resources, interest group membership, interactive collaboration, multimedia displays, real-time broadcasting, shopping opportunities, and much more. Some of the important services provided by the Internet are briefed in the following few sections.

1. World Wide Web: (WWW)

The World Wide Web (abbreviated as the web or WWW) is one of the most popular services available on Internet. It is a subset of the Internet and it presents text, images, animation, video, sound and other multimedia in a single interface. This greatly enhances the experience of the Internet surfer. Although the World Wide Web is often referred to as the Internet, they are actually two different concepts. The Internet is the decentralized global network of computers that transfer information and the wring that makes all this possible whereas the web is a collection of documents or websites, that users can access using the Internet and a web browser. The web is a part of the Internet and it refers to a system of Internet servers that supports hypertext using a specific Internet protocol called HTTP on a single interface (web browsers). In addition, almost every protocol type available on the Internet is accessible on the web. This includes e-mail, FTP, Telnet, and Usenet News. Since the WWW is a subset of the Internet, it stands to reason that the web could not exist without the Internet. However, the Internet would still be the Internet without the web.

The operation of the web relies primarily on hypertext, as it is a means of information retrieval. Hypertext is a document containing words that connect to other documents. These words are called links, which the user can select. A single hypertext document can contain links to documents and resources throughout the Internet. With the ability of the web to work with multimedia and advanced programming languages, the World Wide Web is the fastest growing and the most interesting part of the Internet. With video conferencing and wireless applications, the Internet is ready to take us to the new realm of communication and information exchange.

2. Electronic Mail (e-mail)

Electronic mail, or e-mail, is a fast, easy, and inexpensive way to communicate with other Internet users around the world. It is one of the basic and earliest services of the Internet and the most used application on the Internet too. E-mail overcomes most of the problems and delays of getting a physical document from one person to another. Rather, it has the dual advantage of not only being faster but cheaper to sue as well.

3. File Transfer Protocol (FTP)

FTP or File transfer Protocol is a system of rules and a software program that enables a user to long on to another computer and transfer information between it and his/ her computer. It was the first service developed for the Internet so that government and educational institutions could easily exchange files. FTP allows the user to get access to the files stored in the directory of a remote computer that is connected to the Internet. Using FTP, one can upload and download files from the remote computer (known as FTP servers), if he/she has access permission on the remote machine.

4. Telnet

The word "telnet" is derived from **tel**ecommunications and **net**work and is a protocol that allows a user to log on to a remote computer. Telnet is also known as remote login, which means connecting one machine to another in such a way that a person may interact with another machine as if it is being used locally.

5. Internet Relay Chat (IRC)

IRC or Internet Relay Chat is a service on the Internet that allows people to communicate in real time and carry on conversations via the computer with one or more people. It provides the user with the facility to engage in simultaneous (synchronous) online "conversation" with other user form anywhere in the world.

6. Chatting and Instant Messaging

Chart programs allow users on the Internet to communicate with each other by typing in real time. They are sometimes included as a feature of a website, where users can log into chat rooms to exchange comments and information about the topics addressed on the site.

7. Internet Telephony

Internet telephone is the use of the Internet rather than the traditional telephone company infrastructure, to exchange spoken or other telephonic information. It consists of hardware and software that enable people to use the Internet as a transmission medium for telephone calls. There are many Internet telephony applications available. Some, such as Cool Talk and NetMeeting, come bundled with popular web browsers.

8. Video Conferencing

Video conferencing uses the same technology as IRC, but also provides sound and video pictures. It enables direct face-to-face communication across networks. A video conferencing system has to or more parties in different locations, which have the ability to communicate using a combination of video, audio, and data. A video conference can be person to person (referred to as "point-to-point") or can involve more than two people (referred to as "multipoint") and the video conferencing terminals are often referred to as "endpoints".

The following five elements are common to all video conferencing endpoints:
- ❖ **Camera:** The camera captures live images to send across the network.
- ❖ **Visual Display:** It displays the images of the people taking part in the videoconference.
- ❖ **Audio System:** It includes both microphones to capture audio from the endpoint and loudspeakers to play back the audio received from other endpoints across the network connection.
- ❖ **Compression:** Videos are very bandwidth-intensive and they take a long time to load. Therefore, video systems include technologies, often referred to as codes, to compress and decompress video and audio data, allowing transmission across a network connection in near-real time.
- ❖ **User Interface and Control System:** The user interface allows the users to control interactions for example, placing calls, storing and locating numbers, and adjust environment settings such as volume. The control system handles the underlying communication that takes place between endpoints.

9. Newsgroups (Usenet)

Newsgroups are international discussion groups that focus on a particular topic and helps in gathering information about that topic. The topics discussed here cover all the fields such as politics, computers, technology, and many more. The information or articles that make up the "news" are written by people interested in a specific topic. These articles are posted to the newsgroup so that others can read, reply, and comment on them.

10. Mailing Lists (List server)

The Internet is home to a large community of individuals who carry out active discussions, organized around topic-oriented forums that are distributed via e-mail. This method of Internet communications is known as mailing list and it enables people with similar interests from all over the world to communicate and share information with each other.

Check Your Progress 4

Define Internet.

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.126)

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17.3 LET US SUM UP

1. Internet is a communication network which bridges all the small computer networks worldwide as a whole.
2. Characteristics of the internet gave it the potential to deliver a special set of business benefits over and above existing IT technologies.
3. To connect to the Internet, a computer requires mainly three different kinds of software namely TCP/IP, Dialer Software, Browser.
4. An Internet user has access to a wide variety of services such as electronic mail, file transfer, vast information resources, interest group membership, interactive collaboration, multimedia displays, real-time broadcasting, shopping opportunities, and much more.

17.4 LESSON END ACTIVITY

1. What is Internet?
2. Discuss in detail about TCP/IP.

17.5 POINTS FOR DISCUSSION

1) What do you mean by Internet? Explain its features.
2) Write short notes on Internet Softwares.
3) Explain in detail the various services provided by Internet.

17.7 CHECK YOUR PROGRESS

1. An Internet can be defined as a network connecting an affiliated set of clients using standard Internet protocols, esp. TCP / IP and HTTP or as an IP – based network of nodes behind a firewall, or behind several firewalls connected by secure, possibly virtual, networks.

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1. Perry, P.J., Worldwide Web secrets, Comdex Publishing, New Delhi.
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LESSON – 18

EXTRANET AND E-MAIL

Contents:

18.0 Aims and Objectives

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       18.3.5 Usage of Mails

18.4 Let Us Sum Up

18.5 Lesson End Activity

18.6 Points for Discussion

18.7 Check your Progress

18.8 References

18.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Characteristics and uses of Extranet
2. Relationship between intranets, Extranets and e–commerce
3. Infrastructure Requirement for E-Mail
4. Advantages and disadvantages of E-mail
5. Usage of Mails

18.1 INTRODUCTION

An Extranet is a private network that uses the internet protocol and the public telecommunication system to securely share part of business information or operations with - suppliers, vendors, partners, customers, or other businesses.

Through e-mail, documents are prepared and sent electronically. The recipients need not be present at the other end to send the message. The message gets stored in the electronic mailbox of the addressee. The recipient can open the mailbox whenever he is free and can read or print the message.

18.2 EXTRANET

An Extranet can be viewed a-part of a company's intranet that is extended to users outside the company. It has also been described as a "state of mind" in which the internet is perceived as a way to do business with other companies as well as to sell products to customers. Extranet extends the intranet from one location to another across the internet by securing data flow, to another intranet to a business partner. In these way intranets of business partners, suppliers, creditors, distributors, customers, and the like are connected to extranets by agreements.

An Extranet requires security and privacy. These require firewall server management, e-issuance and use of digital certificate or similar means of user authentication, encryption of messages, and the use of virtual private networks that tunnel through the public network.

Check Your Progress 5
What is an Extranet?

 Notes: a) Write your answer in the space given below
 b) Check your answer with the one given at the end of this Lesson (pp.133)

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18.2.1 Characteristics of Extranet
The following are the important characteristics of the Extranet.
a) It is an extended internet-private business networks located outside of the corporate firewall.
b) It can be referred to an intranet that is partially accessible to authorized outsiders.
c) It is a network that uses the internet to link businesses with others that share the common goals.

18.2.2 Uses of Extranet
 Companies can use an Extranet to:
a. Exchange large volumes of data using Electronic Data Interchange.
b. Share product catalogs exclusively with wholesalers or those in the Trade.
c. Collaborate with other companies on joint development efforts.
d. Jointly develop and use training programs with other companies.
e. Provide or access services provided by one company to a group of other companies, such as an online banking application managed by one company on behalf or affiliated banks.
f. Share news of common interest exclusively with partner companies.

g. The manufacturing companies can coordinate the design manufacturing, scheduling and delivery across supply chain.
h. With extranet the technology firms can support for their customers and partners and makes it possible for remote access for employees.
i. The financial services firms by using extranet can reduce costs of proprietary networks.
j. With extranet the publishing companies can increase the speed of design and production cycles.
k. Other benefits:
    ❖ Quicker turnaround time
    ❖ Improved communication
    ❖ Decreased paper flow
    ❖ Traceable correspondence
    ❖ Better service
    ❖ Lower overhead and expenses
    ❖ Improved employee morale
    ❖ Increased Margins.   ,
    ❖ Flexibility and scalability.
    ❖ Reduced transitional barriers.
    ❖ Versatility.
      A brief list of examples of extranet could include:

    ❖ Allowing suppliers access to relevant inventory levels
    ❖ Allowing clients to review their account records
    ❖ Allowing students to update address information in real time.
      As with intranet, access is granted only where you establish that it is required. User access is controlled by the latest in security technologies, protecting sensitive material from intrusion.

What is the relationship between intranets, **Extranets and e–commerce?**
The answer has three parts. First, intranets, extranets and e-commerce have in common the use of Internet (predominantly web) protocols to connect business users. Second, intranets are more localized and can therefore move data faster than more distributed extranets. (Bandwidth limitations also apply to e-commerce.) Third, the amount of control that network managers can exert over users is different for the three technologies.

On an Internet, administrators can narrowly prescribe access and policy for a fixed group of users. For example, a company could specify Red Hat Linux as its standard desktop operating system, and Netscape Communicator 5 as its standard browser and mail client. The company could then write intranet workflow applications that leverage the uniform computing environment, over which it exercises strong control.

On a business-to business Extranet, system architects at each of the participating companies must collaborate to ensure a common interface and consistent semantics (data meanings). Since one company cannot reasonably enforce standards on its trading partners, extranet application developers must taken into account a wider range of technologies than is the case for intranets. For example, one company participating in an extranet might be using Microsoft Internet Explorer, another Netscape Navigator 4.5 and another Navigator Gold 3.x In

order to collaborate via extranet, the applications have to perform adequately on all represented platforms.

The same is true, even more, for e-commerce, in which the trading partners may be completely unknown to one another. This is the case when you walk into a supermarket: the common interest in communication is based on the need to transact business, and not necessarily on a long-term trust relationship. Thus, e-commerce applications often support a level of security and transactional integrity (for instance, non-repudiation of orders) not present in intranet or extranet applications.

18.3 E-MAIL

E-mail is an electronic message sent form one computer to another. We can send or receive personal and business-related messages with attachments, such as pictures or formatted documents. We can even send songs and computer programs.

The e-mail communication is incredibly simple. A person with a PC and a modem to connect to the network can communicate with the other(s) so connected to the network. The message can be prepared and sent instantly. The other person finds the e-mail when he checks his mailbox and may replay to the message in the same way. The message sent is private and no other person can read it.

Each user of e-mail service has a user ID or password serving as e-mail address. First thing to do is to get online using modem and communication software. The system requires user-id and password. Now the user can prepare his message in the form of a document using a word processor. The e-mail address of the recipient has to be typed in before the message is sent,

With e-mail each person connected to the system is allotted a mailbox and the software required for sending and receiving e-mail. The mailbox is simply a file into which the e-mail system stores electronic documents. The user can check his mailbox for messages over the network. The sender specifies his identify and that of the recipient. The sender then prepares the document or retrieves the stored document and sends it.

E-mail is a document communication facility. To ensure that the recipient also understands the emotions as well, a set of special symbols is used to convey some non-verbal signals. A few of such symbols are given below.

| Symbol	Emotion
:-	Humor
:)	Smile
:(	Frown
:/)	Not funny
p-	Private
: *	Kiss
(: - (	Very sad

E-mail is the transmission of information electronically from terminal to terminal. The document is prepared in a word processor and is mailed electronically. The basic facilities in e-

mail include message creation, message transfer and post delivery service. The e-mail service may be traditional mainframe based or minicomputer based or LAN based system with PCS to access from.

18.3.1 How E-Mail Works?

The first thing to be done is to type the message and the e-mail address of the recipient. Once the 'send' button is clicked, this e-mail is sent through the telephone line after it's conversion into analog signal by the modem. The e-mail message arrives at our service provider's server. If the server recognizes the e-mail address as valid, the mail will be sent either through the network of the service provider or through internet gateway to the service provider of the recipient.

To send e-mail, we need a connection to the internet and access to a mail server that forwards the mail. The standard protocol used for sending internet e-mail is called SMTP, short for Simple Mail Transfer Protocol. It works in conjunction with POP servers. POP stands for Post Office Protocol.
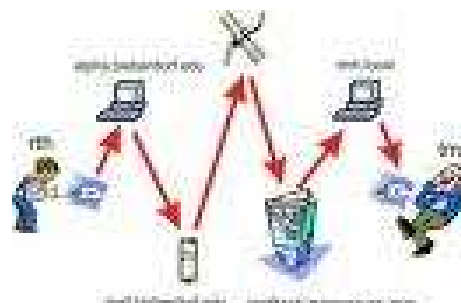
When we send an e-mail message, our computer routes it to an SMTP server. The server looks at the e-mail address (similar to the address on an envelope), then forwards it to the recipient's mail server. Once the message arrives at the destination mail server, It's stored until the addressee retrieves it. We can send e-mail anywhere in the world to anyone who has an e-mail address.

E-mail route

With the advent of MIME, which stands for multipurpose Internet Mail Extension, and other types of encoding schemes, we can not only send messages electronically, but we can also send formatted documents, photos, sound files, and video files.

18.3.2 Infrastructure Requirement for E-Mail
- ❖ Personal Computer
- ❖ Telephone Connection
- ❖ Modem
- ❖ Mailing software viz., Outlook Express or Netscape communicator or Internet Explorer etc.

Check Your Progress 6

What are the infrastructure requirements for E-Mail?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.133)

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➢ Advantages of E-mail
- ❖ Messages can be prepared and sent any time convenient for the sender.
- ❖ Message can be received at the convenience of the recipient.
- ❖ The transmission takes place instantly and the message gets stored in the mailbox of the recipient.
- ❖ The system can confirm delivery of message.
- ❖ Copies of message can be sent to multiple recipients.
- ❖ It reduces paper work.

➢ Disadvantages
- ❖ Recipients must be having e-mail connectivity. They must have computer terminals, modem and telephone.
- ❖ They must be subscribing to the same e-mail service provider.
- ❖ Poor telecommunication affects the quality of message transmitted.
- ❖ Despite all the disadvantages e-mail is a cheap form of information transmission. INDONET, NICNET, DARTMAIL and ICNET provide this service in India. A user can be a subscriber to such e-mail service providing agencies and use their facility.

18.3.3 E-Mail Addressing Pattern

Internet e-mail addresses typically have two main parts:

ibcocppd@satyammail.com

First there is the user name (ibcocppd) which refers to the recipients mailbox. Then there's an axon sign (@). Next comes the host name (satyammail), also called the domain name. This refers to the mail server, the computer where the recipient ha an electronic mailbox. It's usually the name of a company or organization.

The end of the domain name consists of a dot (".") followed by two or three letters (such as .com and .gov) that indicate the top-level domain. This part of the domain name indicates the type of organization or the country where the host server is located.

18.3.4 E-Mail Messages

E-mail messages are similar to letters, with two main parts.

The header contains the name and address of the recipient, the name and address of anyone who is being copied, and the subject of the message. Some e-mail programs also display your name and address and the date of the message.

The body contains the message itself. Just like when sending letters, we need the correct address. If we use the wrong address or mistype it, our messages will bounce back with messages like – Return to Sender, Address Unknown routine.

When we receive an e-mail, the header tells us where it came from, how it was sent, and when. It's like an electronic postmark.

Unlike a letter, which is sealed in an envelope, e-mail is not as private. It's more like a post card. Messages can be intercepted and read by people who really shouldn't be looking at it. We should therefore avoid including any confidential information unless we have a way to encrypt it.

18.3.5 Usage of Mails
- ❖ Incoming mails can be checked on a daily basis at least 3 times a day.
- ❖ We can use the e-mail facility judiciously and extensively for communicating with Circle Office / Head Office/ Service Branch / Customers.
- ❖ Communicate e-mail id to all domestic and overseas customers and use the facility for passing on information regarding new schemes launched by Bank and other important information to them.
- ❖ Encourage customers to contact branch through e-mail for information regarding their urgent banking requirements.
- ❖ Use the facility as a marketing tool to attract new customers, exchange greetings with existing customers and also inform them about recent happenings in the locality.

18.4 LET US SUM UP
1. An Extranet is a private network that uses the internet protocol and the public telecommunication system to securely share part of business information or operations with - suppliers, vendors, partners, customers, or other businesses.
2. E-mail allows users to send and receive messages anytime and anywhere in the world.
3. E-mail is popular as it is fast, flexible, and reliable

18.5 LESSON END ACTIVITY
Create an E-Mail ID, Try to receive and send messages to your friends.

18.6 POINTS FOR DISCUSSION
1) Write short notes on Extranet.
2) State the characteristics of Extranet.
3) What are the different uses of Extranet?
4) What is E-mail? Explain how it works.
5) List out the advantageous and dis-advantages of E-mail.

18.7 CHECK YOUR PROGRESS

1. An Extranet is a private network that uses the internet protocol and the public telecommunication system to securely share part of business information or operations wit- suppliers, vendors, partners, customers, or other businesses.

2.
i. Personal Computer
ii. Telephone Connection
iii. Modem
iv. Mailing software

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LESSON - 19

MOBILE COMPUTING

Contents:

19.0 Aims and Objectives

19.1 Introduction

19.2 Types of Mobile Computers

19.3 Let Us Sum Up

19.4 Lesson End Activity

19.5 Points for Discussion

19.6 Check your Progress

19.7 References

19.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. What is mobile computing
2. Types of mobiles computers

19.1 INTRODUCTION

Mobile Computing is a generic term describing your ability to use technology 'un tethered'(wireless), that is not physically connected, or in remote or mobile (non static) environments. The term is evolved in modern usage such that it requires that the mobile computing activity be connected wirelessly to and through the internet or to and through a private network. This connection ties the mobile device to centrally located information and/or application software through the use of battery powered, portable, and wireless computing and communication devices. This includes devices like laptops with wireless LAN or wireless WAN technology, smart mobile phones, wearable computers and Personal Digital Assistants (PDAs) with Bluetooth or IRDA interfaces.

19.2 TYPES OF MOBILE COMPUTERS

Many types of **mobile computers** have been introduced since the 1990s, including the:
a. Laptop computer
b. Sub notebook
c. Personal digital assistant (PDA)
d. Portable data terminal (PDT)
e. Mobile data terminal(MDT)
f. Tablet personal computer

g. Smart phone
h. UMPC

a. Laptop computer:

A laptop computer, simply laptop (notebook computer or notebook), is a small mobile computer, which usually weighs 2-18 pounds (1-6 kilograms), depending on size, materials, and other factors. Laptops usually run on a single main battery or from an external AC/DC adapter which can charge the battery while also supplying power to the computer itself. Many computers also have a 3 volt cell to run the clock and other processes in the event of a power failure.

As personal computers, laptops are capable of the same tasks as a desktop computer, although they are typically less powerful for the same price. They contain components that are similar to their desktop counterparts and perform the same functions, but are miniaturized and optimized for mobile use and efficient power consumption. Laptops usually have liquid crystal displays and most of them use different memory modules for their random access memory (RAM), for instance, SO-DIMM in lieu of the larger DIMMs. In addition to a built-in keyboard, they may utilize a touchpad (also known as a trackpad) or a pointing stick for input, though an external keyboard or mouse can usually be attached.

b. Sub notebook

A sub notebook is a small and lightweight portable computer, with most of the features of a standard notebook computer but smaller. The term is often applied to systems that run full versions of desktop operating systems such as Windows or Linux. Sub notebooks are smaller than notebook computers but larger than handheld computers and ultra portables. They often have screens that are 10.4" (diagonal) or less, and weigh less than 1 kg; as opposed to full-size laptops with 12" or 15" screens and weighing 2 kg or more. The savings in size and weight are usually achieved partly by omitting ports or having removable media/optical drives; sub notebooks are often paired with docking stations to compensate. Sub notebooks are a niche IT product and rarely sell in large numbers.

c. Personal digital assistants (PDAs)

Personal digital assistants (PDAs) are handheld computers, but have become much more versatile over the years. PDAs are also known as pocket computers or palmtop computers. PDAs have many uses: calculation, use as a clock and calendar, accessing the Internet, sending and receiving E-mails, video recording, typewriting and word processing, use as an address book, making and writing on spreadsheets, scanning bar codes, use as a radio or stereo, playing computer games, recording survey responses, and Global Positioning System (GPS). Newer PDAs also have both color screens and audio capabilities, enabling them to be used as mobile phones (smart phones), web browsers, or portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs). Many PDA's employ touch screen technology.

d. Mobile data terminal (MDT)

A mobile data terminal (MDT) is a computerized device used in police cars, taxicabs, courier vehicles, service trucks, commercial trucking fleets, military logistics, fishing fleets,

warehouse inventory control, and emergency vehicles to communicate with a central dispatch office.

Mobile data terminals feature a screen on which to view information and a keyboard or keypad for entering information, and may be connected to various peripheral devices. Standard peripherals include two-way radios and taximeters, both of which predate computer assisted dispatching. MDTs may be simple display and keypad units, intended to be connected to a separate black-box or AVL (see below) computer. On the other end of the spectrum, MDTs may contain full, PC-equivalent hardware. The function and programmability of the devices is similarly broad.

e. Tablet PC

A Tablet PC is a notebook- or slate-shaped mobile computer. Its touch screen or digitizing tablet technology allows the user to operate the computer with a stylus or digital pen, or a fingertip, instead of a keyboard or mouse.

The form factor offers a more mobile way to interact with a computer. Tablet PCs are often used where normal notebooks are impractical or unwieldy, or do not provide the needed functionality.

f. Smart phone

A smart phone is a full-featured mobile phone with personal computer like functionality. Most smart phones are cell phones that support full featured email capabilities with the functionality of a complete personal organizer. An important feature of most smart phones is that applications for enhanced data processing and connectivity can be installed on the device, in contrast to regular phones which support sandboxed applications. These applications may be developed by the manufacturer of the device, by the operator or by any other third-party software developer. "Smart" functionality includes any additional interface including a miniature QWERTY keyboard, a touch screen, or even just secure access to company mail, such as is provided by a BlackBerry.

g. Ultra Mobile PC

The Ultra-Mobile PC (abbreviated UMPC), previously known by its codename Project Origami, is a specification for a small form factor tablet PC. It was developed as a joint development exercise by Microsoft, Intel, and Samsung, among others. Current UMPCs feature the Windows XP Tablet PC Edition 2005, Windows Vista Home Premium Edition, or Linux operating system and low-voltage Intel Pentium or VIA C7-Mprocessors in the 1 GHz range.

Check Your Progress 7

What are the various mobile computers available?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this unit (pp.136-137)

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19.3 LET US SUM UP

1. Mobile computing is a form of wireless networking that uses common frequencies to permit networked devices move freely within the broadcast coverage area.
2. Many types of mobile computers are available. They are Laptop computer, Sub notebook, Personal digital assistant (PDA), Portable data terminal (PDT), Mobile data terminal (MDT), Tablet personal computer, Smart phone, UMPC.

19.4 LESSON END ACTIVITY

1. Discuss in detail about the various types of Mobile Computers.

19.5 POINTS FOR DISCUSSION

1. Write short notes on mobile computing.
2. Explain the different types of mobile computers.

19.6 CHECK YOUR PROGRESS

- i).   Laptop computer
- ii).   Sub notebook
- iii).   Personal digital assistant (PDA)
- iv).   Portable data terminal (PDT)
- v).   Mobile data terminal(MDT)
- vi).   Tablet personal computer
- vii).   Smart phone
- viii).   UMPC

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UNIT V

LESSON – 20

SYSTEM ANALYSIS AND DESIGN

Contents:

20.0 Aims and Objectives

20.1 Introduction

20.2 System Analysis and Design

    20.2.1 System Development Life Cycle

20.3 Let Us Sum Up

20.4 Lesson End Activity

20.5 Points for Discussion

20.6 Check your Progress

20.5 References

20.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Meaning of a system
2. System development life cycle

20.1 INTRODUCTION

    System development involves conceiving an information system project, implementing it and maintaining to the user's satisfaction. These information systems are developed to solve a problem, to make use of an opportunity, to comply with a requirement and to effect broad improvement in business process.

20.2 SYSTEM ANALYSIS AND DESIGN

➢ **Meaning of a system:**
    A system is a group of inter-related parts or components working together towards a common goal by accepting inputs and producing outputs in organize transformation process**.**

    ❖ The parts perform some function: there must be input and output flows to and from the system.
    ❖ The performance of this function must be measurable, which implies monitoring.
    ❖ The parts are organized, which implies control of actions and a decision – taking process.

❖ The organized of parts also means that if a part has no interaction or connection with other parts, has no interaction or connection with other parts, it is not in the system. The system must therefore have obituaries.

❖ The environment beyond the boundaries can affect and be affected by the system.

➢ **Different resources are available for the system.**

❖ A number or sub – systems exist which interact with each other. There are four categories in particular.

❖ The information sub – system deals with the flow of information between parts of the system, and between the system and its environment.

❖ The control sub – system experts control on the system.

❖ The logistic sub – system collects resources , and feeds the system with resources.

❖ The process sub – system provides the functional output from the system. Thus, s system essentially a group interdependent components together to achieve a specific and common objective. A collection of components that work together to realize a specific and common object forms a system. Basically there **are three major components in every system, namely input, processing and output.**

Input ———————| Processing |——————— Output

In a system the different components are connected with each other and they are interdependent, For example, a human body represents a complete natural system. We are also bound by much national system such as political system, economic system, and so forth. The objective of the system demands that some output is produced as a result of processing the suitable inputs.

20.2.1 System Development Life Cycle (SDLC)

The systems development life cycle model has a well-defined iterative process. It involves a few phases. The development follows the phases fairly exactly. The process theoretically never ends as the cycle gets repeated, that is, on completion of one cycle the next cycle starts with preliminary investigation.

In this approach the systems design activities such as preliminary investigation, requirement analysis, systems design, systems acquisition and systems implementation are carried out in strict sequence.

The traditional system development life cycle stages are to be gone through serially and in strict sequence. Systems development life cycle is made up of the following stages:

a. Preliminary Investigation

It is an investigation into the problem and comes up with options for the management to consider for the proposed system change. The preliminary investigation examines the request for system change in detail to know precisely the requirements. A set of feasibility studies is used to ascertain the viability of the project. This includes technical feasibility, economic feasibility, and operational feasibility and schedule feasibility. The report is submitted to the management for consideration and action.

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│        ┌──────────────────────────┐      │
│        │  Preliminary investigation│      │
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│        ┌──────────────────────────┐      │
│        │   Requirement analysis    │──────│
│        └──────────────────────────┘      │
│                    │                     │
│        ┌──────────────────────────┐      │
│        │      System design        │──────│
│        └──────────────────────────┘      │
│                    │                     │
│        ┌──────────────────────────┐      │
│        │    System acquisition     │──────│
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│        ┌──────────────────────────┐      │
│        │   System implementation   │──────│
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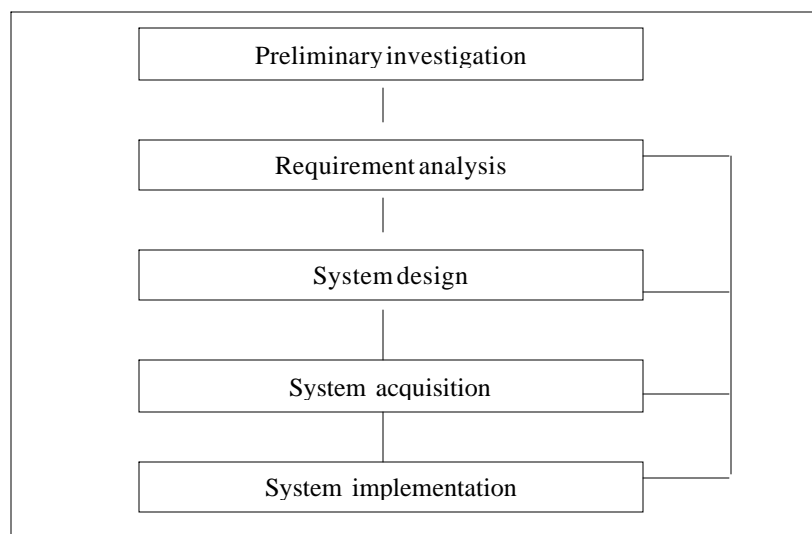
Traditional Systems Development Life Cycle

The steps include:

❖ Conducting preliminary analysis
❖ Determination of objectives, scope and constraints of the proposed system.
❖ Developing alternative solutions
❖ Estimate cost and benefits of each such alternative
❖ Submit a preliminary report with recommendations.

b. Requirement Analysis

If the management permits the system development to continue after studying the preliminary investigation report, new system requirements are analyzed in detail. After the analysis, the results are presented in requirement report to the management. Requirement is any feature that is to be included in the new system.

This process starts with the defining scope of system analysis and identifying users of the current system. Analysts carry out a study of current user requirements and deficiencies of the current system in meeting them. It describes the new system and the benefits it provides to the users. It also produces a requirement definition document.

Steps include;

❖ Gather data employing tools like document walk through, interviews, questionnaires, observation etc.
❖ Analyze the data using CASE tools, data flow diagrams, system flowcharts, decision tables etc.,
❖ Prepare a system study completion report.

c. Systems Design

The requirement analysis provides the input for designing a new system to meet the user requirements. The new system is planned in detail at this stage. Design translates the

requirements into ways of meeting them. It produces specifications of a physical system that is expected to meet the requirements. Specifically this includes output design, input design, procedure design, database design and control design.

This includes:
- ❖ Output design
- ❖ Input design
- ❖ Database design
- ❖ Procedure design
- ❖ Control design
- ❖ Documentation of design.

d. Systems Acquisition

Hardware, software and service needs of the new system are ascertained and vendors chosen for the acquisition.

This includes:
- ➢ Develop or acquire software
- ➢ Acquire hardware
- ➢ Test the system

e. Systems Implementation

The system is finally tested and put into operation. Implementation comprises all the activities involved in putting the system together physically and getting the people adopt the new system. This requires training for people and conversion of data and procedures to be in agreement with the new system.

Steps include:
- ➢ Train the operators and users.
- ➢ Convert to the new system
- ➢ Develop final documentation

f. Systems Maintenance

The system may need modifications or updating due to changes in requirements. If the changes are minor, They are incorporated into the system. If the changes are major, they start another cycle of system development.

Steps include:
- ➢ Perform system audit to see whether the new system implemented is as it should be
- ➢ Perform evaluation of system performance against a set of criteria.

Check Your Progress 1
A What are all the steps involved in system development life cycle?
B. What is meant by system in system Analysis?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this Lesson (pp.142)

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20.3 LET US SUM UP

1. System development involves conceiving an information system project, implementing it and maintaining to the user's satisfaction.
2. A system is a group of inter-related parts or components working together towards a common goal by accepting inputs and producing outputs in organize transformation process**.**
3. There are three major components in every system, namely input, processing and output.
4. Systems development life cycle is made up of the following stages: Preliminary investigation, Requirement Analysis, Systems Acquisition, Systems Implementation, systems maintenance.

20.4 LESSON END ACTIVITY

Analyse the feasibility of LIC setting up a nation wide network to do insurance business and offer customer service.

20.5 POINTS FOR DISCUSSION

1) What do you mean by a system?
2) What are the different resources available for the system.
3) Explain in detail about system development life cycle.

20.6 CHECK YOUR PROGRESS

1. A

   i).   Preliminary Investigation
  ii).   Requirement Analysis
 iii).   Systems Design
  iv).   Systems Acquisition
   v).   Systems Implementation
  vi).   Systems Maintenance

   B.

A system is a group of inter-related parts or components working together towards a common goal by accepting inputs and producing outputs in organize transformation process**.**

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LESSON – 21

INTRODUCTION TO INFORMATION SYSTEMS

Contents

21.0 Aims and Objectives

21.1 Introduction

21.2 Management Information System

       21.2.1 Characteristics of MIS

       21.2.3 Designing of MIS

       21.2.4 Benefits Of MIS

21.3 Let Us Sum Up

21.4 Lesson End Activity

21.5 Points for Discussion

21.6 Check your Progress

21.5 References

21.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Computer based information system and the need for computer based information system.
2. Management Information System and the characteristics of MIS.
3. Designing of MIS

21.1 INTRODUCTION

      Information is data that has been processed and is meaningful to the user. It is a resource, produced by information systems and is important to the operation and management of organizations. It should be noted that information is neither a natural -resource, such as oil and coal nor a resource that is acquired from the external environment or the organization such as raw material or personnel. If it is designed suitably and properly managed, it can be the most effective resource of the organization.

Factors influencing the value of information in organizations:
The following factors are to be considered while processing the information.
     a. Completeness.
     b. Accuracy.
     c. Timeliness - up to date.
     d. Consistency.
     e. Validity - unbiased, representative, verifiable.
     f. Suitability - meaningful and relevant, formatted to suit the user's needs.

g. Distinctiveness.
h. Relevance.
i. Usability.
j. Accessibility.

The Information Processing Cycle
The information processing cycle includes the following steps:
a. Acquisition
b. Input
c. Validation
d. Processing (manipulation)
e. Storage
f. Retrieval
g. Output
h. Communication
i. Disposal/Archiving.

Let us see these steps one by one here under.

a. Acquisition: It is the collection of raw data from the outside world so it can be put into an information system.

b. Input: It is putting the acquired data into the information system.

c. Validation: It is checking the quality of the data before it is processed. Processing invalid data gives waste information.

d. Processing (manipulation): This is a key point. At this stage data is converted into information.

e. Storage: Unless we want to input the data every time we process it, it is useful to store the data. We also may want to store information that we have produced so we need not have to keep repeating work.

f. Retrieval: This involves the reverse process of storage. The stored data or processed information is taken back for further use. It is called as retrieval.

g. Output: All the previous steps are used to produce the results. The important output devices include the following:
  ➢ CRT (cathode ray tube) monitors and LCD displays
  ➢ Printers
  ➢ Sound cards/speakers

h. Communication: This is nothing but sending data or information to another place. This usually involves LANs (local area networks), WANS (wide area networks - LANs joined together), and the internet.

i. Disposal: This involves deleting data or archiving data. Issues involve the security), of so-called "deleted" data. When data is no longer needed it can be deleted. Very sensitive

data-may needs more: when PCs delete data, they do not actually remove it from the disk. They just mark that part of the disk as "available for saving on". Thus data can stay on the disk and be easily restored by snoops. To really delete sensitive data it should be wiped out. That is overwritten with trash until it is no longer readable.

Archiving means taking the data off the main storage and storing it offline usually on floppy or CDs. If in the future the data we needed again, it is still available and it is not taking up important hard disk space. Businesses tend to archive rather than delete data - just in case.

Check Your Progress 2

A. Define MIS.

B. Explain any four factors that influence the value of information in an organization.

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this unit (pp.153)

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Need For Computer Based Information System

The computer based information system is required because of the following reasons: Information is a valuable source to gain competitive advantage.

a) Information helps line managers in taking effective control of operations.
b) Information makes the planning more realistic.
c) Information enhances customer relationship, maintenance of equipment, etc.
d) Information helps in decision making process.
e) Information helps in implementing business re-engineering.
f) Improve the efficiency.
g) Computer operations need information to process the data correctly and produce the desirable output.
h) Individuals need information for managing and operating the organization.
i) Organization needs information to improve the performance and growth.
j) Banker needs information to provide loans or granting credit.
k) Investors need information to know the financial status and the future prospects of the business units.
l) Government agencies need information systems for calculating taxation and taking regulatory measures.

In this context we shall discuss about the following information systems:

1. Management Information System
2. Office Automation Systems
3. Transaction Processing Systems
4. Decision Support Systems
5. Expert Systems

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21.2 MANAGEMENT INFORMATION SYSTEM

Management information system is a general term for the computer systems in an enterprise that provide information about its business operations. It's also used to refer to the people who manage these systems. Typically, in a large organization MIS refers to a entirely coordinated system of computer expertise and management, including mainframe system and the entire network of computer resources.

In the beginning, business computers were used for the practical business of computing the payroll and keeping track of accounts payable and receivable. As application were developed that provided managers' with information about sales, inventories, and other data that would help in managing the enterprise, the term "MIS" arose to described these kinds of applications. Today, the term is used broadly in a number of contexts and includes; decision support system, resource and people management applications, project management, and database retrieval applications.

Thus, MIS can be defined as "MIS is a set of inter related elements which work together to render classified and interpreted data that are usable and used by managers in the process of planning, organizing staffing, directing and controlling the major activities of business".

21.2.1 Characteristics of MIS
MIS generally has the following characteristics.
a. Management oriented:
Beyond any doubt is the fact that MIS is a management oriented system. This could be understood from the terminology itself. The information processing carried out by MIS if always attempting at helping the management.

b. Management directed:
Similarly, all the activities of MIS are initiated by the management. It is the management's need that the MIS strives to satisfy. Hence, MIS is management directed.

c. User-machine system:
The concept of user-machine system implies that some tasks of MIS are done by the users while others are best done by machines. There is co-existence of both men and machines in MIS.

d. Integrated system:
MIS hopes to provide the basis of integration of information processing. This leads to common data flows. Even tough applications in a system are implemented one at a time, their design is guided by an overall plan. In essence information system is designed as a federation of small systems.

e. Involves large planning:
The concept of MIS goes only with planning. There is a huge amount planning coupled with the installation and maintenance of MIS

f. Sub systems:

Naturally, a vast system like the MIS will be having plenty of sub systems which are mutually related with defined with definite relationships and properly ordered. It is based on subsystem concept.

g. Use of models:
MIS uses scientific and mathematical models for planning, organizing, directing and controlling for its analysis.

h. Data base:
One of the pre-requisites for installing, implementing and successful operating of MIS is data. Hence, there has to be a way to maintain data in data in data bases and there has to be a central database.

i. Information as a resource:
MIS transforms data into information and the management is behind MIS. MIS provides procedure for measuring and matching cost of obtaining and using information.

j. Flexibility in use:
MIS is so designed that it is flexible and adaptable to user requirements.

k. Others:
MIS is predictive and related to organizational levels.

21.2.3 DESIGNING OF MIS:
The basic decision has to take into account a general approach, so that suitable systems can be developed for different organizations depending upon their role, functions and decision making requirement. In each organization, data gets generated at different levels. This data when processed and analyzed becomes information which, when properly communicated in time for the decision making can result in decision actions.

Designing of MIS involves the following steps:
   a. Defining the problem or decision area.
   b. Setting of system objectives.
   c. Establishing system constrains(both internal and external)
   d. Determining information needs.
   e. Determining information source.
   f. Finding out alternative solutions.
   g. Evaluating alternative solutions.
   h. Selecting the best alternative.
   i. Preparing decision report.
   j.   Implementing and monitoring the selected alternative.
   k.   Documentation.

a) Defining the problem or decision area:
Undoubtedly problems exist in any dynamic business. What usually lacks is the clear identification of the problems and a priority system for their solution. The problem may be in the marketing where sales are poor or there could be problems in the inventory are where large

stocks exists and every year it is increasing. Therefore, management must take the first step in MIS designing by formulating problems to be solved. The precise definition of the problems is crucial. Otherwise, the problem solver would be restricted to a solution or a system that is sub optimal or that encompasses more than it is needed.

b) System objectives:
The system objective should clearly be stated in terms of the functions the information system is to perform. The objective could be to cater specifically for information needs of finance, personnel, material or any other specific area of business. It could also be to meet of meet the total information needs of the organization. In short, system objective should be stated in terms of what managers can do and how effectively they would be able to function after their information requirements have been met. To give an example, in the field of inventory, the objective could be to design better decision rules so that various levels of inventory could adequately be controlled.

The following questions should be answered while laying down the objectives of MIS design:
(a) What is the purpose of the system?
(b) Why is it expected to do?
(c) What is it needed?
(d)   What are the users and what are their objectives?

The objectives of MIS system design have to match the organization objectives. The aim being to improve decision making, lower cost, meet customer demands and improve the image of the organization.

c) Establishing system constraints:
In designing MIS the designer has to face certain limitations; sometimes called problem boundaries or restrictions. Constraints enable the designer to stipulate the conditions under which objectives may be attained and help to consider the limitations that restrict the design. To state it in another way, constraints, which are provided by the manager, user or the designer himself, limit freedom of action in designing a system to archive the objectives.

Constrains may be classified as (a) internal or(b) external to the organizations as shown in figure:

➢ **Internal constraints:**
(i)   Top management support:
It is very essential for MIS system. A good environment for information system must be set. Approval and support of top management should be taken. Their feedback and guidelines definitely influence the kind of system managers may design.

(ii)   Organizational policy:
Considerations frequently set limits on objectives and modify an intended approval for design of a system. In every organization managers occupying various positions, influence information flow, particularly in a decentralized system. Also company policies frequently

define or limit the approach to system design among these polices are those concerned with product and service, R & d, marketing finance and personnel.

(iii)   Man power:

Perhaps the most signification constraint of all, is the one concerning people of MANPOWER. Men problem is probably the fact, most often mentioned where failure to achieve expected results is concerned. Here we have the difficulties associated with the natural human reaction to change, the lack of interest and support, frequently met in systems design and operation.

(iv)   Cost:

It is a major resource limitation. The cost to achieve an objective should be compared with the benefits to be derived. The other resource requirements could be space, air conditioning, power etc.. and other facilities for setting up the information system inadequacy of resources can greatly limit the system design.

(v)   Acceptance:

Acceptance of the computerized MIS system perhaps presents the most difficult aspect of the problem in organizations, as it causes a natural human reaction against the change .

(vi)   Self Imposed restrictions:

There are those placed on the design by the manager or the designer. The data requirements, the data volume and the rate of processing are constraints imposed by the immediate users.

➢ **External constraints**

i). Customer:

Foremost among the consideration surrounding the external environments are those concerning the customer. Order entry, billing, and other systems that interface with systems of the customer must be designed with the customer's needs in mind. If certain outputs from the system sure not acceptable to the customer, a definite limitation is to be faced.

ii). Government:

A variety of additional external constrains should be considered in addition to the customer. The government(central, state, local)imposes certain restrictions on the processing of data, in maintaining and in the conduct of business like taxes and reporting.

iii). Unions:

Unions can affect the operation of systems involving members in matters such as compensation, grievances and working conditions.

iv). Suppliers:

They are also an important group to be considered when designing information systems because these systems frequently interface with that group.

d)   Determining information needs:

A clear statement of information needs is fundamental necessity to good system design. Unless managers can provide the specifications for What they want out of an information system, the design effort will produce less than optimum results, If on the other hand, the user manager can define the objectives and spell out the items of information's that are needed to reach the objective, he or she is, then, at least half way through in system

A manager needs information for a variety of reasons concerned with the management process. The type of need that he or she will have at various times for various purposes depends largely upon following factors:

Personal Attributes such as
   i) Knowledge of information systems
   ii) Managerial style i.e. Leadership style and decision making ability
   iii) Manager's perception of information needs.

Organizational Environment such as
   i) Nature of the company,
   ii) Level of management and
   iii) structure of the organization

e)   Determination of information sources:

The step for determining information needs is hardly completed, before we consider the information sources. Although some systems require considerable external information, for the most part, the natural place to turn for information is inside the firm –books, records, files, accounting documents etc. thus most analysis refers to the step of determining information requirements on analyzing the present system. We must not only uncover information sources for the particular subsystem under consideration but also take into account how they fit into the overall integrated sources of information and techniques of analysis.

f)   Finding out alternative solutions:

Once the problem has been understood, the solutions for the problem are to be found out. Ideally, one has to attempt to find out more than one alternative solution, but it should not be much more. It should be narrow down to a few. Because having too many alternative affects the problem solving process, increase costs and become unmanageable.

g)   Evaluating alternative solutions:

Each alternative has its own advantages and disadvantages that contribute to solving the problem in question. These must be evaluated and attached to the proposed alternative. In certain business problems, the costs and benefits are party intangible or immeasurable. In such a situation the problem solver should make approximations using surrogate measures and probabilities.

h)   Selecting the best alternative:

In this stage, the problem solver may have many alternatives which have more benefits than costs. In such a situation he applies a decision rule or a yardstick (e.g. rate of return or time etc.) to summaries and rank the alternatives finally the best alternative is chosen.

i)   Preparation of design report:

The conceptual design report is, in a sense, a proposal for the expenditure of funds and for organizational changes. Because it is directed to management, it should have a concise summary of the problems that constitutes the system, the objectives, the general nature of the system, reasons why the concept was selected over others, and the time and resources required to design and implement the system.

j)   Implementing and monitoring the selected alternative:

Once, the best alternative or system has been selected it must be implemented and followed up. If it does not perform well and incurs more costs than implemented and controlled.

k)   Documentation: For the smooth running of the MIS it is necessary that the following types of documentations are to prepared:

i)   For those providing input, a simple overview of the system, a clear description of exactly what input is expected and a note above what input is not acceptable.

ii)   For those running and maintaining the system, all the technical documentation generated during the development process.

iii)   For those using the output, a simple overview of the system, a clear description of what the output means and a note about its limitations.

21.2.4 BENEFITS OF MIS

Information is needed in virtually every field, thought and action. But besides being essential to individuals who use it do achieve personal ends; information is also needed by managers in organizations. Manages at all levels must perform such basic tasks as staffing, directing and controlling. The success of any business is determined by the success of its managers in performing their activities. Activities in turn are being affected by the excellence in decision-making. The blood pool of better decisions is information decision making must be supported by quality information.

In short, quality information leads to better decisions enhance better managerial activates and, effective managerial performance leads to organizational effectiveness. It is MIS which is the supplier of information to the managers. Hence, the role of MIS is very important in every organization.

The analysis, design and implementation of MIS are more expensive and difficult. Even though expensive it is justified for several reasons:

1.Timeliness: Managers make decisions more quickly and take less time to solve the problems and give satisfactory solutions to the management.

2.Accuracy: Normally the organizations are in position to provide variety of regular reports. For the increased government regulations. Also the organizations have variety of customers, requires variety of reports. These reports are organizations by the management accurately with the effective MIS.

3.Reduction in inventory levels: With affective MIS the inventory levels can be maintained at an optimum level which results into cost reduction.

4.Better liquidity: MIS provides for better liquidity by justifying account receivable, cash flow or living systems.

5.Better work allocation: MIS ensures the better allocation of work by evaluating the benefits of personnel allocation, maintenance control and production scheduling system. This results into reduction in work hours which lead to monetary benefits to the firms.

6.Increase in sales: Through effective MIS, one can asses the profitability of distribution, marketing, finished goods, inventory control, and customer order systems. This may result into increase in sales.

7.Reduction in maintenance costs: MIS can be used as a measure for evaluating maintenance control system and spare parts inventory control systems. It ensures reduction in maintenance costs.

8.Completeness: In MIS, the system managers understand the management technique and the procedures, so they are able to produce the complete reports of a system.

9.Accurate reports: The MIS has the ability to provide the complete and concise reports. For example,

(a) Summary reports- Summaries all activities of the organization and present in the form of summary report.

(b) Demand   reports- This reports will be prepared only when they are requested by the management.

(c)   Customer reports- According to the specifications of the management it will be prepared.

(d)   Exception reports- According to the conditions or exceptions the report is prepared.

(e) Responsibility- The MIS structure provides the boundaries of management responsibilities.

10)   Other benefits: MIS provides the following other benefits.

  (i)   Ensures shorter response time.

  (ii)   Reduces the number of negative responses to customers.

  (iii)   Improves decision-making process.

  (iv)   Widens information bases for decision-making

  (v)   Facilitates data integration.

  (vi)   Simple and easy to understand.

  (vii)   Saves the precious time of managers.

  (viii) Saves manpower.

  (ix)   Enhances the quality of decisions.

  (x)   Easy accessibility

  (xi)   Reduces data redundancy.

  (xii)   Improves productivity.

21.3 LET US SUM UP

1. The value of information in organizations is based on completeness, accuracy, timeliness, consistency

2. The computer based information system is required to have effective control of operations, planning, to enhance customer relationship, maintenance of equipment, etc.

3. MIS refers to a entirely coordinated system of computer expertise and management, including mainframe system and the entire network of computer resources.

4. Designing of MIS involves various steps

5. MIS offers certain benefits like timeliness, accuracy, reduction in inventory levels, better liquidity, better work allocation, increase in sales etc

21.4 LESSON END ACTIVITY

Visit a company and see how payroll processing is useful.

21.5 POIJNTS FOR DISCUSSION

1)   What do you mean by information? List out the factors influencing the value of information.
2)   Write short notes on information processing cycle. (or)
     What are steps involved in information processing cycle.
3)   What are the needs for computer based information system.
4)   What are the different steps involved in designing a MIS explain.
5)   Explain the various benefits of using MIS.

21.6 CHECK YOUR PROGRESS

1. A. MIS is a set of inter related elements which work together to render classified and interpreted data that are usable and used by managers in the process of planning, organizing staffing, directing and controlling the major activities of business.

B. Your answer may include any of the following:
a.   Completeness.
b.   Accuracy.
c.   Timeliness - up to date.
d.   Consistency.
e.   Validity - unbiased, representative, verifiable.
f.   Suitability - meaningful and relevant, formatted to suit the user's needs.
g.   Distinctiveness.
h.   Relevance.
i.   Usability.
j.   Accessibility

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LESSON – 22

OFFICE AUTOMATION SYSTEMS AND TRANSACTION PROCESSING SYSTEMS

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22.2 Office Automation Systems

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22.4 Let Us Sum Up

22.5 Lesson End Activity

22.6 Points for Discussion

22.7 Check your Progress

22.8 References

22.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. What is office Automation and Transaction processing systems.
2. Important areas of office automation.
3. Transaction Processing Modes
4. Transaction documents
5. Features of TPS
6. Transaction Processing Cycle

22.1 INTRODUCTION

The introduction of mini computer in to office in the late sixties has since then changed very significantly the way the work is done in office. Office automation is an assorted mix of technologies with the basic objective of improving the efficiency of office work. Office automation systems include the application of computer-based office- oriented technologies such as word-processing, desktop publishing, electronic mail, teletext and teleconferencing.

Business transactions are certain events that occur routinely in a business firm such as purchase and issue of raw materials. The nature and volume of transactions depend on type and

size of business. These transactions are to be recorded to measure efficiency of operations and resource use. The transaction processing system (TPS) is the most important and rich source of data for a business firm.

22.2 OFFICE AUTOMATION SYSTEMS

The important areas in office automation are:
1. Word processing
2. Desktop publishing
3. Word processing
4. Electronic mail
5. Facsimile (FAX)
6. Voice Mail
7. Teleconferencing
8. Electronic fund transfer
9. Image storage and retrieval systems:
10. Multimedia systems:

1.Word processing:

Word processing permits typing in documents, manipulation of such documents and their storage and retrieval.
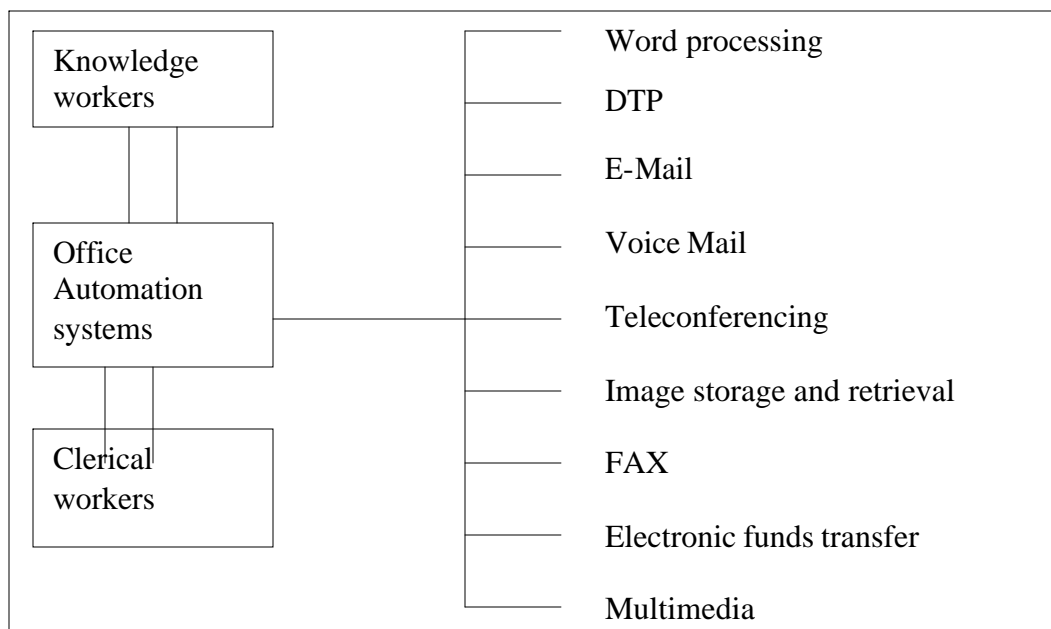
2. Desktop publishing:

This uses computer hardware and software to produce documents of professional print quality. The use can combine test, artwork, photos and a variety of fonts to produce the document.

3. Electronic mail:

E-mail is the fastest growing communication mode. Computer network facilitate communication between computers. The electronic transfer of messages between computers is quick, convenient and economic.

4. Facsimile (FAX):

The FAX machine sends and receives text and images. The text and images are converted into digital form and at the receiving end it is converted into text and image form.

Knowledge workers		Word processing
Office Automation systems		DTP
		E-Mail
		Voice Mail
		Teleconferencing
		Image storage and retrieval
Clerical workers		FAX
		Electronic funds transfer
		Multimedia

5. Voice Mail:

Voice mail sends digitized speech over phone to a mailbox and the message is digitally stored at the receiving end, which can be accessed using telephone.

6. Teleconferencing:

It is the use of telecommunication technology to see people face to face without their physical proximity to each other. The participants gather in specially equipped rooms capable of simultaneous audio and video transmission

7. Image storage and retrieval systems:

These systems convert paper documents into electronic files and images for easy storage and retrieval.

8. Electronic fund transfer:

It is a facility to transfer funds between accounts of customers with banks. At the point of sale counter customers presents his cark and keys in a code and if the card and coke tally the bill amount id transferred to the account of the retailer and the customer's account is updated.

9.Multimedia systems:

The multimedia systems store. Retrieve and process different types of data such as text, graphics, audio, video and animation. They facilitate information storage, retrieval and presentation in a variety of impressive ways.

Check Your Progress 3

What is office Automation? Describe some of the areas of office Automation

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this unit (pp.164)

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22.3 TRANSACTION PROCESSING SYSTEMS

The transaction processing system (TPS) was the earliest form of computerized management information system. Originally, business transactions were processed manually. This was partly replaced by machine-assisted data processing systems. Gradually, electronic data processing was introduced to record business transactions. TPS is today an integral part of computer-based information systems. It is very difficult to imagine an organization without a functional TPS. For example, if an airline reservation system breaks down for a day or two, it will cripple the company and the flights will be in disarray causing untold miseries to customers.

In a business firm, there are two types of flows in and out of the firm. The first is a physical flow. It is the flow of inputs through various processes within the firm and the output of

products and services out of the firm. The second is information flow. Information system tracks the physical flow. The physical flow of input and output is measured and recorded. These records are the sources of data for information corresponding to the physical flow.

Document(s) and processing
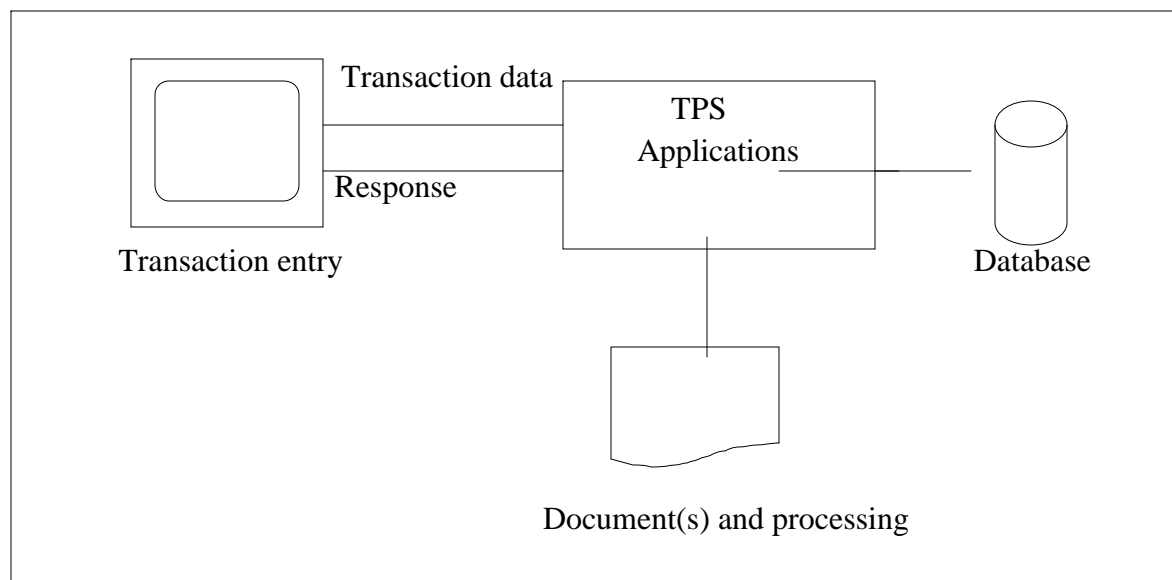
The operations management takes care of the physical flow of resources and the transaction processing system takes care of the information flow. The transaction processing system processes all transactions and records them. This results in generation of transaction data which are structured and stored in databases. Apart from recording routine transactions, TPS also updates master files and databases.

22.3.1 TRANSACTION PROCESSING CYCLE

Transaction processing is a basic activity in organizations. It is a routine and repetitive activity that triggers a few other activities like updating database and generation of documents forming a cycle. The transaction processing cycle consists of six steps such as:

a. Data entry
b. Input data validation
c. Transaction processing and validation of results
d. File and database maintenance
e. Document and report generation, and
f. Inquiry processing

The transactions are measured in some convenient unit for recording such as money unit for expenses, hours in case of labour etc. Data pertaining to the transaction must be entered into the system. The source of this data usually is a document such as sales order from customers, invoice from suppliers etc., these are called source documents and they provide the basic data for TPS. The data is entered using either the traditional data entry methods or the direct data entry methods. In the former method the source documents like purchase order are prepared and usually accumulated into batches. The direct entry method uses automated systems for data

capturing and recording.   Point of sale terminals, optical scanners and MICR devices are used in capturing data and transferring data to computers in real time for transactions processing.

Input data validation is the next step in TPS. It checks the accuracy and reliability of data by comparing it with range data or standards etc. It involves error detection and error correction. Checking for errors include checking the data for appropriate format, missing data and inconsistent data. If the data value falls outside the normal range it is invalid. For example, if a firm's orders for materials in kilograms ranging from 100 to 1000 kilograms and if that range is accepted as normal data range for purchase orders, then this range is coded into the program for validation checking. That whenever a purchase order is prepared, as soon as quantity is entered in the appropriate column the system check whether the quantity entered is between 100 and 1000.   Otherwise it will give an error message as "Check the Quantity Entered, it is out of range" or some other error message as is coded.

Processing of transaction data is the next step.   This involves some computation, checking and comparing etc. For instance, if it is a credit sale transaction, then the total value of the transaction has to be computed, the system should check whether the value is within the credit limit sanctioned to the customer, it should check the availability of stock, delivery data possible etc.
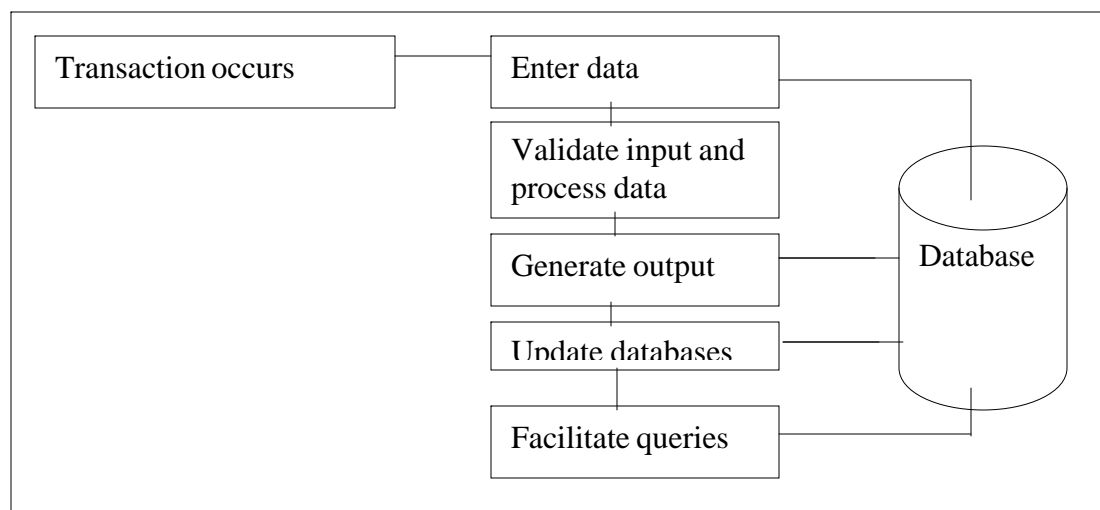
Once the transaction is processed, certain output needs to be generated. The output may be some documents like sales invoices, pay slips etc. Or screen displays or the output data may used to update related databases. Files and databases have to be updated with each transaction or each batch of transactions. In case of applications that are not time critical, the transactions may be processed in batch mode. Certain systems like airline reservation require updating with every transaction for giving status information in real time. Direct data entry devices have to be used to capture transaction data and update related files and databases to provide current information to users.

Inquiry processing is another activity of transaction processing system which involves providing information on current status like inventory levels, customer credit limit, dues from a

particular customer, inbound supply, et. The inquiry response is pre-planned and the on-screen display or output is formatted for the convenience of the requester.

A business transaction with a customer involves a good or service that a customer want and the business provides for a price. The TPS supports the delivery process.

To complete a transaction with an external entity like customer, supplier etc. a series of activities is involved such as checking of account, current inventory balance, delivery time and price.

For instance, the transaction at a bank counter involves checking of account balance, withdrawal of money or deposit of money. In the case of some transactions, an activity serves as a trigger and a series of activities follow it. For example, a sales order from a customer is followed by a number of activities; some of these are queries like:

❖ Checking whether the customer is an existing or a new customer,
❖ Checking customer's credit limit to know whether the transaction is within the permitted credit limit or not,
❖ Checking inventory balance to know whether the order can be fulfilled within the time the customer needs it,
❖ Checking production schedule to know how much will be added to finished stock at the end of a production period,
❖ Checking of back orders to know how much stock will be left to meet this sale order.
❖ Once this querying is over and if adequate stock is available for meeting the order, the sales order is approved and the transaction is processed. This involves
❖ Debiting customer account with the value of goods
❖ Crediting sales file with the value of goods
❖ Updating inventory file with the quantity of stock sold
❖ Generating a packing list for the Dispatch department to assemble the order
❖ Generating documents like sales invoice bill of exchange etc.
❖ Packing the goods and handing them to the delivery staff, and
❖ Delivering the goods.

TPS actually tracks the physical workflows. Each operation of the workflow is recorded. At each of these points in the sales order processing, the information about the state of the order is recorded.

Check Your Progress 4
Bring out the steps involved in transaction processing cycle?

Notes: a) Write your answer in the space given below
          b) Check your answer with the one given at the end of this unit (pp.164)

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22.3.2 FEATURES OF TPS

TPS is a fundamental activity subsystem of information system and plays a very critical role in any organization. Some of the major features of TPS are as follows:

1. Integration tool

TPS integrates the various departments in an organization. Each department will generate data and these transaction data flows into a centralized database. The common database provides the raw data for information generation for various decision makers. TPS thus integrates the various functional units of an organization.

2. Links customers with the organization

TPS also connects customers with the organization's warehouse, plant and management. If TPS fails, it may cut the link with customers and organization cannot transact business with them.

3. Inputs

Processing involves sorting, listing, merging, updating etc. The inputs are transaction data like customer code, name product, quantity price etc.

4. Output

The output includes invoice, sales reports, lists, summaries, and inquiry responses. These are the results of enquiry processing, report processing and interactive processing.

5. The users

TPS is designed to support lower level management. The transactions are highly structured and routine in nature. Applications are developed to facilitate data capture and recording. Mostly, operations personnel and supervisors are the user4s of transaction processing system.

6.User Department Specific

TPS is designed for each department to cater to its special data processing needs. Thus, production department will have a TPS for processing transactions in the department; marketing department will have another TPS for it and so on.

7. Highly structured

TPS is highly structured. Business transactions are routine events with relatively very high frequency like those of inventory management, payroll processing, accounting etc. Hence, these are early candidates for computerization in most business firms.

8.Scope for cost savings

Since manual transaction processing requires too man y hands and are often inefficient, most organizations computerize transaction processing. This results in cost savings and drastic improvement in efficiency of service and information availability.

22.3.3 TRANSACTION DOCUMENTS

Processing of transactions results in certain documents. These documents may be classified into any of the following types:

(a) Informational Documents:

These documents just inform that something has taken place or is taking place. For example, a sale confirms that the order has been received from the customer and has been verified.

(b).Action Oriented Documents:

These documents need to be acted upon. For example, a purchase order initiates a purchase. Similarly a production order instructs the production department to start production of the products mentioned in the production order.

(c). Investigational Documents:

These are generated on an exceptional basis. For example, whenever operations are not conforming to the range of deviations permitted, the variations are tracked and analyzed. A report is generated to enable the control point to take corrective action.

The reports or outputs generated by the TPS can also be classified into the following categories:

(a). Pre-planned Reports:

Formats of these reports are pre-designed. These reports are frequently generated to meet information requirements of planning and control of actions. Most of these reports are periodic in nature like daily report, weekly report, monthly report etc. for example, weekly sales analysis report submitted to the sales manager helps him to know whether the sales targets for the week were met or not. If the targets were not met, the reasons for failure to meet the targets are also analyzed and mentioned in the report. This enables a manager to take corrective action.

(b). Pre-planned Enquiries:

For the smooth an deficient functioning of any business, a lot of status information will be needed. For example, if a sale order comes from a customer, the sales clerk needs some status information about the stock of that particular inventory item, pending orders, credit limits in case of credit transaction etc. before he confirms the order. Most of this type of status information needs can be met through built-in query facility.

(c). Ad-hoc Reports and inquiry Responses:

These reports and inquiries are infrequent or are not anticipated. They are needed to take some non-routine decisions or actions. For example, at the time of wage negotiation with its workers, if a firm is considering to offer a new incentive scheme, the personnel manager / the finance manager may want to know the implications of this decision in terms of financial obligations. This information need cannot be anticipated in advance. Hence, such unique information needs have to be met by ad-hoc reports and enquiry facility.

(d). User Machine Dialogue results:

For interactive decision making like in DSS, the decision maker has to enter into a dialogue with the system to generate more useful information. The results are interactively generated and displayed on the screen.

22.3.4 TRANSACTION PROCESSING MODES

Transactions may be processed individually or in batches. Similarly, the processing may be done at local offices or at the head quarters of companies. The type of processing depends on a set of factors like the volume of data, complexity of data processing operations, processing time constraints, computational demands and the degree of decentralization of authority. Thus, the processing modes are as follows:

(a).Batch Processing:

Under this method transactions are accumulated into batches which are processed periodically. Most organizations handle a large number and variety of transactions every day such as cash sales, credit sales, sales commission, customer credit, consignment sale, advertising, etc, in marketing area. An efficient way to process these transactions is to collect all transactions of the same type of a particular period of time and process them as one batch of transactions. Thus, all sales transaction of a day of a particular product are processed once in a day or period. All these transactions are entered into the system at one time. This enables data processing personnel to better control the entire processing cycle for that type of transaction, and leads to more efficient scheduling of computer time.

(b). On-line Processing:

The term on-line refers to the fact that the input/output files, data files and related equipment are connected to the computer such that a transaction may be entered at once or information may be retrieved immediately any time. Each transaction is entered into the system as and when it arises. There is no waiting for a minimum number of transactions to enter transaction data into the system.

(c) On-line, Real Time Processing:

If the transaction is processed singly and as it occurs without any loss of time between the event and recording of the event, the processing is in on-line, real time mode. It means that the files for the transaction type are kept on-line, that is electronically connected to the computer, and the transaction is processed quickly, for example airline reservation.

The concept of real time means that data is entered relatively quickly as they arise and updated information is available without loss of any time between data entry and information retrieval. Real time processing usually requires dedicated terminals connected to the central computer. An input transaction triggers an immediate processing of data with the response being returned in seconds, for example, on-line stock trading.

(d) Distributed processing:

This arose out of the need to channel data processing power to where data actually arise and where it can be processed more efficiently. That is, some processing power is distributed to local or regional level officers by installing computers there rather than centralizing it at the head

quarters. The detailed information required for daily operations remains at the local level and the summary information required at higher levels for planning and controlling overall operations is forwarded to the central computer.

(e) Online Transaction Processing Systems

Airlines reservation system, online securities trading system, electronic banking, railway reservation system, hotel room booking system etc, are examples of on-line transaction processing system.

Check Your Progress 5
Explain the modes of transaction processing system.

Notes: a) Write your answer in the space given below
 b) Check your answer with the one given at the end of this unit (pp.164)

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22.4 LET US SUM UP

1. Office automation is an assorted mix of technologies with the basic objective of improving the efficiency of office work.
2. The important areas in office automation include word processing, desktop publishing, electronic mail, facsimile (FAX) etc
3. Transaction processing is a basic activity in organizations. It is a routine and repetitive activity that triggers a few other activities like updating database and generation of documents forming a cycle.
4. The transaction processing cycle consists of six steps such as data entry, input data validation, transaction processing, and validation of results and so on

22.5 LESSON END ACTIVITY

Visit an Automated company and see how work is performed.

22.6 POINTS FOR DISCUSSION

1) Explain in detail about the important area in office automation.
2) Explain in detail about transaction processing cycle.
3) Explain in detail about the features of transaction processing system.
4) What are transaction documents? Explain.
5) Write notes on transaction processing modes.

22.7 CHECK YOUR PROGRESS

1. Office automation systems include the application of computer-based office- oriented technologies such as word-processing, desktop publishing, electronic mail, teletext and teleconferencing.

The important areas in office automation are:

i). Word processing
ii). Desktop publishing
iii). Word processing
iv). Electronic mail
v). Facsimile (FAX)
vi). Voice Mail
vii). Teleconferencing
viii). Electronic fund transfer
ix). Image storage and retrieval systems
x). Multimedia systems

2. Modes of Transaction Processing systems

i). Batch Processing
ii). On-line Processing
iii). On-line, Real Time Processing
iv). Distributed processing

3.

i). Data entry
ii). Input data validation
iii). Transaction processing and validation of results
iv). File and database maintenance
v). Document and report generation, and
vi). Inquiry processing

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LESSON – 23

DECISION SUPPORT SYSTEMS

Contents:

23.0 Aims and Objectives

23.1 Introduction

23.2 Decision Support Systems

      23.2.1 Types of DSS

      23.2.2 Characteristics Of DSS

      23.2.3 Components of DSS

      23.2.4 DSS Capabilities

23.3   Group Decision Support System (GDSS)

      23.3.1 Typical GDSS Capabilities

23.4 Let Us Sum Up

23.5 Lesson End Activity

23.6 Points for Discussion

23.7 Check your Progress

23.8 References

23.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Types of DSS
2. Characteristics Of DSS
3. Components of DSS
4. DSS Capabilities
5. Group Decision Support System (GDSS)

23.1 INTRODUCTION

A decision support system is a computer application that helps users analyze problems and make business decisions more confidently. It uses data routinely collected in organizations and special analysis tools to provide information support to complex decisions. For example, a firm's sales department may be interested in analyzing various sales decision options. The decision support application might gather data, present the data graphically and help in

evaluating various options. It may use past sales figures, project sales based on sales assumptions for each alternative considered and display information graphically. It may also use artificial intelligence to enhance its decision support capability.

Decision Support System assists managers in making unstructured decisions. The system enables them to interact with the database, model base and other software. It enables the users to generate the information they need rather than depend on some reports produced according to some anticipated information needs. DSS is more suited to handling unique and non-routine decision problems. In many situations the problem itself may not be easily identified. Similarly, identifying alternatives, identifying outcomes of each alternative considered, evaluation of alternatives etc. pose problems to the decision maker. Each problem might require a different approach to problem definition, analysis and resolution. Not only that it is difficult to solve such problems, it is also possible that the decision process and solution vary with the decision maker.

23.2 DECISION SUPPORT SYSTEMS

DSS is designed to support managerial decision-making, usually, at middle and top levels of management. Decisions made at the top level are mostly futuristic and non-repetitive in nature. Such decision situations are highly uncertain and even specification of information requirements for decisions are difficult. They are classified as non-programmable or unstructured decision situations. The impact of such decisions will be seen throughout the organization and cost of a wrong decision is usually very high, for example a decision to sell off a line of business. This is in sharp contrast to programmable or structured decisions where the decision procedure can be well defined and every information requirement can be pre-specified. Most of the decisions taken at lower levels of management fall into this category. For example, a decision to replenish stock of an inventory item is a highly structured decision taken at the operational level. DSS is intended to help managers making unstructured decisions. 'the system includes a database, various models (Mathematical models for optimization etc.) and an interface for the manager (usually a terminal) to interact with the system. The manager takes data from the database, selects appropriate model or models and analyses the data using these models to know the probable results of various actions.

DSS is thus an interactive computer system with many user-friendly features aimed at helping non-computer specialist managers in making plans and decisions on their own. With the recent advances in computing technology, particularly the powerful microcomputer and interactive devices, the uses of DSS is expanding rapidly as these managers find it easy to access databases and model base for retrieving and analyzing data.

DSS contains a database, models and data manipulation tools to help decision makers. It is useful where decisions are semi-structured or unstructured. The decision rule for a structured decision can be pre-specified. Hence, it is possible to automate such problem solving.

Intelligence
Design
Choice
Implementation
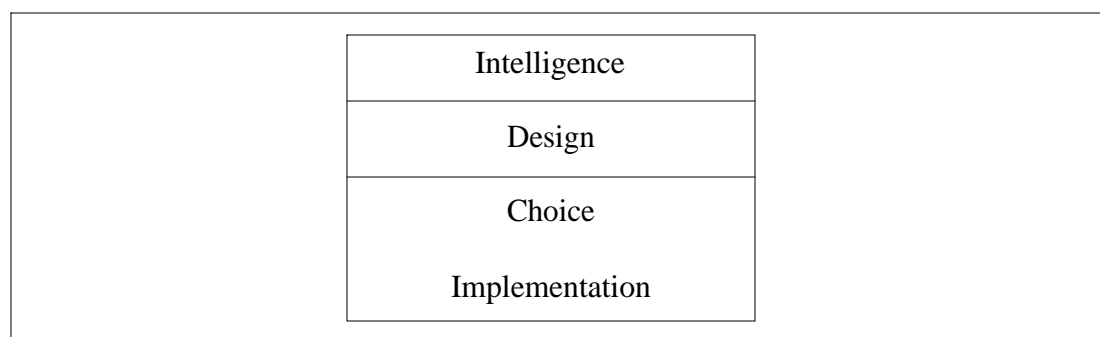
Intelligence activities are targeted at discovering problems of organizations. The information reporting system can handle most of these information requirements. In the design phase, alternative solutions to the problem identified are generated. This stage requires more focused information and more intelligence based systems like DSS and Knowledge based systems. Choice phase involves selecting the right alternative. This requires thorough evaluation of the consequences of all the alternatives under consideration in terms of risk and return, and its impact on problem area.

Information requirements at various stages of Decision-making and the type of systems:

Stage	Information required	Example system
Intelligence	Exception reporting	IRS
Design	Simulation prototype	DSS, KWS
Choice	"What if" analysis	DSS, large models
Implementation	Graphics, Charts	Microcomputer and mainframe decision aids

Decision implementation is a critical phase. Managers are anxious about the results of decision implementation right from day one of implementation. In this phase, managers call for information on implementation of decision such as stage of implementation, time and cost involved, implementation constraints, and impact of implementation.

DSS can support repetitive or non-repetitive decision-making. It provides capabilities for repetitive decision-making by defining procedures and formats. For example, an insurance agent may use a DSS package to help clients in choosing insurance schemes. With the privatization of insurance in the country, innovative insurance products are being introduced. An investor will find it difficult to properly identify an insurance product matching his or her requirements. The agent can carry a laptop with a DSS for insurance products to his clients. The DSS can be used by the sales agent to demonstrate to the clients the details of each scheme in terms of risk covered, bonus, maturity value, premiums etc. and help the clients arrive at their decisions to purchase insurance policy.

DSS can also help non-routine decision-making. In fact its utility is high when non-repetitive decisions are made. For solving a non-repetitive problem, the DSS provides data, models and interface methods to the user to select and analyze data. For example, a marketing manager might want to analyze the potential demand for new products that the company is planning to introduce. The marketing manager can use a DSS to forecast the demand using relevant data about the market obtained form some database service firms like Centre for Monitoring Indian Economy. The analysis will provide new insights into the market behaviour and product performance that will help the manager in introducing new products into the market.

23.2.1 TYPES OF DSS
Basically, there are two types of DSS. One is data-driven DSS and the other is model-driven DSS. The data driven DSS, helps in generating useful information from huge quantity of

data in organizational databases, data warehouses and websites. Data mining techniques are employed to generate useful information. The model-driven DSS contains mathematical models to carry out "what if" analysis and sensitivity analysis.

23.2.2 CHARACTERISTICS OF DSS

- ❖ It is designed and run by managers.
- ❖ It contains a database drawn from internal files and external environment.
- ❖ It focuses on decision processes rather than on transaction processing.
- ❖ It is concerned with a small area of managerial activity or a small part of a large problem.
- ❖ it permits managers to test the probable results of alternative decisions.
- ❖ It supports decision-making, usually in solving semi-structured complex problems.
- ❖ It helps in refining managerial judgment applied to problem solving.
- ❖ It improves managerial decisions and thereby managerial effectiveness.
- ❖ The decision maker retains control over decisions throughout the decision process.

Check Your Progress 6
 List out the characteristic of DSS?

Notes: a) Write your answer in the space given below
        b) Check your answer with the one given at the end of this Lesson (pp.172)

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23.2.3 COMPONENTS OF DSS
        Components of DSS include the following
1. DSS Database:
    DSS requires a database of its own. It can use data in organizational database. But this will slow down the application. There is also a risk of DSS applications modifying data in the organizational database. Hence, DSS generally uses data from its own database built up from transaction data drawn from organizational database and other relevant data collected from outside.

2. Model base:
     It contains a collection of mathematical and analytical models that the DSS user may want to analyze the data. Each DSS is designed for a specific purpose such as firefighting, diagnostics, oil exploration etc. Hence, the models in the model base will vary from DSS to DSS. Generally, it contains statistical models, optimization models, forecasting models etc.

3. The Hardware:
    DSS requires hardware to provide the capability to the users to interact with the database and models using DSS applications.

4. **The User interface:**

The user interface of DSS supports the interaction between the user and the data using the models.

5. **Analysis tools:**

These include many tools which can be used at any level of management. The tools used at the three levels of management in an organization are as follows:

❖ DSS Tools for operational Management

The operational management level requires assistance for day to day operations. The areas where DSS can support operational management include:

- Material requirement planning
- Linear programming
- Queuing theory
- Analysis of variance
- Correlation analysis
- Descriptive statistics like mean, median etc.,

❖ DSS Tools for Tactical Planning and Management Control:
- Dynamic programming
- Regression analysis
- Correlation analysis
- Factor analysis
- Multidimensional Scaling
- Game theory
- Discriminate analysis
- Non-linear programming
- Network analysis

❖ DSS Tools for Strategic Planning:
- Expert systems
- Natural language systems

23.2.4 DSS CAPABILITIES

DSS has acquired many capabilities over the years. Some of the major capabilities are as follows:

1. **What if Analysis**:

This helps in analyzing the cause-effect relationship of variables. For example, if advertisement budget for a year is increased by 30% what will be its effect on total sales that year?

2. **Model Building:**

Model building is a central task in most decision support systems. It involves mathematically specifying the relationship between variables. For example, a sales forecasting model based on advertisement expenditure will specify the relationship between sales and advertisement in terms of mathematical statement as:

Sales = 10.94 X Advertisement expenditure

It means sales turnover will be 10.94 times the advertisement expenditure for the period.

3. Sensitivity Analysis:

This capability offers facility ot analyze the effect of multiple variables. For example, what should be the cost of financing a project to get a return on investment of 20% after meeting costs of interest and other operations.

4. Risk Analysis:

This facility provides a useful probability distribution to the decision maker to assess the risk involved. For example, a probability distribution of profit helps the decision maker to expect certain profit level with certain probability.

5. Goal Seeking Analysis:

This facility is the reverse of 'what if' analysis. It answers questions like what should be the price per unit to generate a profit of Rs. 10, 00,000 from a project. This facility is normally available in spreadsheets.

6. Graphic Capability:

This facility portrays data in the form of charts, graphs and diagrams to reveal underlying trends and patterns.

7. Exception Reporting Analysis:

This facility tracks exceptions like over due accounts, production runs that result in more power consumption than estimated, sales men who could not meet sales targets etc.

8. Hardware Capabilities:

It can be implemented on a wide rage of hardware configuration ranging form PC to mainframes.

9. Access to Database:

DSS accesses data stored in databases also in external files. DSS tools have the capability to maintain internal files once data is retrieved form other sources.

23.3   GROUP DECISION SUPPORT SYSTEM (GDSS)

GDSS is designed to support joint decision making by two or more individuals. The decisions involved in GDSS are mostly unstructured. The group may make decisions in several settings like board rooms, conferences, videoconferences etc. The decision makers are in different places, yet the GDSS software brings them together in group decision making environment. GDSS provides support by facilitating electronic exchange of comments, views, suggestions and approval or disapproval. The system consists of advanced presentation devices, access to database and facilities for the decision makers to communicate electronically. All the participants in the group decision making are provided with computer-based support that

includes data management, retrieval, graphical presentation tools, decision analysis capability, modeling etc.

23.3.1 TYPICAL GDSS CAPABILITIES INCLUDE:
1. **Display:**
   A work station screen or previously prepared presentation material.

2. **Electronic Brainstorming:**
   Participants communicate comments electronically.

3. **Topic Commenting:**
   Participants add comments to ideas suggested by others.

4. **Issue Analysis: Participants**
   Identify and consolidate key items generated during electronic brainstorming.

5. **Voting:**
   Participants use the computer to vote on topics with a choice or prioritization methods.

6. **Alternative Evaluation:**
   The computer ranks alternative decisions based on preferences entered by participants.

   DSS is a part of organizational MIS. MIS reports are still necessary for managers to monitor the on going operations. DSS complements the reports by enabling managers to make less structured decisions with greater confidence. DSS contains models, specialized database and user interface. It helps the decision maker to interact with the data using the models and generate information for solving semi-structured and unstructured problems. GDSS supports joint decision-making by two or more individuals involving mostly unstructured problems in an organizational setting.

23.4 LET US SUM UP

1. DSS is designed to support managerial decision-making, usually, at middle and top levels of management
2. DSS contains a database, models and data manipulation tools to help decision makers. It is useful where decisions are semi-structured or unstructured
3. There are two types of DSS. One is data-driven DSS and the other is model-driven DSS.
4. Components of DSS include the DSS Database, Model base, The Hardware, The User interface, Analysis tools.
5. DSS has many capabilities over the years. Some of them are: What if Analysis, Model Building, Sensitivity Analysis, Risk Analysis, and Graphic Capability.
6. GDSS is designed to support joint decision making by two or more individuals. GDSS capabilities include: Electronic Brainstorming, Topic Commenting, Voting etc

23.5 LESSON END ACTIVITY

Discuss how DSS can help the management in decision-making

23.6 POINTS FOR DISCUSSION

1) Write short notes on DSS.
2) List out the characteristics of DSS.
3) Explain in detail the components of DSS.
4) Briefly explain the capabilities of DSS.
5) What is GDSS? Explain its capabilities.

23.7 CHECK YOUR PROGRESS

1.

i. It is designed and run by managers.
ii. It contains a database drawn from internal files and external environment.
iii. It focuses on decision processes rather than on transaction processing.
iv. It is concerned with a small area of managerial activity or a small part of a large problem.
v. It permits managers to test the probable results of alternative decisions.
vi. It supports decision-making, usually in solving semi-structured complex problems.
vii. It helps in refining managerial judgment applied to problem solving.
viii. It improves managerial decisions and thereby managerial effectiveness.
ix. The decision maker retains control over decisions throughout the decision process.

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LESSON - 24

EXPERT SYSTEMS

Contents:

24.0 Aims and Objectives

24.1 Introduction

24.2 Expert Systems

24.3 Let Us Sum Up

24.4 Lesson End Activity

24.5 Points for Discussion

24.6 Check your Progress

24.7 References

24.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:
1. Components of Expert System
2. Characteristics of Expert System
3. Limitations of Expert Systems and advantages Of Expert System

24.1 INTRODUCTION

Expert systems have evolved out of the work on artificial intelligence over the past few decades and are finding increasing applications in business. The system gathers together a database of knowledge or expertise to offer advice or solution for problems in a particular area by emulating the abilities and judgments of human experts. It accumulates all the expert

knowledge in a given area so that the advice or solution offered is better than that of a single consultant or expert. It guides users through problems by asking them a set of questions about the problem. The answers given are checked against the rule base in the system to draw appropriate conclusions from the problem situation. Expert systems are particularly useful in dealing with unstructured problems.

24.2 EXPERT SYSTEMS

Expert system was originally developed to replicate abilities of human experts. The system captures and stores human knowledge in a area of expertise, called domain, a uses it to solve problems which other wise requires the help of human experts. The solution suggested by the system is expected to be superior to that by any single expert.

Expert systems are designed to solve real problems in a particular domain that normally would require a human expert. It can solve many types of problems. It is designed to solve some problems very effectively. But it cannot solve every problem one might encounter in an area.

Developing an expert system involves extracting relevant knowledge from human experts in the area of problem, called domain experts. Such knowledge is often heuristic in nature. That is, it is some useful knowledge based on some "rules of thump" rather than absolute certainties. Acquisition of such rules of thump and storing them in knowledge base are serious tasks in building a knowledge base. A knowledge engineer does this of knowledge acquisition and building a knowledge base.
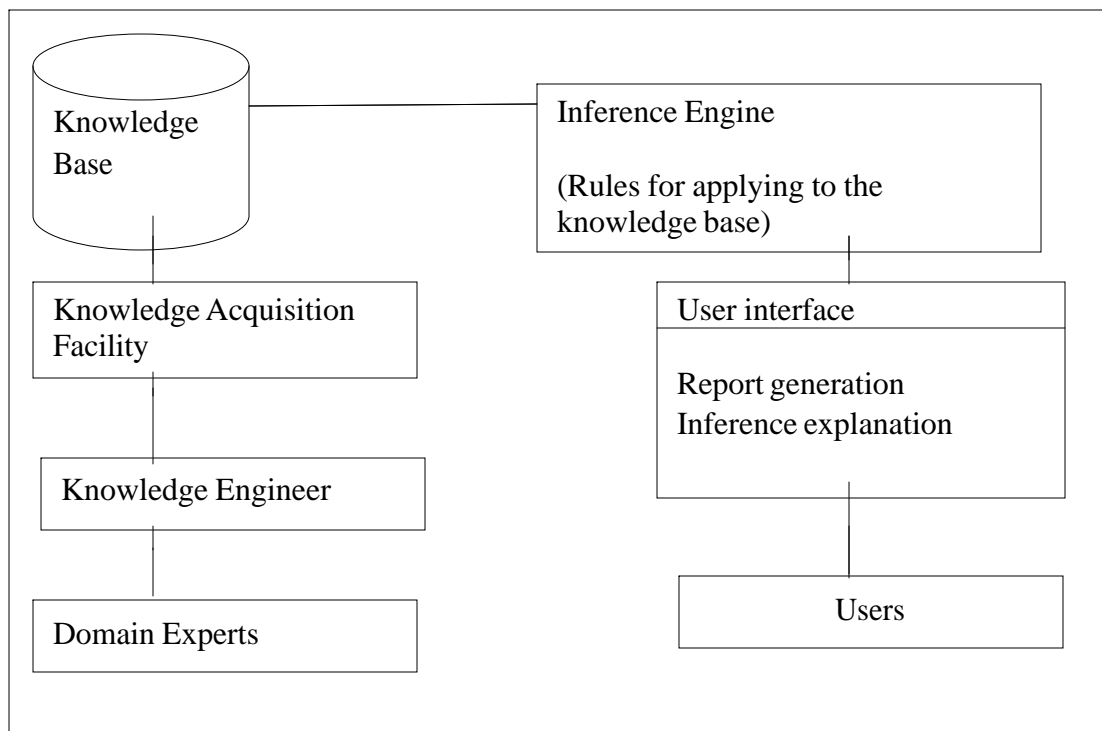
The expert system consists of two major parts: the development environment and the consultation environment. The expert system builder uses the development environment to build the components and store expertise into the knowledge base. Non-expert user uses the consultant environment to get the expert opinion and advice from the expert system.

24.2.1 COMPONENTS OF EXPERT SYSTEM

The expert systems have the following components:
(1). Knowledge acquisition facility
(2). Knowledge base
(3). Knowledge-based management system
(4). Reasoning capability
(5). Work space
(6). Explanation facility
(7). Inference engine, and
(8). User interface

These components are briefly explained below:

1. Knowledge Acquisition Facility

Domain experts acquire expertise in their area of expertise over a long period. The expertise may be the result of their constant interaction with similar experts, observation and personal experience in the domain. Capturing expertise is one of the most difficult tasks of building knowledge base. This facility adds new knowledge and rules to the existing knowledge base and ensures its growth to meet emerging need. Usually a knowledge engineer takes care of this task. He identifies and interacts with the domain experts to gather expertise.

2. Knowledge Base

Knowledge base is just like the database of information system. It stores knowledge and rules and explanations associated with the knowledge. Knowledge representation is a major task in expert system building. The knowledge must be meaningfully represented in the system so that the system can relate to real world problems.

The knowledge base includes three of knowledge such as:
Factual knowledge
Heuristic knowledge, and
Meta knowledge

The factual knowledge consists of facts about the domain, say, finance, medicine, design, etc., heuristic knowledge relates to the rules associated with a domain or problem area. Meta knowledge enables the expert system to use and analyses facts, extract those facts and specify the route to a solution. It refers to the ability of an expert system to learn from its own experience.

The knowledge base contains data and facts relevant to a problem area. The most common way to represent knowledge in expert systems is in the form of rules such as if ……then statements.   Semantic networks and frames are other forms of knowledge representation in expert systems. The inference engine contains reasoning methods. It is a piece of software that probes the user and searches the knowledge base for the appropriate solution. The user interface links the user with the expert system. It sorts up screens for user-interaction with the system. Such interaction leads to identification and solution of problems.

3. Knowledge-based Management System

It is similar to a database management system in an information system. Its major task is to up data the knowledge base with knowledge and rules.

4. Work Space

The workspace or black board is a memory area used for describing the current problem, and storing intermediate results.

5. Explanation Facility

Most expert systems have explanation facilities. It explains how recommendations are derived. The user can know how the expert system arrived at the solution, why some alternatives were rejected, why some information was asked for etc. The explanation facility answers these questions by referring to the system goals, data input and the decision rules. For example, in case of loan proposal evaluation, the expert system's explanation facility will clarify on probing why one application was approved and why another was rejected. In case of a medical expert system such as Mycin, this facility builds confidence in the user about the expert system and the solution it provides to problem.

6.Reasoning Capability or Knowledge Refinement

The expert system has the capability to analyze why its solution failed or succeeded and ways of improving its solution.

7. Inference Engine

The inference engine works like the model base in decision support system. It manipulates a series of rules using forward chining and backward chaining techniques. In forward chaining the inference engine poses a series of if ….then condition checking. Based on the responses a particular solution is suggested. In backward chaining technique, the inference engine starts with the goal and checks whether the conditions leading to that goal are present.

8. User Interface

The system provides an interface for the users to interact with the system to generate solutions.
It is similar to the dialogue facility in decision support system. The artificial intelligence technology tries to provide a natural language interface to users.

Check Your Progress 7

What is Knowledgebase in Expert system?
Notes: a) Write your answer in the space given below
        b) Check your answer with the one given at the end of this unit (pp.180)

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24.2.2 COMPONENTS OF EXPERT SYSTEM – AN ALTERNATE APPROACH

Another way to analyze expert system components is to look at the physical ingredients of the system as follows:

1. Hardware

Expert system shells operate on all types of hardware such as micro-computers, minicomputers and mainframe computers. Since microcomputers have become ubiquitous, it has become the standard hardware platform.

2. Software

Two types of software are needed for expert system: symbolic programs and expert system shells.

The expert systems were developed in symbolic programming languages. They have facility to process symbols rather than numbers. Expert system shells consist of a set of programs that provide an environment to declare rules and other knowledge. The shell also acts as an interface between the user and the expert system.

3. Knowledge

Expert system stores knowledge for decision-making. The knowledge may be represented in a meaningful way such as rule-based format or frame-based or a combination of both so that it can be retrieved to solve real-life problems.

4. People

Expert system requires some personnel with some expertise.

5. Knowledge Engineers

Knowledge engineers are responsible for creating an expert system. They interview domain experts and build knowledge base of the system. Their tasks are acquiring knowledge, modeling knowledge, and encoding knowledge.

6. Procedures

Both the users and expert system operators have to follow certain procedures for working with the expert system.   The procedures for normal operations and recovery operations have to be developed and maintained.

24.2.3 CHARACTERISTICS OF EXPERT SYSTEM

The following are some of the characteristics of Expert system:

- ❖ Expert system is capable of handling challenging decision problems and delivering solutions.
- ❖ Expert system uses knowledge rather than data for solution.   Much of the knowledge is heuristic-based rather than algorithmic.
- ❖ The knowledge is encoded and maintained separately from the control program.
- ❖ Expert system has the capability to explain how the decision was made. It can also state why a particular piece of information was needed for the solution.

24.2.4 WHEN AN EXPERT SYSTEM CAN BE USED?

An Expert system can be used if the following conditions are met:

❖ The problem cannot be specified in terms of a well-defined algorithm.
❖ The problem requires consistency and standardization.
❖ The domain or problem area is narrow or limited.
❖ When the task is hazardous.
❖ There is scarcity of experts in the area.
❖ The problem involves complex logic or a large number of rules.
❖ Human experts have successfully solved similar problems.

24.2.5 ADVANTAGES OF EXPERT SYSTEM

Expert System is an application area of artificial intelligence. Its purpose is to analyze how human experts make decisions and replicate this decision capability at affordable costs for organizations. It advantages are:

❖ It enhances decision quality.
❖ It reduces the cost of consulting experts for problem solving.
❖ It provides quick and efficient solutions to problems in narrow area of specialization.
❖ It offers high reliability of expert suggestions or decisions.
❖ It gathers scarce expertise and uses if efficiently.
❖ It can tackle very complex problems that are difficult for human experts to solve.
❖ It can work on standard computer hardware.
❖ It can not only give solutions, but also the decision logic and how the solution was arrived at. Hence, the explanation facility permits a review of the decision and its logic.

Check Your Progress 8

What are the advantages of Expert system?

Notes: a) Write your answer in the space given below

b) Check your answer with the one given at the end of this unit (pp180)

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24.2.6 LIMITATIONS OF EXPERT SYSTEMS

Expert System is not the result of a one-shot development. It is subjected to an iterative process of problem identification and refinement. Once the system is found to be working satisfactorily, it is implemented for consultation and decision-making. Some of the limitations of expert system are:

❖ It is difficult to extract expertise from human experts and hence the knowledge base may not be complete.

❖ Each problem situation is different from problem to problem. Hence, the solution suggested by a human expert is bound to be different from expert system solution.
❖ Expert system is effective in solving specific problems in narrow domains. It fails in properly analyzing problems in a larger area and in suggesting solutions.
❖ The cost and time required for developing expert system are very high. Hence, expert system is not affordable for most firms.
❖ Expert systems are expensive to build and maintain. In many cases the system has to be developed for the organization. If packages are installed they may have to be customized for the requirement of the organization.
❖ It is impossible to build any useful expert system as the expert system cannot capture all the assumptions on which real-life decisions are based.
❖ It takes long period of time to develop and fine tune an expert system.
❖ Large expert systems are difficult to develop and maintain.

24.2.7 EXAMPLES OF EXPERT SYSTEM
❖ Business Insight
This expert system offers facility for strategic analysis. It is based on knowledge from over thirty business experts. It identifies strength, weaknesses, inconsistencies etc. and gives a through explanation. Business Resource Inc. developed this system.

❖ Forecast Pro
It is a business forecasting expert system. The expert system examines data and the program helps the users in forecasting using statistical tools like exponential smoothing, regression, Box-Jenkins etc. This software is from Business Forecast System.

❖ Prospector
It is designed for use in prospecting for minerals. It recommends probable sites for mineral deposits.

❖ Mycin
It is a famous expert system for medical diagnosis. It diagnoses blood infections and recommends treatment.

Expert system is an extension of the artificial intelligence. The system is designed for mimicking experts in there are of expertise. It collects and stores knowledge and rules in its knowledge base. A user interface is provided to the user to interact with the inference engine in generating solutions and getting explanations. Expert systems are useful in tackling complex problems without the help of experts. They are used in a wide variety of applications such as diagnosis, design, planning, forecasting and control. Even though it is extremely useful for decision-making, it has its own limitations.

24.3 LET US SUM UP
1. Expert systems are designed to solve real problems in a particular domain that normally would require a human expert.
2. The expert system consists of two major parts: the development environment and the consultation environment.

3. The expert system builder uses the development environment to build the components and store expertise into the knowledge base. Non-expert user uses the consultant environment to get the expert opinion and advice from the expert system.
4. The expert systems have the components such as knowledge acquisition facility, knowledge base, knowledge-based management system, reasoning capability, work space etc

24.4 LESSON END ACTIVITY
Discuss how Decision is made by the Expert system

24.5 POINTS FOR DISCUSSION
1) What do you mean by expert system? Explain its components in detail.
2) List out the characteristics of expert system.
3) List out the advantages and limitations of expert system.

24.6 CHECK YOUR PROGRESS
1. Advantages of Expert system:
  i). It enhances decision quality.
  ii). It reduces the cost of consulting experts for problem solving.
  iii). It provides quick and efficient solutions to problems in narrow area of specialization.
  iv). It offers high reliability of expert suggestions or decisions.
  v). It gathers scarce expertise and uses if efficiently.
  vi). It can tackle very complex problems that are difficult for human experts to solve.
  vii). It can work on standard computer hardware.
  viii). It can not only give solutions, but also the decision logic and how the solution was arrived at. Hence, the explanation facility permits a review of the decision and its logic.

2.

Knowledge base is just like the database of information system. It stores knowledge and rules and explanations associated with the knowledge. Knowledge representation is a major task in expert system building. The knowledge must be meaningfully represented in the system so that the system can relate to real world problems.

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