MLS -05

APPLICATION OF INFORMATION TECHNOLOGY

Dr. B. R. AMBEDKAR OPEN UNIVERSITY

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COURSE TEAM

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COURSE - 05 : APPLICATION OF INFORMATION TECHNOLOGY

Information Technology has brought revolutionary changes in all spheres of human activity. Libraries and information centres are no exception. Information Technology has made its impact on acquisition, processing, storage, dissemination and use of information in libraries and information centres. To cope up with the changes the Schools of Library and Information Science in India have restructured their curriculum. Your university has introduced 'Application of Information Technology' as a core course, covering the essential components of IT, library automation, databases and networks, office automation and other applications of IT.

The course, Application of Information Technology, conforms to the syllabus of the Master of Library and Information Science (MLISE) offered by Dr. B.R. Ambedkar Open University. For the sake of convenience, the syllabus is divided into blocks, each of which comprises a number of units. Each unit generally covers a specific area of the subject. The units are prepared by specialists in accordance with the format so designed to enable you to read and understand them without much difficulty. Each unit begins with the structure (contents list) and statements of its aims and objectives, followed by an introduction to the content. The subject content of a unit is divided into subthemes which are numbered upto three levels for easy reference and comprehension. Each unit ends up with let us sum up, glossary, assignments, references and recommended books, and model examination questions.

This Course, is composed of four Blocks, each having about four Units.

The first block, Introduction to Information Technology, comprising of three units (1 to 3), gives an overview of information technology. Here the basics of computers (hardware, software and programming concepts), data communication and data processing are covered.

Block II on Library Automation, comprising of five units (units 4 to 8) is the largest block in the course. This block explains how computers can be used in-house in a library. After a discussion on generalized software development activity, all important activities in a library: acquisitions, cataloguing, circulation, serials control, OPAC, information service related tasks are covered.

The third Block with four units deals with databases and networks. One complete unit is offered for technical aspects of database – types, advantages, structure etc. The CD-ROM and Online databases and searching the databases are discussed from a librarian's point of view. After an exposition on technical aspects of computer data networks, how libraries can come together through networks to share their resources is explained with live examples.

The fourth and final block is completely on Office Automation. Role and importance of all types of communication (written, face-to-face, oral) and methods of achieving these through electronic and computer technology are explained in detail. Use of Internet in libraries and information centres is discussed at appropriate places.

After studying all the sixteen units and supplementing the same by going through a few books mentioned under references, the student should be having a broad appreciation on use of computers and communication technology in various aspects of library work and information services. The entire course is revised and updated in 2001 with an expectation to prepare the students to fit to face the new developments in IT and their challenges in library environment.

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BLOCK - I: OVERVIEW OF INFORMATION TECHNOLOGY

Among several technologies, Information Technology (in short, IT) has become the most important tool for scientists, technologists, businessmen, administrators, politicians, teachers and even to a common man. The integration of computers and communication technologies is commonly believed as Information Technology and it is this combination that extended the applications beyond the boundaries of a country. Before understanding the applications of IT in libraries one should have an overview of IT origin & development, components, programming concepts, etc.,

This Block consists of three units. The major objective of this Block is to provide a broad Overview of Information Technology as applicable to library and information work.

Unit 1: `Information Technology: Origin Development and Applications' introduces the Information Technology and provides a brief history of Computers. The general uses of computers are described in brief followed by the impact of IT on society – both positive and negative impacts are discussed.

UNIT 2 deals with hardware components of a computer. After describing the classification of computers in traditional ways, that is, Super Computers, Main Frame Computers, Mini Computers, Micro Computers and Personal Computers a brief discussion on recent trends is given. Several Input, Output and Storage devices are described. To help the librarian specify while purchasing a PC, a section on a typical configuration of a modern PC has been included. The Unit ends with a brief discussion on Data Communication so essential to link up computers.

The third and last unit in this Block takes care of Computer Software. Categorization of Software, Operating Systems are described. Concepts like program, program development, and programming language are explained. A description on how to go about developing a computer program is included. Information on several popular programming languages is given in the Appendix.

UNIT – 1: INFORMATION TECHNOLOGY (IT) – ORIGIN, DEVELOPMENT AND APPLICATIONS

Structure

1.0 Aims and Objectives

1.1 Introduction

1.2 What is Information Technology?

1.3 Origin and Development of Information Technology

- 1.3.1 Early History of Computers
- 1.3.2 Four Generations of Computer Development
- 1.3.3 Developments in Recent Years

1.4 Impact of IT on Society

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1.5 Information Technology – General Applications

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- 1.5.5 Health Care

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- 1.6.2 Information Services

1.7 Let Us Sum Up

1.8 Glossary

1.9 References and Recommended Books

1.10 Assignment

1.11 Model Examination Questions

1.0 AIMS AND OBJECTIVES

The aim of the unit is to provide a broad overview of Information Technology – a brief description of the phrase "Information Technology", Computers and their history; Use of Computers in general. A discussion on the impact of information technology on the society is presented in this unit.

After studying the unit you should be able to

- Explain what the phrase "Information Technology" means
- Narrate the history of computers
- Describe the various stages of development of computers
- Give examples of use of computers in daily life

- Explain the areas in library work where computers are used
- Discuss the good and bad effects of computer on Society.

1.1 INTRODUCTION

The world is undergoing a major social and economic change, a Second Industrial Revolution, through the new information-processing technology of communications and computers. Computer has penetrated all strata of the modern society. In fact, among all technologies, which have emerged in the 20th century, none has such a profound impact as the computer. It is now the single most important tool in the hands of engineers, researchers, managers, administrators, politicians, and many others. Computer, in turn, has given birth to a new industry broadly labeled as *Information Technology*, better known by its abbreviated form IT. IT is revolutionizing the way in which we live and work. It is changing all aspects of our life and lifestyles. The digital revolution has given mankind the ability to treat information with mathematical precision, to transmit it at very high accuracy and to manipulate it at will.

At first, computers were the experimental toys of university researchers and then they become the tools of government establishments and giant corporations. They were huge, expensive, individually designed and manufactured, and beyond the reach of any but the wealthiest organizations. The progress has been truly amazing. In only about 40 years, electronic communications have become commonplace and indispensable; computers have proliferated, becoming increasingly fast, powerful, small, and cheap, so that now there is scarcely a human activity in which they are not to be found. Since computer is the engine driving our Information Society, you need an understanding of this tool and its uses. Hence, you are introduced to this new world of Information Technology.

1.2 WHAT IS INFORMATION TECHNOLOGY ?

As the title of this Course-05 is: "Application of Information Technology", it is appropriate to discuss in this Unit briefly the meaning of the term "Information Technology" or IT as it commonly known. In a very broad sense we can say that Information Technology is the Application of Technology in Information Management. Information Management, as you may be aware, consists of a series of activities: Information generation, acquisition, storage, processing, retrieval, dissemination, distribution etc. In all these activities we use several technologies like printing, publishing, computers, communication, reprographics etc. A study of these technologies as applicable to Information Management activities is IT.

Generally, there are five major technologies people think of when one refers to IT. These are: Electronic and photon technology; Computer Technology including hardware and software; Communication Technology, particularly telecommunications; Artificial Intelligence and finally Human-Machine Interface Technology. For example, Photocopiers are electronic and photon machines; Computers as such along with several accessories like printers, scanners etc are used in Library activities. Electronic mail, fax, telex, E-mail form a part of communication technology; Artificial Intelligence Systems and Expert systems are used in sophisticated Information Retrieval applications.

Even among these five, only two get most noticed: Computers and Communications (C&C). Hence the common belief that IT means Use of Computers and Communications. In this course we shall deal with the study of use of computers and computer networks for all aspects covering Librarianship and Library and Information Science.

1.3 ORIGIN & DEVELOPMENT OF INFORMATION TECHNOLOGY (IT)

History of Computers had taken its roots with the abacus. In Asia, the Chinese were becoming very much involved in commerce with the Japanese, Indians, and Koreans. Businessmen needed a way to tally accounts and bills. Somehow, out of this need, the abacus was born. The abacus is the first true precursor to the adding machines and computers. For over a thousand years after the Chinese invented the abacus, not much progress was made to automate counting or in mathematics. The Greeks came up with numerous mathematical formulae and theorems, but the entire newly discovered math had to be worked out by hand.

1.3.1 Early History of Computers

Blaise Pascal, a French Philosopher and mathematician, is most remembered among the computer scientists as the inventor of the calculator. In 1642 he presented this his father to assist him. This calculator called the *Pascaline* resembled the mechanical calculators used in the 1940s.

In 1801 Joseph-Marie created the Punched Card Loom. This device was a new type of loom for weaving cloth. Punched cards controlled its operation. Needles could pull threads through cards where there were holes and not where there were any. This scheme paved the way for punched holes in cards to provide data and direct the actions of punched-card machines and computers.

Thomas de Colmar (1785-1870) invented his first *Arithmometer* in 1820. This was the first mass produced calculator. It did multiplication. With some assistance from the user, it could do division as well. This device was widely used, but the importance of it was the inspiration that it later caused.

While Thomas de Colmar was developing the first successful commercial calculator, Charles Babbage (1792-1871) realized as early as 1812 that many long computations consisted of operations that were regularly repeated. He theorized that it must be possible to design a calculating machine, which could do these operations automatically. He produced a prototype of this *"difference engine"* by 1822 and with the help of British government started work on the full machine in 1823. It was intended to be steam-powered; fully automatic, even to the printing of the resulting tables; and commanded by a fixed instruction program. In 1833, Babbage ceased working on the difference engine because he had a better idea. His new idea was to build an *"analytical engine."* The analytical engine was a real parallel decimal computer, which would operate on words of 50 decimals and was able to store 1000 numbers. The machine would include a number of built-in operations such as conditional control, which allowed the instructions for the machine to be executed in a specific order rather than in numerical order. The instructions for the machine were to be stored on punched cards, similar to those used on a Jacquard loom.

Ada Byron (1815-1852) was one of the picturesque characters of the early history of computers. Her published analysis of the Analytical Engine is our best record of its programming potential. In it, she outlines the fundamentals of computer programming, including data analysis, looping and memory addressing. Published in 1843, Ada's prescient comments included her predictions that such a machine might be used to compose complex music, to produce graphics, and would be used for both practical and scientific use. Ada even suggested to Babbage writing a plan for how the engine might calculate Bernoulli numbers. This plan is now regarded as the first "Computer program." A software language developed by the US Department of Defense was named Ada in her honor in 1979.

In 1890 Herman Hollerith applied punched card techniques for use in compiling and tabulating the census. The use of punched cards and tabulating machine resulted in substantial savings in cost and time. Then Hollerith began to adopt his census Tabulator to commercial work. To this end, he organized the Tabulating Company, which subsequently merged with other companies to become the IBM Corporation.

Konard Zuse, a German engineer, completed the first general-purpose programmable calculator in 1941. He pioneered the use of binary math and Boolean logic in electronic calculation.

During World War II, a group of scientists led by Max Newman including Alan Turing in England used a series of computer-like machines to decrypt coded messages used by the German high command. These machines became an electronic marvel. The first prototype called Colossus began operating in February 1944.

Necessity is the mother of invention. The US Defense Department needed a better system of computing the firing and ballistic tables for their missiles. J. Presper Eckert and William Mauchley at the Moore School for Engineering of the University of Pennsylvania developed ENIAC, Electronic Numerical Integrator and Calculator in 1946. The machine filled a 30 feet by 50 feet room and weighted 30 tons. The computer had 18000 vacuum tubes. Programs were stored on plug boards that had wires wrapped around pins. Numbers were entered by turning a series of dials until they correspond to the proper digit.

In 1945 John Von Newmann wrote a paper describing how a binary program could be electronically stored in a computer. Newmann in his paper demonstrated that a computer could have a simple, fixed structure, yet be able to execute any kind of computation given properly programmed control without the need for hardware modification. He contributed a new understanding of how practical fast computers should be organized and built; these ideas often referred to as the stored-program technique, became fundamental for future generations of high-speed digital computers and were universally adopted. The first-generation stored program computers required considerable maintenance, attained perhaps 70% to 80% reliable operations, and were used for 8-12 years. Typically, they were programmed directly in machine language, although by the mid-1950s progress was made in several aspects of advanced programming. This group of machines included EDVAC and UNIVAC, the first commercially available computers.

IBM introduced the IBM701 as its first electronic stored-program computer. Herlan Herrick ran the first successful FORTRAN program in 1954. In the same year Gene Amdhal developed the first operating system, which ran on the IBM704. The IBM 360 was introduced in April 1964 and quickly became the standard for institutional mainframe computer. By the mid-80s, IBM 360 and its descendants had generated more than $ 100 billion in revenue for IBM.

In 1981, MS-DOS runs for the fist time on IBM's prototype microcomputer. Microsoft bought all rights to DOS from Seattle Products, and the name MS-DOS was adopted. The first IBM PCs rolled off the assembly lines. Rapid advances in semiconductor technology since 1960s have made possible tremendous increases in computing power at plummeting costs. Some 40 years ago a computer could be afforded only by large organizations. Now personal computer is within the reach of even individuals.

1.3.2 Four Generations of Computer Development

Developments in computers are categorized as generations. The developments from one generation to the next generation are given below:

Table 1 : Developments in Computers

Period	Size	Speed	Components	Capabilities	Cost
1942-59	Macro	-	Vacuum Tubes	Performs tedious and lengthy computations	Expensive
1959-65	Mini	Single operation in millionth of a second	Transistors; printed circuit cards	Little computation. Reliable and efficient. Acts as a control cards	Less expensive
1965-70	Micro	Single operation in billionth of a second	Integrated circuits	Basic power to perform a great variety of small and large tasks simultaneously	Less expensive
1970-	Personal computers	Postage stamp size can store 50 billion characters and so the speed	Laser memory Optical storage memory	Multiprocessing Parallel processing Data communications	Less expensive

In 1984, Apple Computers introduced the Macintosh machine. This was so easy and intuitive to use that thousands of individual users as against institutional users took to computers easily. Same year saw the introduction of the 3.5" floppy disk. This became and still continues to be the de-facto standard for small volume storage and transfer of computer data from PC to PC. In 1985, CDROM disks with a capacity of 650 MB were introduced. Now we have DVDs with a capacity of 17GB as a common feature. 140GB DVDs are said to be in the pipeline (Aug 2001). Over the years, hardware capabilities have been increasing manifold and costs have been coming down.

The following Table illustrates how Computer Chips have been packing more and more transistors over the years.

Table 2: Packing of Transistors in a Chip

Packing of Transistors in Computer Chips			
SN	Year	Chip	Number of Transistors
1	1986	Motorola 80386	0.3 million
2	1989	Intel 80486	1.2 million
3	1999	Mobile P III	27 million
4	2000	Pentium 4 CPU	170 million

1. 3. 3 Developments in Recent Years

During the 1980s the emphasis was on networking of computer systems through several types of networks like Local Area Network, Wide Area Network etc. Initially networking was used to access Mainframe computers from users terminals and share the

computing power and resources of the Mainframe. Thereafter networking was used for "Client-server Computing" where computers at both ends took part in computational activities though the part played by Server was high. Now networking is used for "distributed computing": here several computers share the burden, some keeping data, some the programs etc.

Last decade saw the emergence of Internet. Internet, a powerful network of networks, was thrown open to public in 1992. Earlier to this, Internet was restricted to R&D, defense and academic and governmental organizations only. Rapid growth of Internet (especially one of the there services available there called World Wide Web) in the recent years has been phenomenal and unimaginable. Growth of Intranets – Internet facility exclusively used for a limited user group say that of a company - is another development during the last four years.

Internet on TV, Internet on Cell Phone, Telephone conversation via Internet, Video-conferencing over Internet are some recent happenings. As seen from the recent happenings, during the past few years (1999-2001) there has been a total convergence of several technologies: Distinction among technologies like telephony, telex, fax, computer, communication, cable, TV etc are diminishing. So much so, India is one of the few countries to have enacted Information Technology Act in May 2000. A draft bill called Communications Convergence Bill is also under consideration (as of Oct 2001).

1.4 IMPACT OF INFORMATION TECHNOLOGY ON SOCIETY

The early applications of computers were in the areas of Government Research and were applied to the solution of business problems. Today computers have affected the lives of each and every one of us. It is being put to use everywhere – homes, organizations of all sizes. No doubt computers have a strong impact on people. Computers have been responsible for ushering into the era of information revolution. However, in the wake of developments in computers, there are problems also. Let us briefly summarize the positive and negative impact of computers on people.

1.4.1 Positive Impact

The positive impact of computers is directly witnessed in the areas of education, medicine, business, industries, administration, entertainment, etc.

a) Computers at Home: Self-Study and Entertainment

Life is now unthinkable without computers. They are everywhere and touch everyone's life. Millions of people use *home computers* for education and information. The children and adults in homes use many of the educational software programs. Encyclopedias, dictionaries, atlases, almanacs, telephone directories, medical references, and other specialized references now come in low-cost CD-ROM versions – often with multimedia capability. More up-to-the-minute information is available from the Internet.

People use home computers mostly to play games. Most computer games are simulations. Computer games can simulate board games, card games, sporting events, intergalactic battles, and street fights.

Computers have now become an integral part of the *entertainment industry*. Digital video cameras capture images on silicon chips rather than on the 16- or 35-millimeter film that spools through a traditional film camera. Such digital data can be transmitted to cinemas via satellite or fiber optic cables when digital projectors become widespread.

b) Movie Making

Computers are used for creating dazzling special effects in movies. They give movie makers a lot of options by giving them the power to create the kind of special effects they want –those that were not possible in olden days. They are used in creating full-length movies with cartoon characters. Computers help in composing, editing, recording and reproducing music and sound effects. The computers can create outer space, alien characters, extinct animals and so on without the need of creating their physical models. Thus, computers and information technology have helped the film industry in reducing the cost of production as physical models and sets are no longer required.

c) Medical Field

Computers are revolutionizing the *medical field*. They are used for everything from diagnosing illness and monitoring patients to controlling movements of robotic surgical assistants. Robot helps perform open-heart surgery. A team of French surgeons has performed six open-heart operations by remote control using a computer-linked **robot**. Health care professionals achieve greater efficiency in conducting research into complex problems with the aid of computer. These studies could not have been conducted without the computers.

d) Education

Computers allow students to learn lessons based on the *drill-and-practice* principle. The computer-based training software allows students to learn at their own pace, in small steps and give feedback about how much they have learned. These are the same principles of the drill-and-practice methods – individualized rate, small steps and positive feedback. A traditional drill-and-practice program presents the student with a question and compares the student's answer with the correct answer. If the answer matches, the program offers praise, possibly accompanied by music and animation. If the student's answer does not match with the correct answer, the program offers an explanation and presents another similar problem. The program may keep track of the student responses and tailor questions based on error patterns; it might also provide reports on student progress to the teacher.

Teachers use computers and multimedia technology to create in-class presentations. From teacher's point of view, the advantage of computer technology is that the material can be customized to meet the needs of the class. Instead of using commercial transparencies and handouts deigned for generic classrooms, a teacher can create custom visual aids for specific classes. Instead of being forced to move through videotapes sequentially, the teacher can choose to present material any order.

e) Legal Profession

Lawyers use online databanks to locate precedent cases in order to serve clients better. They can also use computers for following up court cases. Many have started using sophisticated dictating systems to record their data by speaking into audiotapes or directly into computer systems. Medical and legal transcription is growing n a big way.

f) Sales and Marketing

Sales people receive information online about the products in stock, marketing strategies of their products from their company and improve their sales performance.

g) Office Automation

There is a great revolution in office automation. People in office seldom use paper as a carrier of information. They exchange predominantly softcopies of files, office memos, notifications etc, using their computers and the Intranet facilities.

h) Consumers

Benefits to consumers of goods and services that are provided by organizations using computers are many:

- Improvement in productivity and reduction in prices as availability of products is more
- Higher quality of product, better design and improved performance.
- Better services and prompt redressal of grievances without long waits

i) Common Man

Most of the public utility services like electricity, water, property transactions, Air, railways and bus bookings, transport and communication services like fax, telex, telephone etc. have been greatly improved due to computerization. There are Information Kiosks everywhere providing multiplicity of computer related services just like photocopying centers.

j) Safety and Security

Computers contribute in a very big way to personal safety. Computers are applied in aircraft design, automobile transmission and gas utility companies where safety measures are incorporated through computers. Automobiles are fitted with computers, which take care of driver's safety. Providing Fire Alarm Services, Theft alerting devices etc as a part of building automation is common.

k) Libraries

As far as Library and Information Science areas are concerned, computers are extensively used for information storage and retrieval. Librarian has made early use of computers for library and information applications. Libraries created integrated systems in which the traditional library functions viz., circulation, cataloguing, the public catalogue, acquisitions and serials check-in were computerized using the library's database as the foundation. A veritable sea change has occurred in the last five years, however. Today's integrated system not only provides modules automating the traditional library functions but also is capable of connecting through the local system into systems of other suppliers, databases – bibliographic and full content, online and CD-ROM – and the *Internet.*

The *Internet* represents what is potentially the most important economic/technological innovation of our time. What makes the Internet so exciting is its potential to transcend geography to bring information on myriad topics directly to the desktop. All over the world, libraries have begun the Herculean task of making faithful digital copies of the books, images and recordings that preserve the intellectual effort of humankind. For armchair scholars, the Internet promises to bring such a wealth of information to the desktop.

One of the striking facts about this technology is that it has spread rapidly from the scientific community to other computer users in advanced countries and then the third world. Three years ago, most of Africa was not connected to the Internet. Today virtually every country is connected. The extent of usage is critical for the Internet to achieve the position as marketplace for goods, labor and ideas that the stock market expects. Individuals without access or without the knowledge of how to use the Internet are likely to form a new socially excluded group in the future.

l) E-Commerce

By logging on to appropriate web sites of commercial firms and vendors you can buy books, CDs, Music Cassettes, gifts, travel tickets, hotel accommodation etc using computers.

The convenience of shopping from home using credit cards brings shops to the house. Payments to utilities, Drivers License, various types of certificates from government offices can be and through computers.

m) Messaging and Email

Electronic mail has revolutionized sending and receiving of personal messages across computer networks. Even if a person does not have a computer he can send email using cyber cafes and information kiosks. There is a complete Unit in Block 4 on Electronic Mail.

n) Better Job Opportunities

It is well known that new job opportunities are increasingly available for people with requisite qualification and experience. IT jobholders enjoy better pay packets and perks. New careers have opened up in Computer teaching shops, Call Centers, Transcription centers, hardware and software companies, Internet related areas.

Overall we can say that computers have made our lives a lot easier, improved our quality of life, they have increased our level of expectation of service quality from service providers. They are also becoming indispensable, at least in urban areas.

1.4.2 Negative Impact

Just as we have a number of advantages there are a few disadvantages of using computers. Let us see some of these now.

a) Over Dependence

In addition to the too many benefits we drive from computer applications, we also have negative effects and problems. The complete dependence on computers can lead to serious and often insurmountable problems should they malfunction or fail completely. Just like we feel miserable when there is a power failure, non-availability of computers can leave us utterly helpless.

b) Inaccurate Data

There is a great deal of concern on the part of many individuals with respect to their lack of control of knowledge concerning information about themselves and concerning who might have access to this information and for what purpose. Data are sometimes gathered without any valid reason or check about its accuracy and as a result many people are victimized by systems errors and inaccurate data input.

c) Unemployment

Major scare about the impact of computers on the organizations is about displacement and unemployment of manpower. Computers can perform many jobs at a time automatically and eliminate manual operation that causes displacement of existing manpower. This results in major unemployment problem. This is more predominant in labor-intensive organizations where labor is being replaced by computer programmable robots.

d) Data Confidentiality

Data secrecy and data integrity are the other major issues. This is more in strategic areas like defense, space, banking etc. It is difficult to maintain the secrecy of the data since the systems and data are accessible to many people. For instance, a reference librarian can make moral judgments not to provide information on how to make a bomb or how to commit suicide, but inanimate systems such as information system cannot. Availability of computer systems has become more predominant and hence the security aspect has become more

critical. More and more people now have skills in programming, manipulation of computer systems and have been able to make use of the data causing difficulty in maintaining secrecy.

e) Data Privacy

The privacy issue is another major problem like data secrecy and it is difficult to maintain privacy. Personal data available on network of computers may be put to unauthorized use or misuse by government, commercial organizations or black mailers. In the absence of proper controls, knowledgeable employees can steal data and program with their skill and sell the same as if it is their data. They may erase data and cause damage to vital organizational systems if they are not happy with their management. This is called hacking into computers.

f) Stress among IT workers

Computers can cause organizational stress due to reshuffling of people to undertake automation jobs. Creating new departments or removing some existing departments disturbs staff in the existing departments. The people affected by such changes may react in different ways. Some people get adjusted to the new jobs but some resort to open opposition and even sabotage the systems. During this process a number of stress symptoms may occur. Some employees may find it difficult to cope up with the technological changes and challenges posed by the same.

g) Attitudinal Problems

There is a pessimistic view on the application of information technology increases unemployment, leads to depersonalization, threatens our right to dignity and privacy and threatens to pollute or blow up the world. Computers and technology may be looked upon as a curse of humanity.

h) Health problems

Computer may cause damage to personal health and hygiene. Persons sitting before the terminals continuously for hours together are vulnerable to ultraviolet radiation emitted by the displays from visual display unit. Vision of the persons also gets affected as they continuously scan the information on the small screen. Continuous sitting in bad posture may lead to back pain. Constant use of fingers may cause severe pain chronic in fingertips and bones of the hands.

i) Electrical Shock

Computers are electronic gadgets and hence run on electrical energy. Computer personals are vulnerable to the hazards associated with electrical energy like short circuits, power failure, shocks etc.

j) Virus Attacks

Virus may attack computers, especially if they are inter-connected by a network. Computer viruses are programs that are written with a bad intention of causing damage in computers. Viruses may destroy data, re-write them, make programs to malfunction, make computers slow down etc. Prevention, detection and cleaning of viruses are time-consuming costly jobs.

1.5 INFORMATION TECHNOLOGY: GENERAL APPLICATIONS

As discussed earlier, information technology has revolutionized the human environment in a very big way. Today you will find the impact of computers in all walks of

life. It has mesmerized the people to such an extent that nobody can ignore the application of computers in their daily life. We are just crossing the threshold of this new information era in which you will live and work. There is a flood of personal computers everywhere. Computer finds its way in cloth stores, grocery shops, homes and not to speak of larger applications in scientific research, health care, transportation services, space communications, machinery design, banking sector, factories, schools, laboratories, offices, government agencies and department stores. In addition to these visible general-purpose systems, there are 'invisible' special purpose computers everywhere we turn-in our appliances, vehicles and wrist watches. Computers have literally pervaded the entire world. In fact, if all computers malfunction today, there is no life on earth. Airplanes will not fly, trains will not run, cars and elevators can not move, traffic lights and telephones would be useless and there will be utter confusion and chaos.

The computer revolution is for all practical purposes a second industrial revolution. It has created many careers for tens of thousands of people all over the world making data processing big business. In terms of capital investment there is a phenomenal increase from million dollars in 1950 to an expected one trillion dollars by AD 2000.

1.5.1 Business Applications

Computers were initially applied to business transactions. Mainly accounting and payroll transactions were computerized. Computers can be applied to prepare pay-bills for the employees of an organization. This involved the data input of various earnings of an employee like Basic, DA, HRA and other allowances and deductions like provident fund, savings towards insurance premium, taxes (professional and income tax) and any recoveries due to advances taken from the company towards festivals, house building, motor car and others. Deductions also include the wages for non-attendance to duty without applying for leave and loss of pay due to non-availability of leave etc. The job of preparing the payroll with all the above up-to-date details in organizations becomes increasingly more difficult as the number of persons employed increases. Manual operation of the job is error prone also, whereas a computerized payroll system is advantageous in which the operations can be performed with much ease.

In addition, computerized system can help us in preparing many detailed and timely reports for the management. Such reports can facilitate a careful and fruitful evaluation of the organization that would otherwise be impossible. Reports, if desired by management, might include details of:

- Employee daily performance record that will be useful when considering employees for increases in salary and responsibility.
- Absentee ratio by department that will be useful for the management to know the departments that are exceptionally good in attendance and with bad attendance record.
- Employees earning, savings and recoveries that will be useful in sanctioning further advances and other financial benefits.

There are some of the many reports that an automated payroll system can provide us. Inventory Control, Production Planning and Monitoring, Market analysis are other areas where computers may be used in businesses.

1.5.2 Science and Technology

Application of computers in science and technology is enormous and present day life is an indication to this. Complex problem can be solved through computers. All fields of

science and technology have been transformed with the application of computer and telecommunication technologies. Computer application is conspicuous from a classroom to a laboratory and to a factory where a product is manufactured. Personal computers have entered the classrooms and even tiny tots are taught computer operations, which is a new world for them. Computers are extensively used in educational and training to impart a variety of skills in an effective manner.

In laboratory scientific operations are performed with computers in a safe and healthy environment. Advanced applications of computers by using Computer Aided Design (CAD), AutoCAD, Computer Aided Manufacturing (CAM), Computer Aided Engineering (CAE) etc., a complex design of a component and a laboratory experiment in a nuclear engineering area can be performed without any hazard which was the case with manual operation earlier. For example, computers are used in nuclear reactor design, aircraft design, missile design, space vehicle design and their launching operations in real time situation. An illusory atmosphere of flying in sky is created in a closed room on earth by applying computer simulation. Here pilots are trained to monitor the operations in an artificial atmosphere before they take off in a real time simulation.

Likewise, a spacecraft is designed and experimented with computer simulation methodology. In a workshop, working of heavy machinery can be programmed with the help of computer. In a shop floor, material can be moved from one place to another with the help of a *robot* that is again programmed to do manual work without actually involving men. A robot can be programmed in a schedule so that it carries out jobs mechanically as per the time schedule assigned. Many routines and repetitive jobs can be performed through computers and drudgery of physical labor can be completely avoided.

1.5.3 Home Needs

Computers have found their way into homes. Family members are using millions of home computers. Video games with entertainment and educational value are common. Business people to keep telephone numbers and addresses for handy reference also use home computers. Also used for preparing letters and tax returns and carry out countless business related tasks. We have already seen how they are used in homes for education and entertainment.

1.5.4 Office Automation

Computers in offices perform multifarious functions. Computers and communication technologies have revolutionized office atmospheres. Phrases like *office automation, electronic office* have been coined on this revolution only. Computer-based word processing software can efficiently create, edit and print documents and electronic mail system accept messages from a setting station, store these messages in electronic form and transmit them on demand over communication channel to the stations of recipients. There is whole block (Block 4) on Office Automation.

1.5.5 Health Care

Computer applications to health care are one of the marvels of this century. Sex determination and malformation of organs can be detected before the birth of a child through computer scanning. It means that except creation of human being every thing is possible by man. Information about the doctors and their specialization can be stored in a computer and accessed by any person in an emergency and doctors can be easily contacted. In USA and other places such information is available round the clock to all the people who have access to computer.

For Example, Apollo Hospital in Hyderabad provides Telemedicine facility for heart patients. The patient is given an instrument, which he has to use at the time of distress; the instrument will dial itself to the hospital computer system, transfer details of heart condition on-the-fly so to say, so that the expert doctor in the hospital can observe and suggest suitable action. This can happen without the patient having to visit the hospital saving time in cases of emergency.

1.6 *IT* IN LIBRARY AND INFORMATION SERVICES

By now you have already become aware of the role of computers in the present day world. Let us discuss briefly what computers or information technology has contributed to our profession of Library and Information Science. This section is broadly divided into two sub sections.

1) Library house keeping applications

2) Information storage and retrieval

What is presented here is just an overview. You have a complete Block – Block 2 devoted to this important topic.

1.6.1 Library House-keeping

Computers have already been employed in various library housekeeping functions all over the world. Library housekeeping broadly involves functions like acquisitions, circulation, cataloguing, and serials control. In all these functions most of the operations take a lot of time in manual operations and more over they are not error-free. With the advent of computers these functions have now been made foolproof. Computer operation of these functions makes them interesting and removes drudgery in routines, which was noticed in manual opersation.

Broadly speaking the individual function such as acquisition involves selection of books, locating the suppliers, placing orders, filing and reminding for the pending orders, certification of bills for payment, maintaining and monitoring budget allocations and expenditure of various heads of account. In addition to these regular functions, there are other occasional functions like preparation of statistical reports required by management on number of books acquired on a particular subject during a given period, budget allocation and expenditure over a number of years to asses its growth rate and improve the performance. Wherever required, performance of certain budget allocations, vendors for prompt supply of books etc. can be made possible with the application of computers. Likewise the other housekeeping functions mentioned earlier are being computerized for getting innumerable benefits, which are not available in manual operations.

1.6.2 Information Services

The term information services came into existence because of computer applications only. All libraries are now acquired a special status in the society with introduction of computer-based information services and they are now treated as information centers instead of mere libraries. In fact the service component has been added in the libraries with the advent of computer applications only. Hitherto libraries were considered as storehouses of books and people had to refer the books and other documents and toil hard to find the required information for themselves. The librarian was acting only as a custodian of library collection without much hope for him to offer to the readers by way of information service. The scenario has been completely changed for the better.

Computers are engaged in creating a database of information to form a basis for retrieving the right information at the right time in a format required by the user. The information that goes into the database ranges from data on book held by the library to data on the actual contents of each book, journal, pamphlet, report etc. A separate database or composite database can be created for its eventual search and retrieve the required information within a matter of minutes. A research library or a special library requires creation of such databases abundantly to save the time of the reader as envisaged in the laws of library science.

Developments in communication technology have greatly helped computers more so the information service to transmit the data from one corner to the other in a much faster way. Users at remote corners are greatly benefited by accessing the database in an interactive mode and getting aware of the state-of-the-art in their areas of interest. Updating of information and keeping abreast of latest developments and similar terms are quite common now with the introduction of computer application to information services. Research and developments in computer technology has yielded more sophisticated systems and refined techniques in information services.

Computers and communication technology have helped emergence of networking concept in which a number of computers can be linked up and data in one computer can be accessed simultaneously by the other computers. Artificial intelligence is a branch of computer science that involves in using computer to solve problems that appear to require human imagination or intelligence. Expert systems are the products of research in the field of artificial intelligence.

1.7 LET US SUM UP

We have explained what the term "Information Technology" means and discussed the history, origin and development of Computers. Early history of computer technology and the development of ranges of computers in the form of generations have been described. We have seen the positive and negative impact of computers on society and environment. We have dealt with the general applications of computers in business, science and technology, health care, home needs and office automation. Finally we have discussed specific applications of computers to library and information services.

1.8 GLOSSARY

Abacus: A device that was used by Babylonians in early 2200 BC for doing calculations.

Artificial intelligence: Branch of computer science concerned with the design of computer systems so that they have attributes associated with intelligence such as games playing.

CAD: Computer Aided Design. It is the process of design, using computers as aids.

CAE: Computer Aided Engineering

CAM: Computer Aided Manufacturing

Expert System: A system using the techniques of artificial intelligence, in particular use of logic other than Boolean. Usually such systems are based on a set of rules (and are hence known as rule-based systems). By applying these rules, the program can estimate probabilities and so seem to be an expert in a particular subject.

Generations: A term used to indicate the stages of development in computer memory and its processing capacity.

Integrated Circuits: Electronic circuits used in computers to store memory.

Internet: A group of interconnected networks of computers throughout the world.

Networking: Connecting a computer to various other computers through communication lines to share the data stored in all the computers simultaneously.

Office Automation: A term used for computer application of office routines.

Personal Computers: A single user oriented computer-processing system to perform a wide variety of tasks.

Robot: An artificial device programmed to do a manual work exactly like a human being.

Simulation: To represent and analysis properties of hypothetical system by the behavior of a system model

Transistors: Electronic computers used in second generation computers to store memory.

1.9 REFERENCES AND RECOMMENDED BOOKS

FUORI, William H. *Introduction to computer*. 2nd ed. Englewood Cliffs: Prentice-Hall, 1977.

SANDERS, Donald H. *Computers today*. 3rd ed. New York: McGraw-Hill, 1988.

TREMBLAY, H.P. *Introduction to computer science*. New York: McGraw-Hill, 1981.

LEON, Alexis and Leon, Mathews. *Fundamentals of information technology*. Chennai: Leon Techworld, 1999.

1.10 ASSIGNMENT

Talk to 20 persons whom you know and ask them how computers have affected them; summarize their views in a two-page essay.

1.11 MODEL EXAMINATION QUESTIONS

1. ESSAY QUESTIONS

1. Explain what "Information Technology" means. Discuss the positive and negative impact of Computers on our society.SS
2. Describe the history of Computers from the earliest times till the present day, describing important milestones.
3. Describe how computers are useful for humanity citing examples from various fields like Science & Technology, Engineering, Business, Government, Education, Health and others

II. SHORT NOTES

a) Personal computers

b) Super Computers

c) Generations of Computers

d) Employment and Information Technology

e) Computer Viruses

f) Convergence of Technologies

UNIT– 2 : COMPUTER SYSTEMS : HARDWARE, SOFTWARE AND DATA COMMUNICATION

Structure

2.0 Aims and Objectives

2.1 Introduction

2.2 Computer Systems: Types of Computers

- 2.2.1 Supercomputers
- 2.2.2 Mainframe Computers
- 2.2.3 Minicomputers
- 2.2.4 Microcomputers
- 2.2.5 Personal Computer
- 2.2.6 Recent Trends

2.3 Organization (Structure) of a Computer System

- 2.3.1 Input Devices
- 2.3.2 Output Devices
- 2.3.3 Storage Devices
- 2.3.4 Typical Configuration of a PC

2.4 Data Communication : Systems and Networks

- 2.4.1 Data Communication: What and Why
- 2.4.2 Data Communication Systems
- 2.4.3 Data Communication Networks

2.5 Let Us Sum Up

2.6 Glossary

2.7 References and Recommended Books

2.8 Assignment

2.9 Model Examination Questions

2.0 AIMS AND OBJECTIVES

Due research and development computer hardware and software technologies have grown enormously in recent times. The aim of this unit is to explain basics of computer hardware including data communication.

At the end of this unit, you will be in a position to

- list and describe various categories of computers
- categorise the computers into various types - super, mainframe, mini, micro or personal computers
- describe the organization of a computer system - input, output and storage devices
- describe a typical configuration of a modern Personal Computer
- discuss data communication systems and networks with respect to computers.

2.1 INTRODUCTION

Like any other machinery or device, computer has also its limitation regarding its processing function, storage of memory, design and capabilities it can perform. Depending on the requirements and speed and efficiency, computers have been developed. Sophistication in design has been effected due to continuous research and development in computer science and technology. Many computer manufacturing firms have entered the market and they have revolutionised the design. The cost of computers has also come down and making their availability more abundant now. They are at affordable prices and as such the scope of computer applications has been extended to many areas. We find that computers are used in homes and small offices.

In the first Unit we saw a brief history of computers developed over the past few decades. In this unit a detailed discussion is provided based on the size of computers like Super Computers, Main Frame, Minicomputer, Microcomputer, Personal Computer etc. Hardware components of a computer: Input and output devices, storage and memory devices; A closer look into the typical configuration of the all pervading PC is given. Extension of computers to a wide area of applications through telecommunication networks so as to link up more than one computer situated at remote locations is also described.

A computer is incomplete without software. Hardware is all that you can physically touch and see. Software is a set of programs written in certain programming languages. This is like human intelligence that cannot be seen but its existence and effect can be felt by other methods. In this Unit we shall deal only with hardware components. As connecting up computers for mutual sharing of data also needs different types of hardware (phone modem, telephone lines etc) a discussion on data communication is also included in this Unit. Computer Software will be discussed in Unit 3.

2.2 COMPUTER SYSTEMS : TYPES OF COMPUTERS

Computer systems used to be classified as Super Computers, Mainframe Computers, Mini Computers, Micro Computers and Personal Computers. This categorization was based on several factors like, the physical size, memory, data storage capacity, speed of execution of instructions, word-length (that is at the most fundamental level, how many bits can be handled at a time), versatility (different types of uses that a system can be put to), power, cost, etc. We will take brief look into this classification, though such differences among the types are decreasing. Therefore in the following discussions, details of word length, speed etc is subject to change with progress of time.

2.2.1 Super Computers

These are very large sophisticated computers, with extremely large data storage capacities, equipped with multiple set of very fast processors. They are used where high speed, real-time, accurate computing is needed – for example in weather forecasts, scientific computation, missile navigation etc. PARAM and CRAY are examples of Super Computers. They have a word length of 120 characters or more. They also possess very large core memories of the order of a few Giga Bytes.

Supercomputers are very expensive and only a few organizations in the world can afford to have. It is a national resource for any country. USA and Japan are competing to produce more powerful supercomputers. Intel is developing a Supercomputer using 9000 Pentium Processors with a speed of 1.8 tera flops.

PARAM computers, produced in India, were recently used during Pokhran Tests. Computers identified suitable time slots for conducting the nuclear tests. Actual blasting tests were carried out in such a schedule that the surveillance (spy) satellites can not get a glimpse of activities on the test ground.

2.2.2 Mainframe Computers

Third generation computer, introduced in 1964, is a family of mainframe computers. Mainframe computers ranging in size from small to very large, are typically grouped together under family designations. They are 32, 48, 60, 64 bit machines. They are more powerful than mini and super-mini computers and less powerful than Supercomputers. Mainframes are used to process a high volume batch applications, to manage large databases and to act as central host computers in distributed systems and to perform thousands of other tasks. By virtue of their large processing capacity, mainframe computers can process data faster than minicomputers and personal computers. In smaller computer, we find a single control unit, primary storage and arithmetic logic sections in the processor unit. In a mainframe several processors (multi-processors) are used to process several tasks simultaneously at a time.

Most of the software packages developed in the past by large manufacturers have been written for mainframes only. Mainframe suppliers can provide customers with a high level of applications design support and maintenance service.

Mainframe computers are housed in a central place in an organisation and terminals are provided in remote locations through communication links from the mainframe. Most of the high level programming languages are available for mainframes.

2.2.3 Mini Computers

The first mini computer was built in 1965 by Digital Equipment Corporation (DEC), now they are the largest producers of mini computers in the world. Minicomputers are small general purpose systems but they serve multiple users. They are more powerful than micros and less powerful than mainframes. In size they vary from desktop models to the size of small file cabinets. The superminis have given the advantage of the performance of small mainframe computers at less cost.

Minis are used for single specialised applications or a number of general applications in a small organisation. They can be used for high speed transaction processing in a financial industry. They are also used for linking mainframes and outlay remote terminals to handle the flow of information. High level programming languages are now available in minis as like mainframes. Minis fit in between mainframe computers and personal computers. DEC, Varian, Hewlett Packard are some popular Mini Computer brand names.

2.2.4 Micro Computers

Microcomputers are the smallest units. They may be the tiny special purpose devices dedicated to a single task such as time keeping in wrist watches or controlling an automobile ignition system. They may be familiar personal computers, ranging from desktop to pocket size that we can use in a number of ways. Micro computers can perform the same operations and use the same type of instructions as much larger computers. Micro computers give people personal processing capabilities and main frames hold many billions of bytes of data important to an organisation. Thus micro users have sought ways to get at mainframe data extract the facts they need and store these facts in their microcomputers where they can be manipulated and analysed by micro computer applications software. From micro computers files of interest to other managers can be sent to mainframe database for further distribution.

2.2.5 Personal Computers

Personal computers came like an avalanche into the market since 1975. Personal computer is a general purpose micro computer system that executes program instructions to perform a wide variety of tasks. Personal computers come in many shapes and sizes. Some are note book sized or smaller and weigh less than 4 pounds. Other briefcase sized portables weigh a little more. Then comes suitcase sized transportables that usually substitute small Cathode Ray Tube (CRT) display screens for liquid crystal displays used with the smaller models. They weigh about 30 pounds. Then there are desktop models.

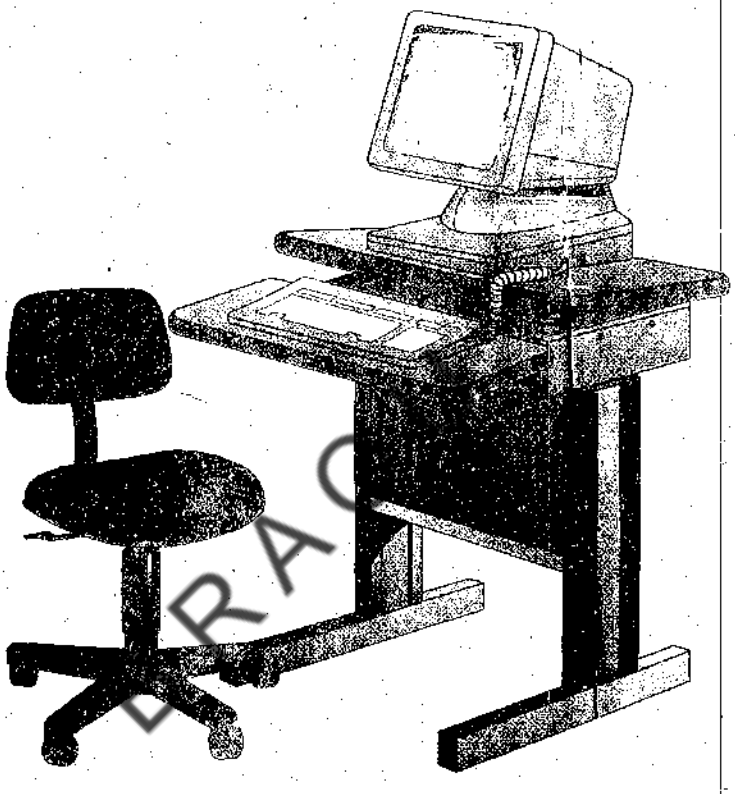

Fig.1 Desktop Computer

Regardless of size, personal computers are designed to be used by one person at a time that is they are single user oriented. Hence, they are called Personal Computers (PC).

Technological changes are taking place so rapidly in the computer industry that it is now difficult to classify the broad range of available machines on the basis of size and computing capabilities. For convenience, the sizes are classified arbitrarily as Supercomputers, Mainframes, Minis, Micros and PCs.

2.2.6 Recent Trends

Series of smaller Computers for personal use have been introduced in recent years. Notebooks, Lap Tops, Palm Tops are common.

a) Notebooks: These are portable personal computers. Nowadays all the facilities of a standard desktop are likely to be in Notebook as well. For example, Dell's INSPIRONS Notebook weighs 2.8 KGs. It has a configuration of: PIII processor, 850 MHZ speed, 128

MB RAM, 14.1 " TFT screen, 8X DVD drive, 10GB Hard disk drive. A floppy slot is available for external floppy drive connection. Power supply lasts for 3 hours. (June 2001). (Please read this paragraph on Notebooks once again after the section on Typical Configuration on a PC presented later in this Unit).

b) LapTop: This is a computer is much smaller and is lighter. It is intended to be used on the laptop while traveling. They come with their own screen, floppy drive, hard disk drive, motherboard, modem, key board etc – all are compactly arranged. The screen display is much like that of a cell phone or calculator much bigger.

c) PalmTops: Also known simply as Palm, this is a palm top computer. There is no mouse or keyboard. This hand-held device is used by writing on its screen by a special stylus. Email, text writing, web-browsing scheduling are all possible on a Palm.

d) Cell Phone as a Computer Terminal: Cell phones today come with two facilities: SMS and WAP. SMS stands for Short Messaging Service and WAP means Wireless Application Protocol. SMS allows users to send short messages to other cell phone users who are online. It is equal to online Chat. WAP-Enabled Cell phones can act as Internet terminals. This means that you can send and receive email messages. It is also possible to do limited Internet Surfing using a WAP cell phone. (*Computers @ Home* March 2001; pp.80-83)

Due to technological improvements, there is not much difference in the facilities available in desktops, notebooks or laptops. The differences lie in the comforts and conveniences they offer and the price you need to pay.

2.3 ORGANIZATION (STRUCTURE) OF A COMPUTER SYSTEM

A typical digital computer system consists of Input Unit, Output Unit, Memory, Arithmetic Unit, Control Unit and the Console. The inter-relationships among these components is shown in the diagram below:

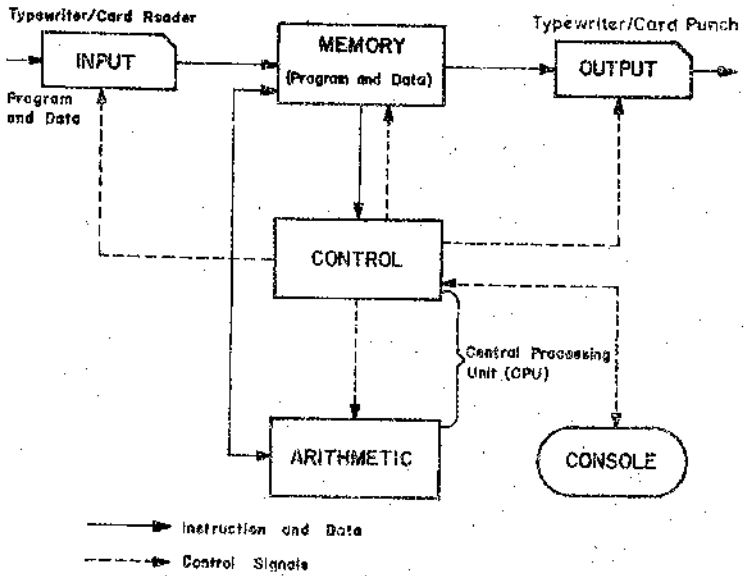

Figure 1.2: Organization of a computer.

Fig 2. Structure of a Computer

This is a pointing device (Fig.4) It is about the size of a tape cassette. It usually rolls on a small bearing and has 2 or 3 buttons on the top. When a user rolls the mouse across a flat surface, the screen cursor moves in the direction of the mouse movement. If the user rolls the mouse forward and to the right, the cursor moves up and to the right on the screen. With a click of the mouse's button, the system can then be notified of his choice. Because the cursor follows the way the user's hand moves the mouse, positioning a cursor with a mouse is easier for non typists than pressing various key combinations for entering and working with data on the screen. A mouse can also be used to draw pictures on the screen. The right button provides for context sensitive functions via special drop down menus.

iv) Track Ball

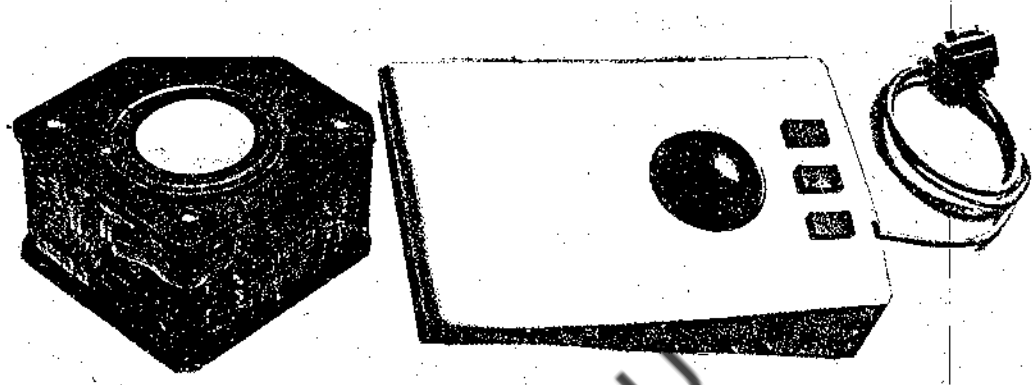

Fig.5: Trackballs

This is similar to a mouse(Fig.5), but the roller ball is mounted in a fixed position and the user spins the ball in various directions to effect screen movements. With a "Joystick" (Fig.6) these movements are determined by how the user pushes a single vertical stick.

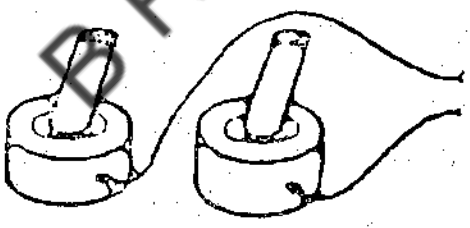

Fig .6: Joysticks

v) Light Pen

A *Light Pen* (Fig7) is another pointing device used to choose a displayed menu option. The pen consists of a photo cell placed in a tube. As the tip of the pen is used over the screen. It is able to deflect the light coming from a limited field of view the light from the screen causes the photocell to respond when the pen is pointed directly at a lighted area. This electric response is transmitted to a processor, which can identify the menu option that is triggering the photocell. The light pen is used for graphic work. With light pen user can draw directly on the screen and with a keypad attached to it he can select different colours and line thickness and can reduce or enlarge drawings and can add or erase lines.

Fig. 7: Terminal provided with a keyboard, a light pen and CRT display

vi) Digitizer/ Graphic Tablets

Digitizer Tablets or *Graphics Tablets* are graphics instruments found at Computer Aided Design terminals. A typical tablet is a work surface that a light pen is used for graphic work. A light pen contains hundreds of copper lines that form a grid. This grid is connected to a computer. Each copper line receives electric pulses. A special pen or stylus, attached to the tablet is sensitive to these pulses and is used to form the drawings. The pen does not mark on the tablet directly. Instead an architect or other user traces a sketch on a piece of paper placed on the tablet. The tablet grid senses the exact position of the stylus as it moves and transmits this information to the processor. The developing sketch is displayed on the screen. Changes in the drawings can be quickly made.

vii) Point-of-Sale Terminals

Point-of-Sale Terminals are used to read bar codes containing data in the form of light and dark bars. For example, manufacturers print a Universal Product Code (UPC) on most items sold in a departmental stores. When bar-coded items are presented at check out, they are swiped across a fixed scanning window. As items are scanned, the bars are decoded by a device called a Bar Code Reader. The data is transmitted to a computer that looks up the price, possibly updates inventory and sale records and forwards the price and description information back to the checkout stand. By passing a hand-held wand across a special tag attached to departmental stores merchandise, a clerk can read the item description and price into a terminal. Under computer control, the terminal displays the scanned data and then prints an itemized sales receipt that shows the total cost of the purchase with tax. If a credit card used by the customer, the wand can read and enter the credit card number into the computer to update the customer's account.

viii) Automated Teller Machine (ATM)

Automated Teller Machine (ATM) is an unattended device that is located on or off the premises of the financial institution to receive and dispense cash and to handle routine financial transactions round the clock. User's account number and credit limit are magnetically encoded on a strip of tape on back of the card, when the card is inserted into the ATM, the terminal reads and then transmits the tape data to a processor which activates the users account. By following instructions displayed on a screen and pushing a few keys, you direct the computer to carry out transactions like depositing or withdrawing money. In a typical ATM you can find out the balance in your account; withdraw cash; and deposit cash or cheque into your account.

ix) Voice and Vision Systems

Voice Input System uses a microphone to convert human speech into electric signals. The signal patterns are then transmitte ' to a computer where they are compared to a dictionary of patterns that have been previously placed in storage. When a close match is found, a word is recognized and the computer then produces the appropriate output.

A *Machine Vision System* generally uses a TV camera to see images and details and a computer then compares the scanned patterns with the stored images that it has been programmed to recognise. Rapid development of robots with machine vision will permit the wide spread automation of future quality control and assembly processes Cameras attached to computers can also be used to transmit live video images..

x) MICR and OCR

There is another class of input devices which will eliminate expensive and time consuming data entry operation by operators. These devices directly read the characters from the source text and convert directly into computer-usable input. These are called character readers.

Magnetic Ink Character Recognition (MICR) is widely used by banking system to process a huge volume of cheques written every day. You will find in each cheque a precoded number at the bottom; this represents bank's identification number and the depositor's account number. These numbers and other special characters are printed with ink that contains magnetisable particles of iron oxide. Cheques are accumulated into batches and sorted with the help of reader sorter unit. As they enter the reading unit the cheque passes through a magnetic field which causes the particles in ink magnetised. Read heads in the reader then read the characters on the check and input into a computer for further processing through computers. Upto 2600 cheques pass through the machine each minute and are simultaneously sorted out according to code number. The limitation of MICR is that only 10 digits and 4 special characters needed for bank processing are used. No alphabetic characters are available.

Optical Character Recognition (OCR): OCR on the other hand eliminates the above limitation of 14 characters. No special ink is required. Optical scanners work on optical character recognition principles. They convert data from a printed or a hand written source document into a machine recognizable form. This process is especially used in converting a large amount of data in a very short time. The need for proof reading which is to be done in manual entry is completely removed in this process. An optical page reading system is used to

read the data that has been scanned into the computer. The principle is the same as in the barcode system explained earlier.

xi) Scanners

Scanners are like photocopiers. They are input devices. You scan a piece of text or picture and the result is a computer readable file. Hand held scanners are cheap (and therefore less accurate) and you get softcopies of pictures y swiping the scanner across the image. Flatbed scanners are used to copy stationary 2D or 3D pictures. Rotary scanners are costly but versatile. Both Black and White and Color scanners are available. Resolution of a scanner determines the sharpness and quality of the image. High-resolution scanners are needed while scanning utility drawings, maps etc.

When a printed text is scanned only an image of the entire page is obtained. An OCR (Optical Character Recognition) software converts the image into characters and numbers. The OCR software can make errors if the original is not sharp or clear. (! May look like 1 and 3 may be interpreted like 8). A lot of manual proof reading is necessary. Scanners are very useful devices to convert a large number of printed matter into computer readable files; this avoids re-keying in of data.

2.3.2 Output Devices

We have considered so far how to enter our data into a computer with the help of a wide range of input devices. Once we have entered into the computer we have to come out of it. Hence we need to know the output devices that help us in retrieving the data contained in a computer storage. Like input devices, output devices are instruments of interpretation and communication between humans and computers. These devices take machine coded output results from the processor and convert them into a form that can be used by people in the form of printed or displayed reports.

i) Printers

Printers are primary output devices (Fig.8). They are classified according to their speed and the quality of printing. Low speed and High speed printers are two types of printers. Low speed printers include impact printers. An impact printer is one in which printing occurs as a result of the impact of a character form striking against an inked ribbon, causing the ribbon to press an image of the character onto paper. This can be done one character at a time or one line at a time.

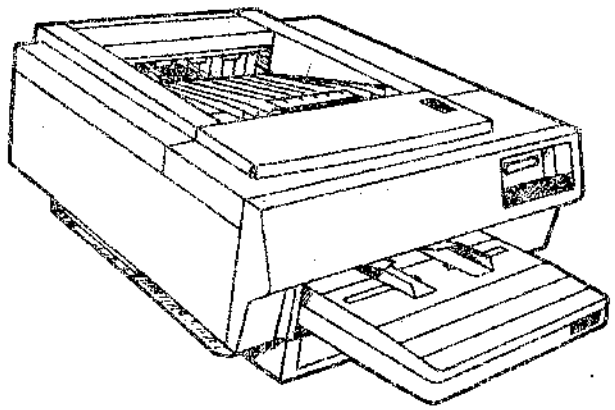

Fig.8: Printer

a) Impact Printers

Impact Printers use a **daisy-wheel** or a dot-matrix printing mechanism. In a daisy wheel printer each petal of the wheel has a character embossed on it. A motor spins the wheel rapidly and when the desired character spins to the correct position a print hammer strikes it to produce the output. These are low speed printers. Quality of print will be just like typewriter. These daisy wheel printers are useful for individuals.

High speed impact **line printers** use line-at-a -time. From 300 to over 6000 lines can be printed each minute. Print chain mechanism is used in this printer. As the print chain containing five 48 character sections revolves horizontally each character is printed as it comes into position. Line printers are noisy and are prone to frequent break downs as mechanical components are present. Number of characters available are limited. Line printers are good for large volume printing like exam results, electricity bills etc.

b) Dot Matrix Printers

Dotmatrix Printers (DMPs) as they are called are popularly used printers with PCs in offices and homes. This output device produces paper prints from processed data in the computer. DMPs produce characters composed of dots, resulting from energizing a set of vertical pins. A DMP may have 9 or 14 pins. The latter produces sharper prints than the 9 pin machine. They come in 2 widths – 80 characters and 120 characters. The speed of printing varies from 160 characters per second (cps) to 300 cps. Color Ribbon gives color prints also. Continuous paper or cut sheets can be used. Some printers allow abnormal size of papers – small envelops, thick catalogue cards etc. DMPs are cheap to buy as well as to use. Though it is possible to print images also in DMP, the quality is not good.

c) Non-impact Printers

Non-Impact Printers are the other category of printers. Ink Jet printers and Laser printers fall in this category.

Laser printers write the desired output image on a copier drum with a light beam that operates under computer control. A difference in electric charge is created on those parts of the drum surface exposed to the laser beam. These laser exposed areas attract a toner: an ink powder that attaches itself to the laser generated charges on the drum. The toner is then permanently fused on the paper with heat or pressure. Laser printers produce high quality output. Both Black & White as well Color printers are available. Laser prints are costly and are useful for desktop publishing and for preparing quality presentations. Laser Printers are faster than ink jet printers but slower than Digital High Speed Photographic printers.

Inkjet Printers also fall in non impact printer category. In this kind of printers droplets of ink are electrically charged after leaving a nozzle. The droplets are then guided to the proper position on the paper by electrically charged deflection plates. Continuous stream inkjet printers give good quality print as the ink continuously spread over each character. The Ink Cartridge is costliest part of the printer which requires replacement often. Prints can be obtained as draft, economy or high quality modes. Quality almost nears laser prints. Ink Jet printers are slow.

d) High- Speed Digital Non-impact Xerographic Printers

In non-impact printers there are high speed printers. A high speed page printer can produce documents at speeds of over 2000 lines per minute. Electronics, Xerography, lasers and other technologies have made these high volume systems possible. They are very

expensive and worth using when hundreds of thousands of pages are to be printed every month.

Sophisticated printers in this category are available which combine the functions of scanning, copying and duplicating. Originals can be in paper form directly used in the printer like in a copier. Originals can also be computer produced soft files of pictures, text etc. If the printer is in a network, print orders can be fired from any connected computer. Some printers are capable of printing on both sides of the paper; collate copies according to pagination; staple the sets to form booklets etc.

The above output devices are used to retrieve output in paper medium. There are other output devices which can bring output in film medium. Computer output microfilm (COM) technology is used to record the output on a microfilm as microscopic filmed images. The information that can be printed on a page of a paper can be reduced 48 or more times and recorded on a sheet or roll of microfilm. A typical microfiche reproduces upto 270 page sized images. Rolls of 16mm and 35mm film packaged in cartridges are also used.

ii) Video Display Unit (VDU)

Visual Display Screens are the popular Input cum Output devices. The screens are similar to Television screen with 12 to 15 inch viewing screen. Normally 24 or 25 lines with 80 characters in each line are displayed on the screen at a time. A Cathode Ray Tube (CRT) operate much like those in Television sets on screen. CRT screens are relatively heavy and bulky. So liquid crystal display (LCD) screens are used in personal computers. Visual Display Screens are used to receive alphanumeric and graphic output information. Graphic output can be copied using printers, plotters and film recorders.

iii) Plotters

A *Plotter* uses a pen or an inkjet. Pen plotters use drum and a paper placed over it rotates back and forth to produce an up and down motion. A carriage holding one or more pens is mounted horizontally across the drum and the pen can move along this carriage to produce motion across the paper. Under computer control the carriage and drum movements act together to produce a picture. Computer pictures can be plotted by mounting several pens on a carriage and each pen filled with different colour ink Plotters are used for outputting maps, utility and engineering drawings. Plotters are available in different sizes, speeds, colors.

2.3.3 Devices

Computer storage unit consists of a large number of cells each with a fixed capacity for storing data, each with a unique location and address. The addresses of these cells are like post office boxes in that each box has a unique location and address. Each storage cell is capable of holding a specific unit of data and depending on the system the unit of data may be a fixed number of digits, characters, words or even an entire record. The storage methods are broadly categorized into primary and secondary storage. Secondary storage again is in two categories: on line and off-line. All the Storage devices mentioned here are both Input as well as output devices. Hence they are discussed last.

i) Primary Storage

This is in-built into the computer system in the processor unit. Primary storage section is divided into four areas: Input storage, programme storage, working storage and output storage. Data are fed into input storage. Software is stored in program storage. Working storage space is used to hold intermediate processing results. An output storage area

holds the final processing results. Primary storage is also called main memory or the core memory of the computer. The above four areas are not fixed by any built in boundaries. Depending on the application the area is varied. Earlier machines used to have a core memory of 64KB. It is common nowadays to see computers with 128 MB of primary storage.

ii) Secondary Storage

Secondary storage supplements the storage capacity of primary storage. The primary storage is in-built into the system. It has a limited capacity whereas secondary storage is kept away from the system and hence it has unlimited storage capacity. Hard Disks, Magnetic Tapes, Zip Disks, Floppy Disks belong to Secondary Storage media. Magnetic Tapes and Floppy Disks have been discussed earlier under "Input Devices – Offline devices". Most of the Storage devices are both input as well as output devices. All these storage devices can also be stored separately hence they may be classified as "Offline Input - Output Devices" also.

In the following discussions it must be noted that there is a drive and a disk (or the media) associated with each. For instance, in the case of Floppy Disk, there should be a Floppy Disk drive fitted to the computer. In this drive, the media, that is the floppy disk is inserted. The drive is the input or output device and the media (Floppy) is the storage media.

a) Floppy Disks

Floppy Disks, also called diskettes (Fig.9), are used to key in the data directly from source document. It is also an Input, output device. It is also a storage device though for small volumes of data. A magnetic disk, floppy disk is made out of flexible plastic materials. The base is coated with iron oxide recording substance as in magnetic tape. Data are recorded as tiny invisible magnetic spots on this coating. Floppy Disks come in three sizes: 8", 5.25" and 3.5". The last one has become the de-facto standard. It can hold 1.4 GB of data. Floppy disks need to be 'formatted' before use. Many manufacturers supply pre-formatted disks. They are prone to malfunction on account of dust, magnetism etc. Use of Floppies also increases the problem of virus infection.

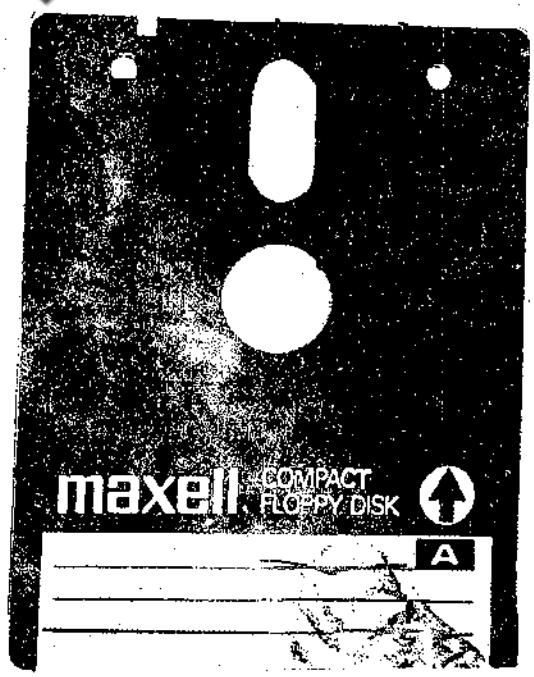

Fig. 9 : Floppy Disk

b) Hard Disks

Magnetic disks are the most popular medium for direct access secondary storage. They are like gramophone records. All magnetic disks are round platters coated with a magnetisable recording material. They can be taken away from the system when not in use or permanently mounted in their storage devices called disk drives. When data are fed into the computer they are recorded on this magnetic disk which is called WRITE in computer jargon. To retrieve and view the data that is written on the magnetic disk an indicator called 'READ' is displayed. In a disk drive READ/WRITE heads are tiny electromagnets that can read, write or erase the polarized spots that represent data on magnetic media. There are different sizes of magnetic disks. A 14-inch metal disk that is permanently housed in a sealed, contamination-free container along with Read/Write heads and access mechanism sealed in with disks they serve are called hard disk drives or

c) Winchester Disk

Winchester Disk is a special type of a hard disk. While floppy disks are flexible and hold only about 1.44 GB of data, Hard Disk capacities range from 4 GBs to 100 Gbs. Hard disk is nothing but a series of disks stacked together with a read/write mechanism sealed positioned in a sealed box. Hard disks provide faster access and can be permanently fixed the Computer with nuts and bolts. Disks that can be removed easily and stored away separately elsewhere are called removable hard disks. Removable hard disks are useful for taking back up of data. Winchester Hard disk is a special type of hard disk .Fig.10 shows a typical hard disk drive. Earlier Winchester Disks came with a capacity of 30 MB. There are other metal disks packaged in removable cartridges or disk packs which can be detached from the systems and kept separately. Now hard disks are available in much smaller sizes but bigger capacities. Even in a PC 40GB is common.

Fig.10 : Winchester Disk Drive

d) Zip Disk

Zip Disk is a special variety of a disk of the size of the Floppy but with capacities from 100MB and 250 MB. It is used for portable backup, large file downloading from Internet etc. They require special drives and cannot be used in ordinary Floppy Drives. JAZ disks similar to ZIP disks.

e) Magnetic Tapes

Magnetic tape is used as input/output/storage medium. It can accommodate large volume of data and its data density is high and data transfer from data entry to storage and to the processor is very fast. Tape comes in reels of 1/2 inch wide and 2400 feet long. It is similar to the kind used in a sound tape recorder. It is a plastic ribbon that is coated on one side with iron oxide that can be magnetized. Tiny invisible spots representing data are recorded by electromagnetic pulses on the coated side of the tape just as sound waves are converted to magnetic patterns on the tape of a sound recorder. Like sound tape, computer tape can be erased and reused repeatedly. Old data on a tape are automatically erased as new data are recorded in the same locations.

Before the data on a magnetic tape can be processed by a computer, the tape must be placed in a tape drive unit. This machine either reads data from a tape into the processor or writes the information being produced by the computer onto a tape. Tape moves through a tape drive in much the same way that film moves through a movie projecter.

f) Compact Disk (CD)

State-of-the-art technology is used in secondary storage. Optical disks are now used by consumer electronics companies to record sounds and sights of movies, concerts and sporting events. Optical disks in a compact size (4.7 inch) are used to record high-quality music. Tiny pits are turned into a thin coating of metal deposited on a disk. These pits represent streams of digital data that is copied from source documents in both letters and drawings, photographs or graphics in one sequence. When the optical disks are placed in disk playback devices a beam of laser light is used to read the pit patterns and convert them into the audiovisual signals. CD technology was adapted to develop CD-ROM (Compact Disk - Read Only Memory) optical storage disk (Fig.11) and drives that are used with personal computers.

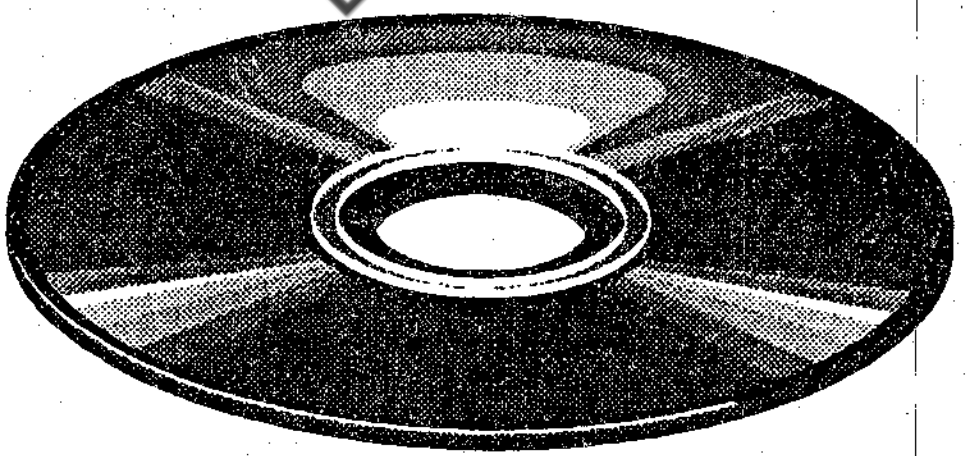

Fig.11: CD-ROM Disk

The storage density of optical disks is enormous, the storage cost is very low and the access time is relatively fast. Just one CD-ROM disk stores about 650 megabytes of data which is equivalent to the contents of about 2,70,000 A4 size sheets of printed matter. Entire set of Encyclopedia Britannica (33 Vols) can be brought out on a 12cm diameter CD-ROM

disk. However as the name indicates it is used for reading only and you cannot erase or add any data to it once a disk is produced. There are other optical disks which permit writing also. WORM (Write Once Read Many) systems, users can record their own data on blank optical disks. CD-ROMs are discussed in greater detail in Block 4 unit.. on Multimedia.

g) Digital Video Disk (DVD)

Digital Video Disk (DVD) is a high density digital disk storing large quantities of digital video and audio data. It can store 4.7 GB of data enough for 133 minutes of high quality full-motion video, combined with multiple surround sound quality audio. The audio tracks allow consumers to choose audio track of their choice from several language tracks in which the movie dialogue is presented. Using tricks like multi layering techniques and using both sides DVDs can hold larger amounts of data like: 8.5GB, 17 GB etc. It can hold compressed video at 720X480 resolution, delivering 30 frames per second for two full hours!

DVD has five different formats:

DVD ROM Read Only Optical Disk : General Purpose Storage Device.
DVD – Video: High Quality Audio Video & Graphics 17 GB
DVD-Audio: High Quality Audio
DV-R: Write Once Read Many Times: WORM Disk.
DVD-AM: Read Write Optical Disk 2.6 GB General Purpose

2.3.4 Typical Configuration of a PC

When we buy a PC for home use or for Office it is necessary to give a set of specification required for the computer you intend buying. In this context some details of a typical PC configuration is discussed below. Here only the Basic Computer is considered. Peripherals (input out devices) are excluded.

Processor: Presently PCs come with Pentium III processor – P2, P3 or P4.Celeron is a cheaper Pentium Chip. P4 Chip offers a speed of 1.3 to 1.5 GHZ; it has 42 million transistors. The motherboard commonly used is Intel 810e

Speed: Speed that one can look for is of the range: 600 Mhz, 800 Mhz, 933 Mhz, 1.3 Ghz, etc. Faster the speed, better is the performance and more costly. Faster speeds are needed for Multimedia applications.

Cache: This is a sort of a additional memory storage space where programs and data may be held temporarily for faster processing. Generally Cache is of the order of 128 or 256 or 512 KB

RAM: This is the core memory also called main memory. Normally, the RAM size is 32 MB, 64 MB or 128MB.

Hard Disk: The hard disk capacity may range from 10 GB to 40 GB

Video Card: This is a special IC card providing extra memory for video processing. Many PCs come with "On Board" memory of 4 to 16MB. It may be present as external (extra) memory also.

Sound Card: A Card for supporting Audio. Sound Blaster Card and ESS Allergo PCI card are familiar ones. The card may be "On Board" or extra fitting.

CD/DVD Drive: A PC may have CDROM or DVD Drive. CDROM designations are: 16X, 32X, 48X, 52X etc. This denotes the speed of access. Faster speeds are needed for heavy music lovers. . In the case of DVD drive, which are needed if you like to see movies often on your PC, you may go in for 16X DVD drives.

CD-RW is a CD Writer cum Reader: You can write onto a blank CDROM disk using this drive. There are 3 speeds that are usually mentioned. Thus if a DVD specification is: 8X/4X/32X then it has a 4X write speed, 8X re-write speed and a 32X read speed. The Write and Re-write speeds determine how fast a CD may be recorded. The read speed is for accessing information from the CD.

Monitors: Color or B&W; Size: 14", 15", 17": Bigger monitors are needed for graphical jobs, engineering applications etc.

Mouse: 2 Button mouse and 3 button mouse are available. Third button if present, allows easy scrolling of long texts while browsing the Net.

Key Board: This the most basic input device. Boards with 107 keys are most common. Multimedia Keyboards multi language keyboards are available.

Modem: External modems compatible with ITU V90 data/fax standard with speeds of 56Kbps are most popular. (Modem is discussed in a later section in this Unit)

Software: Generally PCs are supplied with some minimum software items like the Operation System, some Word Processing Packages some DBMS, Some spread sheet etc. Windows ME, Windows 98, Windows 2000, Outlook Express, MS OFFICE (A suite of four office products), some Anti-Virus Software etc ate very common. The vendor might give a few games and a few CDs as well. (Software is discussed in next Unit fully).

As has been repeatedly mentioned earlier, the above specifications will change very fast. One can keep abreast of current situation by reading magazines like *Computers @ Home* or newspaper advertisements.

2.4 DATA COMMUNICATION : SYSTEMS AND NETWORKS

In the late 1950s computing/communications linkage was established in passenger reservation system in American Airlines. Hundreds of computers located at different places were linked to central processing centre. Developments in computer technology have necessitated the need to develop communications technology also simultaneously so that a happy marriage between computers and communications is possible. These two technologies have been complementary to each other.

2.4.1 Data Communication: What and Why?

Data communications are an integral part of an information system. Data communication refers to the methods and means of transferring data between locations where systems are located. This enables direct interactive (i.e. Person to person or system to system) link at the stations and the central processing system. While a telephone is meant for

transmitting voice messages, the data communications transmit data message through the same telephone lines.

Computers can offer business to communication products and communications technology can offer business to computers. Now personal computers can use telecommunications channels to link up with information retrieval services, banks and electronic bulletin boards. Computers can contact other computers and exchange information/data automatically. Sitting at a terminal in your office you can link, up to a remotely located host and use remote computers facilities. Remote computing, electronic mail, interactive information retrieval, bulletin boards, Video conferencing, electronic data exchange are some of the other uses of data communication.

2.4.2 Data Communication System

A data communication system links input/output devices at remote locations with one or more central processors. An interface element called modem (modulation-demodulation device) (Fig.12) converts the digital data into analog signals that can be transmitted through voice communication lines. When two computers are interconnected using telephone lines there will be modems at both ends.

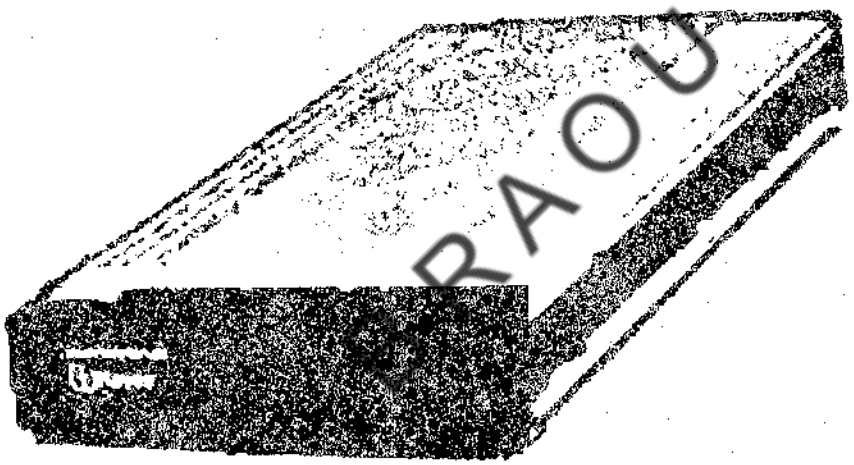

Fig.12: Modem

The **modem** is a piece of equipment for converting analog signals into digital signals. It is used in computer-to-computer communication using a telephone line. Modem stands for Modulator and De-modulator. They may be Internal or external: internal modems are in the form of a "Card" to be placed inside the PC in a vacant slot. External modems are connected externally with its own power supply, connection to phone line and connection to the suitable serial port. The speed with a modem can transmit data is measured in Bits per second. Modem speeds range from 1200, 2400,4800,9600,14480 bps to 56 kbps. They may have error-correction features by which errors in data transmission are detected and corrected. Most modems also have compression facility and this enables you to send more information packed through a narrow bandwidth pipe. Zytel, Zoom, Multi-tech are some important brand names of indigenously available modems. *Acoustic Couplers* are used as interfaces to portable computers to communicate with distant processors.

Low bandwidth and High bandwidth Channels

Telecommunication lines are nothing but data transmission channels, which are also called "highway". These channels are classified as Narrow band (Telegraph lines): Broadband: Coaxial cables, microwave circuits and communication satellites; Voice-band: telephone lines. The transmission rate varies from one channel to another. While telegraph and telephone lines work for the transmission of small volume of data, broadband channels are used when large volume of data to be transmitted at high speeds. Dozens of communication satellites are now in orbit to handle international and domestic data, voice and Video communications. Scores of public and private companies have been offering these services in USA and other developed countries while in India this is under government control.

Public Data Network System

Public telephone and telegraph services are offered by common carrier, which include American Telephone & Telegraph System of USA. Coordination of the various data communication systems is required as the number of computing and communicating are now in operation at various sites. These sites in turn may be linked by different transmission channels to larger computers. Hence, the need to coordinate. A link up of the computer with transmission channels will form a network and this network will move the data from one place to another place at the right time at the lowest possible cost. The following discussion will highlight formation of networks and maintenance of the same.

2.4.3 Data Communication Networks

You have seen the role of communication channels in connecting various sites and people and computers located in those sites. Now we shall see how the data containing in one computer can be shared by others sitting before another computer. This is possible only when these computers are connected with the help of a number of telecommunication linkage components. Such a connection is called networking.

a) LAN and WAN

LAN (Local Area Network) operates in an organization where the computers are located in a small area of an office building or a campus. This is used to link up computers, workstations and other devices to transmit data and to share the data from and to the computers. Since LAN is operational in a small area special hardware/software elements are used in place of modems and outside telephone lines. LANs can be high speed networks to transmit 20 millions bits per second (Mbps), medium speed networks to transmit 3mbps to 20mbps, low speed networks designed for use with PCs and other work stations. These LANs draw data for main computer located at a central place and process the required data in microcomputers or personal computers located in their work spot and are connected to the main computer.

LANs have many advantages to the people, working in different departments in the same campus, to communicate and to transfer data and to use the memory of the main computer by utilizing it through microcomputer available on their desk. LANs enable the data available at all places once it is stored in a central computer. Resources like hard disk, printer, plotter, CD-ROM drives etc. can be accessed by all members of the LAN.

b) Real Time and Time Sharing Connectivity

Real Time processing system is an interactive processing system, which receives input from all terminals and produce information quickly enough to be useful in controlling the current activity. Many stations are linked up by high-speed telecommunication lines to one or more processors. Files are updated each minute and inquiries are answered by split- second access to up-to-the-minute records. Rail bookings, Airlines, Hotels use real time systems.

Time-sharing is another network service. A number of organizations sell time-sharing and remote computerising services to other customers. Some organizations install terminals or personal computers in customer offices and then use telecommunication channels to link these workstations to their central processors. Remote computing services may accept customer's input data over telecommunication lines, do custom batch processing for the customer and then transmit the output information back to the customer terminal. Time-sharing and remote computing service organizations generally offer a library of online application programmes to their clients who only supply the input data and access the programs to obtain the desired information. Library and Information databases are normally searched through time-sharing systems.

Distributed Data processing network consists of many geographically dispersed independent computer systems connected by a telecommunications network. It places the needed data at the end user's location. Networks and networking are discussed fully in Unit 11.

2.5 LET US SUM UP

We have discussed various computer systems, their hardware and storage devices the structure and organization of a computer has been explained. An account of different types (categories) of computers was seen under computer systems. Several examples of Input devices output devices have been seen. Specifications (configuration) for a typical Personal Computer has been described with a view to help select a good computer system. A brief account on the data communication systems, transmission channels, and data communication networking and networks has been presented.

2.6 GLOSSARY

Acoustic Coupler : A type of modem which permits data communication over telephone lines by means of sound signals.

Address : An identification that designates a particular location in storage memory

Bar Code : A machine readable code consisting of vertical bars of varying widths that are used to represent data.

Byte : Equivalent to 8 bits or one character

Bit : Binary digit (0 to 1)

Chip : A tiny silver on which integrated electronic components are deposited

COM : Computer output Microfilm a technology that permits the output information produced by computers to be stored microfilm

Computer Network : A processing complex consisting of two or more interconnected computers.

Data communications : The means and methods of transferring data between sites.

Disk : A revolving platter upon which data and programs are stored.

Floppy disk : A magnetic disc used for secondary storage purpose

Hard disk : A rigid metal platter coated with a magnetisable substance. Used or secondary storage purpose.

Hardware : Physical equipment such as electronic, mechanical, magnetic devices

Interactive : One that permits dialogue between users.

Interface : The boundary between two system or devices

Internal storage : The addressable storage in a computer directly under the control of the CPU

Light pen: An electric device used for inputting data into a computer by writing on the screen

Local Area Network : Communication system that links computers, terminals and other devices in a compact area

Magnetic ink : The recognition of characters printed with a special magnetic ink by *character recognition* a computer

Magnetic storage : Using magnetisation to store data on devices as disks and tapes.

Microprocessor : A chip on which is provided central processing unit

Modem : A modulation demodulation device

Mouse : An input device when rolled across a flat surface,it guides the cursor on the screen.

Narrow band width : Communication channel thro' which data is transferred in a low speed. Telephone and telex channels are slow and hence narrow.

Optical character The recognition of printed characters through use of optical machines.

Online : A term describing devices that are in direct communication with the computer

Optical disk : A medium used with laser reading/ writing device to store huge volume of data

Peripherals : Input/output devices and storage units of a computer.

Plotter : A device that converts computer output into a graphic hardcopy form

Point of sale Terminal: An input/output device used in departmental stores.

Primary storage: Also known as main memory this holds program instructions, input data etc

Random Access Memory : Primary storage section of a computer

Terminal : A device that performs input output operations in a computer

Time sharing : Sharing of computer time and its processing capabilities.

Winchester disk : Name given to hard disk

2.7 REFERENCES AND RECOMMENDED BOOKS

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2.8 ASSIGNMENT

1) Go to a nearby computer training school and discuss with the person n-charge. Identify and describe several pieces of hardware devices you see there;

2) Collect a picture of each of the Input and Output devices discussed in this Unit from magazine and news paper advertisements into a scrap book.

3) With respect to the PC learn and note down the recent developments.

2.9 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS:

1) Describe the various types (categories) of computers with their features?
2) With the help of a diagram, explain the organization of a computer. Describe various types of hardware items seen in a computer.
3) What are input and output devices? Describe and Discuss important input and output devices.
4) What is primary and secondary storage? Describe in detail examples of secondary storage devices like hard disks, magnetic tapes, CDs etc.
5) Discuss how you would go about specifying the requirements of a PC that you want to buy.
6) Present an overview of Data Communication and networking of Computers. State the advantages, types of networks equipment used etc. (This question may be attempted after learning Unit 11 later on)

II. SHORT NOTES:

a) Magnetic storage
b) Optical disk technology
c) Modem
d) DVDs
e) Non-impact Printers
f) The processor Chip
g) Portables Computer Systems

UNIT - 3 : COMPUTER SOFTWARE - PROGRAMMING LANGUAGES, PROGRAMMING AND DATA PROCESSING

Structure

3.0 Aims and Objectives

3.1 Introduction

3.2 Computer Software - Categories

- 3.2.1 Pre-written Software
- 3.2.2 Custom made Software

3.3 Operating Systems

- 3.3.1 MS-DOS
- 3.3.2 Windows
- 3.3.3 Multi-User Operating Systems

3.4 Data Processing - Need, Steps and Types

- 3.4.1 Need for Data Processing
- 3.4.2 Steps in Data Processing
- 3.4.3 Types of Data Processing

3.5 Computer Programmes and Programme Development

- 3.5.1 Programming Concepts
- 3.5.2 Steps in Developing a Programme

3.6 Let Us Sum Up

3.7 Glossary

3.8 References and Recommended Books

3.9 Model examination Questions

3.10 Appendix: Programming Languages

3.0 AIMS AND OBJECTIVES

In Unit 2 you learnt about several hardware components of a computer systems including Input devices, output devices and storage devices. A brief discussion on connecting computers via telephone lines and data communication channels was also seen. In this unit we will concentrate of computer software, data processing, programming languages and programming.

By the end of this learning unit you should be able to

- explain various categories of computer software
- describe different types of data processing and discuss the steps involves data processing activity.

- describe important programming languages with their salient features
- narrate how a computer program is developed
- discuss what programming languages are suitable for library applications

3.1 INTRODUCTION

Mechanical and electrical and electronic components that we physically see in a computer are not enough to make it work. We need software – a set of instructions written in some programming language understandable by the computer – to make it work. Software is like the human intelligence in our brain- that which can not be seen but its effect felt and understood.

We shall discuss now on categorization of different types of computer software, especially the Operating Systems in some detail. When large volumes of data have to be processed in more or less the same way at periodic intervals, we need to know about Data Processing. To use the computer efficiently we need knowledge about Computer Programs (basic component of a software package - that is the individual programs that make up the software package), program development methodology, and some details about various Programming Languages one might use for this purpose.

Aspects of Application Software development as applicable to Library Software Application Packages is dealt with in next unit (Block II). Details of Word Processing Software, Desktop Publishing Software, Multimedia Software, Electronic Mail, and Spread Sheets etc are discussed in Block-IV on Office Automation.

3.2 COMPUTER SOFTWARE - CATEGORIES

At the risk of repetition let us say once again that software is a piece of computer program written in some Computer Programming Language like C, C++ Basic, Fortran etc. Software can be broadly divided into Pre-written Software and Custom made Software. Pre-written software is already produced for some general purpose by Software Vendors that may be useful or indispensable to computer users. Custom made, as the name implies, is a set of programs specially developed for an organization by a vendor specially commissioned for that purpose.

3.2.1 Pre-Written Software

Pre-written software is again divided into System Software and Application Software. The System Software is a complex group of software items intended to make the computer run in the first place, to extend its capabilities, to help do several common jobs. Operating Systems, Language Compilers and Translators, Utilities and others belong to this category. Application Software, on the other hand, addresses the needs a specific application or requirement. There are General Purpose Application Software and Special Purpose Application Software. In the first category, Word Processing Systems, DBMS packages, Spreadsheet Programs, Desktop Publishing Package etc would be members. In the special category software for CAD (Computer Aided Design), Library Applications, Hospital Management etc could be placed.

3.2.2 Custom Made Software

If a library is so specialized in nature that none of the Library Application Packages available commercially from a number of Vendors is found suitable, then the library may

commission a software firm to develop an application package exclusively to take care of their requirements. In that case we have a custom made Library Application Software Package. IT is also possible that a library may find a ready-made package, with some changes useful. Here the vendor would make the changes needed – may be addition of a separate module, special type of reports etc -. In this case we have customized software.

The following table shows the different categories of Software:

CATEGORIZATION OF SOFTWARE			
Pre-written Software			**Custom made Software (Examples)**
Application Software		**System Software**	1. Specially designed for an organization against specific requirements 2. Engineering and Scientific applications developed In-house by R&D. 3. Space Applications
General Purpose	**Special Purpose**		
Word Processing; Spreadsheet; Presentation; DBMS; Anti-Virus Email DTP Communication	CAD /CAM; Statistics; Library Application; Lawyer's Office; Hospital Mgmt; Pay Roll; Inventory Control;	Operating Systems like MS-DOS, Windows, Unix; Languages & Language Compilers and Interpreters; Utilities for Sorting, file management, diagnostics etc; Software Development Tools.	

3.3 OPERATING SYSTEMS

An operating system is an organized collection of software that controls the overall operation of a computer. Operating system enables the system's hardware to work with the user's applications programs. It allows users to load application program to primary storage section of computer system. Operating system moves the data between primary and secondary storage units. It functions in many other ways unseen by the user. Computer manufacturers and independent software vendors furnish operating system programs. Operating system acts as a link between the raw data and processed data in a computer.

An operating system permits the computer to supervise its own operation by automatically calling in the application programs and manage the data needed to produce the desired output. Operating system isolates the user from the hardware so that the user

communicates directly with the operating system supplies the application program and input data that are in a language and format acceptable to the operating system and receives output results. OS completely controls input/output house keeping operations. It monitors keyboard, display screen and printer. A computer with virtual storage capability keeps active program pages in primary storage and assigns other program parts to an on-line storage device. The operating system handles the swapping of program pages between primary and on-line secondary storage units as needed.

Earlier, Operating Systems used to be small and they were supplied in a set of Floppies. Currently most Operating Systems are fairly large and are supplied in CDROMs and by default most Personal Computers are fitted with CD Drive in present days. When the computer is switched on the system reads the Operating System from the Hard Disk into memory so that it can take control over everything that needs to be done on the computer. The OS manages seven resources of the computer: CPU, Main memory, Secondary Storage, Input Devices, Output Devices, Data and Processes.

3.3.1 MS-DOS

MS-DOS is a single User Operating System. It has command for file manipulation, loading and executing external programs and routines to control the printer etc. This got merged with Windows later on. DOS has internal and External commands. DOS is a command driven program: That is for every action, you need to type in the appropriate DOS command at the "DOS Prompt".

3.3.2 Windows

Windows is a multi-tasking system; in this sense several tasks, or programs or processes could simultaneously be running on the same machine. There are several versions of WINDOW (Windows 3.1, 3.3. Windows 95, Windows 98, Windows 2000, Windows NT and presently Windows XP are available. In Windows applications are run in separate Windows. Each Window is a rectangular piece of space on the screen. The window can be re-sized, closed, minimized, etc. The way in which people use software based on Windows has been so standardized that all software prepared for Windows look alike: learning to use a new software is easy. Windows is a highly user-friendly OS as it is GUI (Graphical User Interface) based and all the commands are menu based; simple mouse movements activate them.

3.3.3 Multi-User Operating Systems

UNIX OS developed by Bell Laboratories in 1969 for larger machines. It is a multi-user, multitasking system that is used in 16 and 32 bit personal computer systems. It is now adapted for personal computer systems also. Multi-user operating Systems allow many persons to work on the same computer simultaneously. Sharing of Information and programs, security of data, speed of operation, etc are some concerns of multi-users that a multi-user OS would normally take care of. In Unix, concepts like priority of tasks, memory management, scheduling of tasks etc are predominant. There are several versions of UNIX. VAX VMS, Solaris, IDRIS, LINUX are popular versions.

3.4 DATA PROCESSING - NEED, STEPS AND TYPES

Whenever any large volume of data has to be processed in a routine way periodically, data processing is done. This section deals with basic principles and also discusses various types of data processing systems in practice.

3.4.1 Need for Data Processing

Data in computer parlance refers to all pieces of information about an event, activity or a situation. A piece of data in itself does not mean much nor does it make sense. For instance, "20010527" might mean the accession number of a book (' 527th book added in the year 2001') or the date acquisition of a book (27th May 2001) or something else totally different. The meaning depends upon the context, coding and the like. In order to make a set of data meaningful it has to be processed.

Let us assume we have a set of data about students, say names and marks obtained in a certain examination. This table of data as such has no meaning. If we perform some calculations and come out with information as to the minimum marks in the class, maximum marks awarded, average marks of the class, Range of marks obtained by majority of students etc then the results make sense. The processing involves sorting, summing, division, averaging etc. These steps, carried out in some orderly fashion, to meet a specific objective is called Data Processing.

3.4.2 Steps in Data Processing

Data Processing involves basically five distinct steps. These are

I. Preparation of Source Documents
II. Input of Data
III. Manipulation of Data
IV. Results Presentation
V. Storage

I. Preparation of Source Documents

Depending upon the purpose, data has to be collected from suitable sources by surveys, files, documents, office forms, reports etc. Data Input sheets are filled up. Such input sheets contain spaces for fields, in some useful order; instructions for filling up the form are also given. Income Tax Return forms of application for Fixed Deposits etc are some examples.

II. Input of Data

Actual Data Entry into the computer is done in several ways. Data Entry Screens specific to the applications may be used. Special Data Entry Terminals may be used. For example, details of books added to a library may be entered in forms shown on the screen. This Data Entry form may have spaces for Author, Title, and Accession Number etc.

Data Entry Software provides for detection and correction of errors during the data entry stage. Normally, two operators enter the same data simultaneously and independently. The two sets of data are compared by a program, which throws up differences. Such differences are compare and action taken to remove errors if any.

Using Special devices like Scanners, OCR software etc it is possible to read directly into a computer system a large amount of data from paper documents.

III. Manipulation or Processing of Data

This involves activities such as sorting, comparing, relating, interpreting, computing etc. If you need a list of books added to your library during a specific month, then the data has to be ordered or sorted on the date of acquisition. If you ask the computer to give you a report on books costing more than Rs. 10000/- each then the Price field information has to be

compared. These steps are carried out through a program written in COBOL and such languages.

IV. Output of Information

Results in required format are shown on the screen, saved as a file on the disk or printed out on paper. Results may be in summary form or a full-length report. For instance, in the case of a Pay Roll processing job, the results may be reports of - a) Pay slips for all eligible employees; b) Statement of IT, PF and other deductions; c) Summary statement showing salary expenditure department wise for the month as well as cumulated figures as of date; d) Report on employees who have been excluded, etc.

V. Storage

After the processing and supply of results it may be necessary to store the data, as it existed before processing, results after current processing and perhaps an updated set of files also. Storage of data may also be needed as a safety and back-up measure. In this stage also some programming routines may be used.

3.4.3 Types of Data Processing

There are many types of data processing. We employ different type processing depending upon the availability of hardware, networking facilities, needs of the organization, costs involved etc. Some of these methods involve manual processing in part also. Computers are suited for most of these types. Let us see the various types in detail.

I. Batch Processing

The very name indicates that this processing type is performed in batches instead of processing done in one go. In this type the data is gathered for a time and collected into a group (batch) before they are entered into a computer system and processed. When batch processing is used, the input data are typically recorded on source documents before being converted into a machine-readable form.

Batch processing is an efficient approach to use in applications such as preparing bills, processing pay-roll checks, library catalogue card preparation. For example in the case of library catalogue cards preparation, you need not enter the data for cataloguing of new books that are added to your library every day as and when a book is accessioned. Over a period of time you can accumulate the data and once in a week or fortnight or a month you can feed into the system where it will be processed in batches. Mainframe Computers are best suited for submitting Batch Processing Jobs. Preparation of Telephone Bills, salary slips, reminders for payment of insurance premia are some examples suitable for batch operations.

In batch processing there is always some delay between the occurrence of the event and the availability of results. For example, if catalog cards are printed once a month, details of books added immediately after a run of the job will have to wait for month to get added to the catalog.

II. Interactive Processing

Interactive processing occurs immediately after input data are entered into a computer system, and the output results are quickly produced. In this type, the user responds to program queries to supply data about a particular field in a record. The system instantly reacts to process the data and produce the output information and is then ready to interact further. A teller responding to questions displayed on a screen enters the input data into an online transaction terminal. The computer system then immediately traces out the previous

link from the memory and responds in an interactive manner. The system supplies up-to-the minute information in response to the inquiries it receives from the user workstations. s

A salesperson uses a workstation to answer a customer's question about the availability of a part. Similarly, an airline ticket agent can have immediate access to reservation system records to see if seats are currently available on a particular flight. In a library environment a user can find out if a particular book is issued out and when it is due or a particular book issued out earlier has been returned now.

Interactive processing produces output results immediately after input data are entered into a computer system. When a computer system relies on scattered online data entry stations, such a quick response is needed. In interactive processing the response time depends upon the network traffic, number of people using the system, complexity of the query etc. Results, which contain lengthy reports and graphics output, are likely to take more time.

III. Combined Processing

Combined processing is a combination of interactive processing and batch processing in a single system. A common business practice is to use interactive processing when customers are waiting and a quick response is needed. At the same time, data produced by the interactive processing may be captured and accumulated into batches so that they may be processed later. As an instance of combined processing scenario, we may mention a library that may opt for data entry of books added as a batch operation and go for Interactive processing for Circulation Control. Here there might be a delay in finding out books added to the library – because of batch operation; but as far as circulation is concerned one can find out the status of a book (available for loan or not) immediately as this part of the work is done interactively.

IV. Real-time Processing

Real-time processing is in a parallel time relationship with an ongoing activity and is producing information quickly enough to be useful in controlling this current live and dynamic activity.

A real-time system uses interactive processing but an interactive system need not be operating in a real time situation. The difference is that real time processing requires immediate transaction input from all input-originating terminals. Many stations are tied directly by high-speed telecommunication lines into one or more processors.

In Real-time processing several stations can operate at the same time. Files are updated each minute and inquiries are also answered by split-second access to up-to-the minute records. But it is possible to have an interactive processing that combines immediate access to records for inquiry purposes with periodic transaction input and updating of records from a central collecting sources. For example, one can think of a computer system in an aircraft which automatically controls the course of the flight depending upon changing inputs such as altitudes, pressure, wind velocity, cloudiness etc. Another example is the Railway Reservation facility: Here, as soon as a ticket has been issued and a specific Berth on a certain train on a certain date has been blocked, this information is made available instantly to all reservation clerks.

V. Time Sharing Systems

'Time sharing system' is a general term used to describe a processing system with a number of independent, low-speed, online and simultaneously usable stations. Each station, of course, provides direct access to the processor. The use of special programs allows the processor to switch from one station to another and to do a part of each job in an allocated

time slice until the work is completed. The process is frequently so fast that a user has the illusion that nobody else is using the computer.

In the centralized computing environment of the early 1950s, users prepared their data and programs and then submitted them to the computer for processing. The computer center collected these user jobs and fed them to the computer in batches at scheduled intervals.

A number of organizations sell time-sharing and remote computing services to their customers. These organizations may install terminals or personal computers in customer offices and then use telecommunication channels to link these workstations to their central processors. Time Sharing systems have become obsolete nowadays.

VI. Parallel Processing

Parallel Processing is performed by thousands of processors in a parallel processor. Mainly supercomputers are fitted with parallel processors which cost around $1,00,000 a piece. Information is processed in parallel simultaneously in different processors when compared to the single processor in old computer system which process information in a sequence. Parallel processors will be able to solve scientific, technological, business and artistic problems too complicated for sequential computers. Parallel computers have many small computer chips working together to perform millions of arithmetic operations second. Computers with parallel processing capabilities are costly. Applications like weather forecasting, tracking of satellite movements, remote sensing etc call for parallel processing.

VII. Distributed Data Processing

Information is generally scattered over a long distance. Accessing such information is an important point to be considered. This is done by storing the information in a central computer located at a central point and accessing through remote terminal through telephone service. An alternative method of accessing information is to telephone the central computer and ask the operator to interact with the central computer and give the results over phone or by mail. This kind of accessing information is possible through distributed data processing. Most of the databases which are being accessed by librarians and information scientists all over the world are working on this type of data processing. In this processing a third technology (while computers and programming are the two technologies), data transmission via long distance telecommunications links is involved.

Briefly a distributed data processing network consists of many geographically dispersed independent computer systems connected by a telecommunication network. It places the needed data, along with the computing/communications resources necessary to process these data, at the end user's location.

In distributed data processing, the processing activity itself is carried out in parts by different computers linked through a network. For an example, please see section under Z39.50 in the Unit on OPAC. This is an example where data is obtained from different computers and processed in a central server and passed on to a client machine.

3.5 PROGRAMMING AND PROGRAMME DEVELOPMENT

We shall learn in this section the meaning of several words like a computer program, programming, programmer, programming language etc. We shall also look at some basic steps in developing a computer program.

3.5.1 Programming Concepts

We have already said that a program is a list of instructions, which the computer can understand. The set of instructions are written (using some Computer Programming Language like Fortran or Cobol) in a sequence so that the computer can follow step by step (one instruction at a time) and process the data as per the instruction.

Normally the instructions are of four types: 1) Arithmetic, 2) Tests or conditional expressions, 3) Sequence changes, and 4) Input/output. All instructions are presented to the computer in a single list and the control unit follows down the list in strict sequence, causing each instruction to be obeyed in turn. Arithmetic Instructions do addition, subtraction, multiplication or division or a combination of these basic operations.

A test instruction has two possible answers: 'equal to zero' and 'not equal to zero'. Another type of test will have three possible answers: 'less than zero', 'equal to zero' and 'greater than zero'. The reasons for a test are always that we want the computer to do one thing for one answer, but a different thing for a different answer. In other words, we need to have the ability to change the strict sequence in which the computer follows the program.

The third type of instruction is a sequence change or jump. With a jump instruction we could tell the computer that if a certain value is zero, it is to jump to a different part of the program. If the value is not zero, it will not jump but will go on to the next instruction in sequence. The final type of instruction is an input/output (I/O) instruction. Computer must be able to get a "read" or "Write" data. Typical I/O instructions are 'read', 'print', 'display', 'input', 'output' etc.

High-level languages allow the precise and very detailed computer instructions to be written in simpler, more easily understandable form and programs written in high-level languages are compiled by a special program -a compiler-into machine code. There are also languages, which fall between high-level and machine code, usually called assembly or low-level languages, and these still require translation into machine code by a special program called a translator.

The programs are stored in a computer memory and the data related to these programmes is processed by the computer as and when a new transaction takes place. Hence a computer should allot memory space to store programs and as such it is called a stored program.

3.5.2 Steps in Developing a Programme

Developing a programme involves the following steps:

1) Problem Definition

2) Program Design

3) Coding

4) Debugging and Testing

5) Documentation

6) Implementation and maintenance

We shall consider these steps one by one now.

1) Problem Definition

Problem definition is the first and perhaps the most important step in program development. If the problem is not well understood, the program may not function, as it

should. This step involves mentioning: Input, Output, Processing requirements, System constraints such as time, Operating System, Hardware availability, Accuracy expected, response time etc). Error-handling methods also form pat of this step. Study of System documentation and discussions with users are needed at this stage.

2) Program Design

Here the programmer decides precisely what steps the program should take and in what order. Algorithms and flow charts are useful here. Algorithm is a like food recipe showing how to cook a specific item, but more precise. Flow Chart shows the logical flow of action using specific flow chart symbols. A flow chart is a graphical representation of the nature and order of the operations and the decision logic required to solve a problem.

Both aid better understanding of the exact procedure involved. Some other techniques useful at this stage of program development are:

Modular Programming: The entire task is broken down into smaller pieces called modules. Each module is independently developed - coding, testing, validation are done separately for each module. Thereafter all modules are integrated to form a whole.

Top Down Design: Here the programmer starts with an overall view then goes down to specifics. Bottom up design is the converse of the Top Down approach. All specific small individually identifiable modules and functions are developed first; then they knitted together to form bigger modules and then the whole application.

Structured Programming: Here program are written following a rigid format. Each function or module has only one entry and one exit point. Structured approach ensures better programs. Hierarchical relationships among modules are drawn up. Pseudo-code is used to show how the program flow is likely to be.

Documentation prepared at this stage shows clearly how the program will be developed.

3) Coding

Coding involves writing out a series of statements or lines of code as they are called in the programming language chosen. Rules of the grammar of the chosen language are followed. Following Table shows a simple program in Basic Language.

A Simple Basic Program	
10	Let A = 10
20	Let B = 20
30	Let C = A * B
40	Print C
50	End

In the above example, the numbers at the left hand column are statement numbers. The program gets executed statement by statement, sequentially following the statement number. Statement Numbers are given in steps of ten in order to provide for insertion of extra statements if needed in between. The meaning of the statements are given below:

1. Statement 10 says: Locate a place in the computer memory; call it A; place the value 10 into this location.
2. Statement 20: Similarly, in other words, assigns a value of 20 to the variable B.
3. Statement 30: Similarly locate a place in the memory of the computer, call it C, and place in that location the value obtained by values placed at A and B
4. Statement 40: Show the value of location C on to Computer Screen
5. Statement 50: End the Program.

Coding consists of writing out such statements in the chosen language. Appendix to this Unit gives some information on several popular programming languages.

4) Debugging and Testing

A bug is an error and debugging is detecting and elimination of errors. It is an important and time-consuming step. Inadequate attention at this stage results in bad program resulting in a lot of re-working later on. Program maintenance costs will go up if this step is neglected.

Debugging (also called Verification) is detection and elimination of errors. Verification ensures that the program does what the programmer wanted it to do. Verification answers the question: does the program perform as it intended?

On the other hand, Testing, also called Validation, answers the question: Has the programmer understood correctly what the program should do? Testing ensures that the program produces correct (expected) results for a set of input data. This can happen only if the programmer has correctly understood the problem.

Three are two types of errors one might encounter: Syntax errors and Logical errors. Syntax errors result as a result of not following the rules of the grammar of the programming Language. For instance if a Verb is "DISPLAY" and you have typed "DISSPLAY", syntax error is thrown up. Logical errors are more difficult to detect and correct. If a programmer mentions ADD while SUBTRACT is the correct instruction, then logical error occurs.

Testing involves preparation of test data and feeding it to the program to see if correct results come out. Modules are tested independently till they are perfect. Thereafter modules are integrated. Testing to see if data flow is proper between one module and another is called Integration Testing. Taking the entire application as a whole, some tests are carried out. This area is called System Testing.

5) Documentation

The next step in program development id Documentation. This process involves collecting, organizing, storing and otherwise maintaining on paper a complete record of what functions a program can perform and how these functions are performed. Documentation should include:

1. Objectives of the program
2. Description of the system: Specification, scope, form of input data and out formats needed
3. Program flow charts, program listing (the Code part), test data and test results
4. Operator instructions. Running and terminating instructions
5. Program controls to check correctness and reasonableness of input data

A program becomes perfect when it is fully tested validated and documented

6) Implementation and Maintenance

After through debugging and testing and ensuring that documentation is in place, the program is implemented. During the implementation stage, the manual system may also be run in parallel till complete confidence in the program is developed. Training in use of the program may be needed. Problems faced during implementation are noted and program corrected appropriately.

Due to a number of reasons like: a) change in operating systems or hardware b) revised needs of users c) changes in laws etc the program may have to be frequently revised. Errors might crop up several months after proper running of a program due to reasons unforeseen by the programmer. The Y2K problem is a classic example requiring thousands of programs being re-written. Good documentation is useful in program maintenance and revision.

3.6 LET US SUM UP

Unit we have seen the meaning of Computer software; different categories of Software like Pre-written Software and Custom-made Software etc. Various steps in Data Processing Activity and various types of Data Processing have been described in detail. We also learnt briefly about Operating Systems in general. What constitutes a program how to go about developing a computer program and what computer Languages are available for this task – have all been covered in the last section. In the next UNIT 4 Library Software Application Packages will be dealt with.

3.7 GLOSSARY

Application Program: Software designed to perform specific applications like word processing, billing etc.

Applications Packages: Prewritten computer programs designed for specific tasks.

Assembler Program: A computer program, which converts non machine language into machine readable language

Batch Processing: A technique in which a number of similar items or transactions to be processed are collected into groups and periodically processed.

Compiler: A program that produces a machine language program from a source program that is usually written in a high level language by a programmer.

Debugging: To detect, locate and remove mistakes from a routine or malfunction from a computer.

Distributed Processing: A method of using many computers to share the computing and processing work

Flow chart: A diagram that uses symbols and interconnecting lines to show a logic and sequence of specific program operations

High-level languages: A programming language oriented towards the problem to be solved. A set of instructions given to a computer by using letters, symbols or text rather than codes 0s and 1s that the computer normally understands.

Interactive Processing: A processing approach that starts immediately after input data are entered and the output is produced.

Logic Errors: Errors result from an incorrect sequence of sequence of instructions.

Machine Coding: An operation code that a machine can understand and execute.

Machine language: A language that is understood by a computer

Operating system: An organized collection of software that controls the overall operations of a computer.

Parallel Processing: Simultaneous execution of two or more processes in multiple devices such as channels and processing units.

Program Library: A collection of portions of programs that are used repeatedly in several programs

Real Time Processing: An online computer processing which receive and process data quickly enough to produce output to control the outcome of the process.

Symbolic Addressing: An address expressed in symbols convenient to the computer programmer.

System software: Collection of complex program designed to operate control and extend the processing capabilities of the computer.

Source program: A computer program written in a source language such as BASIC, COBOL, FORTRAN etc

Syntax Errors: Errors in expressions in language in a computer program.

Translator: A routine for changing information from one language to another.

Word processing: Use of computers to create view, edit, and store and retrieve textual data

3.8 REFERENCES AND RECOMMENDED BOOKS

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3.9 MODEL EXAMINATION QUESTIONS

I ESSAY QUESTIONS

1. Describe the various steps in Data Processing Activity. What are the different types of Data Processing approaches?
2. What is a computer program? Describe the various steps in developing a good Program.
3. Write an essay on some of the important Computer Programming Languages, mentioning the suitability of each for Library applications.
4. Briefly describe how computer software can be categorized. Discuss features of any one of the popular Operating Systems you are familiar with.
5. What is programming? Name some high level languages and discuss their applications?

II. SHORT NOTES

a) Multi-user Operating System

b) Custom made Software

c) Java

d) Visual Basic

e) Debugging and Testing

f) Combined Processing.

g) Syntax Errors and Logical Errors

h) LINUX

3.10 APPENDIX : PROGRAMMING LANGUAGES

A computer program is a series of instructions written using a computer programming language like Basic or Fortran. The computer will execute the program in the fashion indicated. A program may contain statements to do the following:

1. To branch to another part of the program
2. To perform repetitive tasks
3. To open read and close a file of data
4. To create variables to hold temporary data etc.

The art of writing, testing, evaluating, debugging a program is called computer programming. (You have learnt about Computer Program development in a separate section in this Unit; in the next Unit, Unit 4 you will find some details about Application Software Development). Therefore to write programs, programming languages are needed. This Appendix gives information on a number or complete Software Packages of programming languages. It is divided in to three parts. Part 1 gives information on "Conventional" programming Languages. These languages have been in existence for well over two decades. Newer ones are given in Part 2. The last Part discusses briefly the suitability of Programming Languages for Library Work.

Part 1: "Conventional" Programming Languages

Assembler is a language using machine codes that are closer to the computer hardware. They execute fast. The language is cryptic and not easy to use. These are called low-level languages. High-level languages on the other hand are easy to use and t implement. COBOL FORTRAN Pascal Basic ALGOL etc are examples of High Level Languages. In the later part of this section we will see details of recent programming languages.

BASIC (Beginners All Purpose Symbolic Instruction Code)

This programming language is very easy to learn. About a decade ago most children used to learn programming starting with BASIC. It is available DOS. As Windows has come into prominence a graphical version of Basic called Visual Basic is also in use. Basic Programs comprise of statements and line numbers. Both Compilers and interpreters are available for Basic. Basic programs are very slow. It is an interactive program, which means a direct interaction between the computer, and the user is possible. The statements in BASIC are written in free form without restricting to a line. A small example is given in the main unit.

There is an ANSI (American National Standards Institute) standard for a minimal version of BASIC published in 1978.

COBOL (Common Business Oriented Language)

This is a very popular high level programming language. It is used or commercial, business and data processing applications. It is suitable for text processing and has also facilities for manipulating strings. It is suitable or library applications as bibliographic databases are mostly text fields. Cobol is very verbose and programs are voluminous and big. COBOL is slow compared to Fortran or C.

COBOL uses ordinary business words such that accountants, auditors and others can easily understand it. It has four divisions in a program. Identification Division identifies the author, machine environment and such other details. Environment Division consists of two required sections that describe the specific hardware to use when the program is run. If the application is to be processed on different equipment, then this division has to be rewritten. The Data Division is divided into file and working storage sections. The purpose of this division is to present in detail, a description and layout of input data items in a record and all the records in each file that is to be processed. All storage locations that are needed during processing to hold intermediary results and the format to be used for output results. Procedure Division contains the sentences and paragraphs that the computer follows in executing the program. In this Division, most of the processing wok is performed.

The major advantage of COBOL programming is that it can be written in simple English language by employing commonly used business terms. Because of this non-programmers in business can easily follow this program. COBOL is better able to manipulate alphabetic characters, which are important in business processing where names addresses and descriptions are frequently reproduced. A standard version of the COBOL language is supplied by computer manufacturers, which takes care of 80 % of the code needed in a particular application program. The other 20 % of the code is to be manually written by a programmer.

FORTAN (Formula Translator)

Fortran is one of the early programming languages suitable for scientific and mathematical applications. Fortran IV and Fortran 77 are popular versions. Fortran 77 has a number of additional facilities for string processing. It can be used for library work with some difficulty. Large "libraries" of scientific functions are available on a ready-to-use basis. Scientists, mathematicians and engineers use Fortran much. This is a compact language. Huge libraries of engineering and scientific programs are readily available now.

PASCAL

PASCAL is named after the French mathematician Blaise Pascal. It is a highly structured language. When a person wants to learn the art of programming he should tart with PASCAL. It allows users to define their own data structures and is therefore very flexible. It is highly procedure oriented. CDS/ISIS a library software package has its own version of Pascal built into it.

Programming Language 1 (PL/1)

A language that combined the features of Fortran, Cobol, and Assembly Language was developed in mid 1960s. It was a 'large' language for mainframe computes. After a lapse of non-use for a number of years, because of Y2K interest in PL/1 was re-kindled.

C Language

C is a language useful for all purposes – system programming, applications programming, and to develop other programming languages. C programs are very compact (small) and run fast. It is available on all Operating Systems inkling DOS. Unix and C go together as Unix has been developed using C. In C operators, functions, data types are very rich.

Part 2: Recent Programming Languages

JAVA

JAVA is a programming language developed by SUN Microsystems in 1991. It was called OAK then; it was later renamed as JAVA in 1995. Present version is JAVA V2.0 It is a purely an Object Oriented Programming language taking all the best features of C and C++. It is simple and easy to learn. It is portable and platform independent. That is to say, programs developed in Java are not specific to any single operating system like Windows or Unix. It is also secure and robust: the programs will be safe to be used on the Internet and virus may not attack them easily. JAVA can be used as an independent programming language and as well to develop short programs called Applets, which run at client's site over the Internet. In this respect Java is very Internet Oriented.

Visual Basic

This is a Microsoft programming language used as a front end to develop application packages. For example if you store your data in a DBMS say MS SQL and retrieve portions of it using some query form, the user's query can be captured through a front end program. VB programs follow standard Windows practices and therefore very user friendly. Concepts like Object Linking and Embedding (OLE) and ActiveX are employed in VB. For instance in Windows, one can drag and drop a file from one directory to another as a file is treated as an object. VB has run through many versions and VB 6.0 is the latest (2001). As of September 2001 Microsoft was putting a Beta version of Visual Basic.Net as a new and improved product.

C++

This was developed by Dr. Bjarne Stroustrup of AT&T Bell Laboratories in early 1980 to improve C by adding Object Oriented Programming concepts. C++ is flexible, fast and portable. It is fully compatible with C. C++ supports two popular programming models: Procedural programming and Object Oriented Programming (OOP). It is an extremely case sensitive language and uses extensively functions. Like other programming languages, source code written C++ must be compiled and linked to produce an executable program file.

JavaScript and VBSscript

These are scripting languages. They are highly stripped down sub-sets of their parent languages viz.: Java and VB respectively. The code using Jscript or VBSscript is written into html files. They are interpreted by the interpreter part of the Web browser at client end. This arrangement reduces the load on servers. Scripts are used for performing simple tasks like data validation etc when a user files up a form on the net. Internet Explorer has both Jscript as well as VBSscript interpreters.

Visual C++

Microsoft Visual C++ is another OOP front end programming language for developing applications on the Net. It uses Microsoft Foundation Classes Library. Internet is

tightly integrated into VC++ environment. Concepts like ActiveX, COM DCOM are used in VC++

Part 3: Suitability of Programming Languages for Library Work

Library applications involve hug textual and bibliographic records. Text processing, string manipulation and comparisons are needed more than arithmetic calculations. Most library applications deal with string comparisons, data processing and information retrieval. From these points of view COBOL, SNOBOL, Fortran77 and C are suitable. Fortran IV, Basic, ALGOL are not suitable.

Among the newer languages. when library applications are on an Intranet or on the Web, languages like Visual Basic, VC++ are suitable for front-end programming. For developing stand alone packages any of the newer ones including C, C++ will do.

Jscript and VBScript are also useful for Internet based applications.

Use of Fourth Generation Languages in Libraries

During the eighties and early nineties, many PC based Data Base Management Systems like dBASE, FOXPRO, Clipper were popular. They are commonly referred to as xBASE. DBASE has its own database creation, report generation and program development facilities. Many libraries developed in-house library applications using these DBMS packages and are till running satisfactorily. They are OK for single independent libraries and very useful in networked environment. Data security in xBASE is generally poor. Presently many RDBMS packages like Oracle, Sybase, Ms SQL, Ms Access etc have come with their own programming and querying languages. When an RDBMS like Oracle is used for library work it is used in a network. Visual Basic, VC++ SQL in combination with Oracle or Sybase is used.

Many library applications are also made accessible via Internet. In such cases for example OPAC, the client side programming is done using a mixture of HTML, JavaScript, VBScript, XML and the like.

BLOCK - II : LIBRARY AUTOMATION AND INFORMATION SERVICES

This block consists of five Units. A Librarian needs to know what is a software package, how is it developed, how to select a good software and also have a good overview of Library Automation scenario in India. He should also be aware of most popular Library Application Software Packages available in India. Unit 4 covers the Library Application software and provides some major Indian Software Packages.

Two of the most important library activities are Acquisitions of books and periodicals and Cataloguing of acquired resources. Use of computers in each of these activities is outlined; the workflow in the manual process and in automated process is compared; advantages of computerization are explained; and features to look for in a good software package are listed in Unit 5.

Unit 6 shows how the catalogue can be made accessible to a large number of people at the desktop of individuals over a Local Area Network by means of an OPAC. As OPAC is an indispensable part of Library Automation, a complete unit is devoted to it. Features expected of a good OPAC, examples of established OPAC systems, searching techniques on OPAC are given in this Unit. Web-based OPACs, a recent phenomenon, are also explained.

UNIT 7 concentrates on two further areas of a librarian's concern: Serials Control and Circulation Control. Problems associated with serials management and how automation is beneficial are explained. Automation of Circulation Control, most easily carried out task in libraries, is fully explained.

Units 4 to 7, together, have dealt with traditional tasks normally covered under "Library Automation". Unit-8 covers Information Services related activities: classification, indexing, thesaurus construction, CAS, SDI, translation, reference service, databases and searching.

It is suggested that the Appendix of Unit-4 may be studied once again after completing all the units of Block II. To get a complete picture of 'searching techniques' the student should read relevant portions of Units 6, 8 and 10 together once again. After completing Block II you would be having a good idea of how computers are used and the most important activities of a decent library.

UNIT - 4 : LIBRARY APPLICATION SOFTWARE

Structure

4.0 Aims and Objectives

4.1 Introduction

4.2 Application Software

- 4.2.1 What is an Application Software
- 4.2.2 How to Develop an Application Software
- 4.2.3 Library Application Software

4.3 Elements of an Automated Library System

- 4.3.1 System Purpose
- 4.3.2 System Workflow
- 4.3.3 System Input
- 4.3.4 System Processing Operation
- 4.3.5 System Output

4.4 Developing an Automated Library System

- 4.4.1 Locally Developed Systems
- 4.4.2 Turnkey Systems
- 4.4.3 Adopted Systems
- 4.4.4 Shared Systems

4.5 Features of an Automated Library Systems

4.6 Library Automation History

4.7 Library Automation in India

4.8 How to select a Software Package ?

4.9 Let Us Sum Up

4.10 References

4.11 Assignment

4.12 Model Examination Questions

4.13 Appendix: Some Indian Library Software Packages

4.0 AIMS AND OBJECTIVES

This unit introduces students to the computer application software, the elements of automated library system and the features expected in the same. The unit also introduces history of library automation in general, with particular reference to India.

After going through this unit, you will be in a position to:

- explain different modes of adopting a library application software
- discuss the particular features expected from library software in order to adopt it

- describe the history of the library automation and its current scene in India.
- explain broad criteria for selecting library software
- briefly describe some popular library application packages in use in Indian libraries.

4.1 INTRODUCTION

The term 'Software' denotes the program or predefined sequence of instructions, which a computer executes to accomplish a given information processing task. The hardware components in a computer system are visible, tangible, and readily comprehensible. Software, on the other hand, is a conceptual entity - an intellectual product. It does however have a tangible manifestation. The individual instructions that make up a computer program are basically in human readable form.

Computer software are sets of step by step instructions or programs that command the machine to perform operations on information. A string or set of these instructions is called a computer program. The computer follows the program, one instruction after another in a specified sequence, until a job is completed. A different set of instructions is required for each application or job the computer is to perform. All computers are built to respond to a predetermined set of instructions which initiate the execution of arithmetic logical or other data manipulations as well as transfer of data between various system components. The exact number and nature of such instructions varies with the size and power of the central processor of a given type regardless of the number of instructions provided. Programming is that activity in which executable instructions are selected and combined in an appropriate sequence. A programming language consists of syntactical and semantic rules which specify the manner in which particular instructions are to be used and combined. Computer software can be classified into two groups, system software and application software. System software refers to the group of multifunctional supervisory programs. Computer operating systems such as DOS and Unix fall in this category. Operating system provides user-computer interface. Such software is generally maintained by the manufacturer.

4.2 APPLICATION SOFTWARE

Application software is the computer program developed to perform tasks specific to the individual user. The software used in library falls in this category.

4.2.1 What is Application Software ?

Application software is developed to make the best possible use of the computer hardware and system software to obtain the desired user needs. Assemblers, compilers, and interpreters support the development of application software, which consists of those programs which perform one or more user specified tasks. For most users such application software is the most important component of computer system. This hardware/software relation can be shown as below:

User - Application programs - Compilers - Operating Systems- Computer

User interacts with application programs which are compiled using compilers. These compilers which validate the instruction and syntax are part of the operating system. These operating systems translate the program instruction to machine readable form.

Unlike system software, the development of application software is typically the users responsibility. An increasingly substantial amount of application software is purchased and pre-written, but still custom developed programs continue to play an important role in many

installations. Although the automated library systems make extensive use of prewritten software, customized enhancements may be developed for specific situation.

A wide variety of computer languages such as PASCAL, COBAL, C and others can be used to develop applications. Choice of a particular language depends mainly on the nature of application. These days relational database management systems like Oracle, Ingress, etc. through the System Query Language interface provide for development of applications efficiently.

4.2.2 How To Develop An Application Software ?

In most applications the software development process begins with a detailed study of the existing operations or combinations of operations which accomplish the task to be computerized. This study is called a system analysis and in the broadest sense its purpose is to gather and evaluate the information necessary to improve an existing system or replace it with a new one. The system analyst determines what is being done in an existing system, whether and to what extent it is being deficient and what alternatives for improvements exist.

Library comprises a number of separate but interrelated and interacting parts called systems which are organized sets of activities, tasks, or operations performed on information, library materials, or other items to achieve a specified end result or purpose. Acquisition, cataloging, circulation, serials control are the large systems in the library. In the traditional manual library system staff perform the various tasks required to complete each operation but if a computer is used to perform some processing operations, an automated library results. In such a system humans and the computer usually share responsibility for performing the work.

4.2.3 Library Application Software

When a computer is used to support a library function - i.e., when a computer performs some of the basic processing operations in a function such as acquisition, cataloging , circulation or providing access to information - an automated library function results. In an automated library function, staff and computer share responsibility for performing work. For example: a staff member might perform the first five processing operations, the computer next 25 operations and staff member next, two and so on. Due to this sharing of responsibilities todays automated library functions are actually human-machine systems.

4.3 ELEMENTS OF AN AUTOMATED LIBRARY SYSTEM

An automated library system regardless of its nature and size consists of a number of interacting elements including system purpose, processing and workflow.

4.3.1 System Purpose

A primary element of an automated library system is its purpose. An automated library system needs to have a goal or mission which provides a focal point for developing the system and for operating and managing the system being implemented.

Example: The purpose of a cataloging system is to process materials to be added to the library's collection in an efficient and timely manner. And to provide access to those materials through effective bibliographic control mechanisms.

The purpose of online catalogue is to decentralize access to bibliographic records and to show their availability from the library's collection. Thus, the purpose of an automated library system is the same as that of its parallel library system. The computer is merely a tool enabling the librarian to do specific tasks faster, more accurately than the staff using manual methods.

4.3.2 System Workflow

Automated system requires the processing of information or physical objects. This processing in a system consist of input, processing operations and output.

4.3.3 System Input

Each automated system requires an input of information, library materials or other items as "raw materials" to be converted or processed into a desired end product. An acquisition system, for example might require an input of bibliographic, fund accounting and location or inventory information about items to be acquired. A materials labelling system might require an input of materials to be processed and located as well as bibliographic and inventory information which will be placed on the identifying labels. The computer itself accepts information as input and that information must be in machine readable form.

4.3.4 System Processing Operation

Each automated library system has a set or group of processing operation which are performed in an orderly and pre- determined sequence on the input of information or physical items. The information or items input into the system are converted to the desired end product. The movement of information materials and other items through the processing steps within a system is referred to as workflow. Common processing operations that the computer can perform include information verification, sorting, merging, calculation, comparison, storage, retrieval, reproduction and dissemination. The computer cannot perform direct physical acts.

4.3.5 System Output

An automated library system produces a defined end result called 'Output'. Physical output includes a variety of reports, management information on system use, OPAC consultation, library circulation etc. which depends on results achieved by performing prescribed information processing and physical operation on input.

In other words systems analysis, an essential prerequisite to the development of computer applications, would go into:

Preliminary Analysis

- determining the user need
- understanding the organizing
- operational review
- outlining the system requirements

Input Analysis

- analysing the present forms/files
- input screen design

Output Analysis

- Print report
- screen display requirement
- Processing Analysis
- flow charting
- developing friendly user interface

Software and Hardware Selection Other Analysis

- implementation planning
- documentation

4.4 DEVELOPING AN AUTOMATED LIBRARY SYSTEM

In all libraries there are routines which are essential to running of the libraries. There are letters to be written, budgets to be prepared. While these areas are not usually in the forefront of the minds of those aiming to computerize libraries, they do lend themselves to this. Software available for general commercial purposes like Word Perfect, dbase, Foxbase and others could be used effectively to computerize some of the library routines. However, these packages have their own limitations and do not necessarily accommodate the specific requirements of the complex library applications. This is also to suggest that library application software need not necessarily be an integrated and a total system with all the subsystems of a library. It could also be one of the several components of the total system. Irrespective of the choice made in adopting an integrated system or only a subset of the total system methods of developing a library system fall into one the following categories.

4.4.1 Locally Developed System

Under this method, designing, coding, installation and testing of the system has to be done locally from a scratch. The software may be maintained and adopted on an in-house computer or on a computer located in a computing centre serving the library. Typically, such a system can be designed to meet the exact needs and requirements of the library and it can maintain control over all aspects of the system's development, installation and operation. However, developing such a system is expensive and time consuming. For this purpose library must have access to software specialists to develop and maintain the system.

4.4.2 Turnkey System

The most prevalent method of developing an automated library system is to purchase and install a library system. A turnkey system is one which has been designed, programmed and tested by an organization and then offered for sale or lease to libraries ready to install and operated. Turnkey systems has its advantages and disadvantages:

Advantages include a possibility of evaluating its operation in a live environment, the cost of designing, coding and testing of the system can be eliminated. And, because of this the system can be installed within a few months, these systems could also be tailored to individual needs. Vendors usually take the responsibility of making the system work in the library.

Among the disadvantages are: these packages may not have all the desirable features, some of these system are inflexible and do not provide for customization.

4.4.3 Adopted System

Another method to develop a library system is to locate a suitable system, then duplicate and adopt the software for local installation and operation. The system could be installed to operate on an in-house computer. Though such a system would have the obvious advantage of saving on design, it may bring along the idiosyncrasies of the original system.

4.4.4 Shared System

Library systems can also be shared with other libraries through networking. Such understanding could be had between main library and branch libraries or keeping the holdings information in a larger network database.

4.5 FEATURES OF AN AUTOMATED LIBRARY SYSTEM

Library Systems differ from other applications in several ways. It is necessary to have a clear understanding of these features before embarking on either developing or adopting a system. These features include:

1) ALPHABETIC INFORMATION

The library system's need for greater alphabetic rather than numeric information. More often the fields for recording author, title and other information need lengthier fields.

2) VARIABLE FIELDS

As titles and other information are not of uniform length, library systems should take care of accommodating such a requirement so that the disk space on the computer will not be wasted.

3) REPEATABLE FIELDS

Fields in a catalogue entry are not only variable in length but also repeatable in nature. There is always scope for more than one author, subject heading, etc., in a record. These authors and subject headings have to be individualised for indexing them as individual access points. Repeatable nature of information is a peculiar feature of the library records.

4) SORTING INFORMATION

Library database which normally contain hundreds and thousands of records are not only expected to select and retrieve the appropriate records but also display them with on author or title.

5) INDEXING

Library databases are frequently searched and large files of bibliographic information are to be retrieved with a satisfactory time frame. This function frequently require indexing of various fields in the databases. There is also a frequent need for wild card searching on title and other fields.

6) SEARCH CAPABILITIES

As efficient retrieval is the key purpose of communication, library software has to provide search capabilities using Boolean conditions namely 'and' 'or' 'not'

7) FLEXIBILITY OF THE PARAMETERS

It is well known that individual libraries vary in their practice of book circulation rules, acquisition procedures, etc. Library software has to take into account possible changes required over time. A general purpose library application has to accommodate for considerable changes across the libraries.

8) OPTIMIZATION OF RESOURCE USE

Though this is a feature expected of all application software, there is a particular need to ensure this in the library situation. Bibliographic information that is input into the system needs to be used in several library operations. Example: catalogue information is required for book circulation, reminder letters to the members, etc. An efficient design should avoid data duplication at different levels.

9) STANDARDIZATION

Library application must invariably adhere to standardized bibliographic formats, on line public access display and serial records. MARC and CCF are the accepted bibliographic

storage formats. Standard input formats are essential for effective database merging and resource sharing among the libraries.

10) AUTHORITY CONTROL

Authority control is a feature important to libraries. Huge files of cards of standardized author and subject headings are maintained in the manual systems for this purpose. Computerization must facilitate this work by providing list values to search while cataloging.

11) IMPORT AND EXPORT FACILITIES

Need for importing data from other databases and exporting the data in acceptable standard formats are increasingly felt these days. This is an essential feature which helps avoid duplication of efforts particularly in cases where there is a need for merging databases, importing catalogue record from a larger system or even in cases where the library decides to migrate to another software.

12) BACKUP AND UPGRADATION

As the library database are usually very large there is a need to take con s backup of the data. Library software is expected to provide a routine for this purpose. So a there is a need for upgradation of the software as the intention of any library application is facilitate better storage and retrieval of the information.

4.6 LIBRARY AUTOMATION HISTORY

Library automation projects sprung up in large numbers in the United States in the early 1960s. National Library of Medicine began a project to mechanize its handling of medical literature (MEDLARS). The University of California at San Diego began its pioneering work in serials control and Southern Illinois University began studies on its circulation project, all in 1961. In 1963 the publication of King Report 'Automation and the library of congress' which established the feasibility of automating many of the activities of that library.

Project MARC initiate at the US Library of Congress to provide a format for cataloging data that would be machine readable, acceptable as a natural standard and usable interchangeably on all of the different computers. Its success laid the foundation for rapid advances in the field. All these programs were off line or batch processing systems.

In 1967 two large scale projects began which culminated several years later in on-line systems which provided access in seconds to a much larger body of bibliographic data. The Ohio College Library Centre (OCLC) and Stanford University's BALLOTS (Bibliographic Automation of Large Library Operation using a Time Sharing System) were designed to access most of the hundreds of thousands of catalogue records made available by project MARC and additional thousands added by other libraries. Bell Telephone Laboratories and Eastern Illinois University had on-line circulation systems, Laval University in Quebec around this time was using an on-line serials control system, and Washington State University had implemented one for acquisitions.

There were several who spoke of "total systems approach" in the initial stages. But disparity between acquisition data and catalogue data was thought to be too great to make the total system possible. In fact, the library automation started as independent acquisition, catalogue, serials and circulation systems.

Acquisitions systems were used to printing purchase orders and maintaining book budget, provide information on orders outstanding and to prepare vouchers. Book order and

selection system of the University of Massachusetts (1969) BALLOTS - a combined acquisition and catalog systems (1970) were among the sophisticated systems implemented during the time.

Automated Catalogs became more common in the 1970's. A Survey conducted by LARC Association in 1970 revealed a total of 158 catalog systems. These systems usually accomplished creation of worksheets for input, prompting operators by displaying input tags, maintenance of name and subject authority files, provision for editing records, and arrangement of entries in filing sequence, etc. MARC project gave a big boost to automation of cataloging. On line catalog input system, however, came a little later. Most influential of such systems was the OCLC.

Around this time UCLA Biomedical Library developed an efficient and comprehensive search system in 1971. Because of the relative ease with which circulation system could be implemented, circulation systems were very popular from the very beginning.

The dominant trends in Library Automation during the first three decades were shaped and driven by the cost and capabilities of the computer and communication technologies that were available at the time. Local systems dominated in the 1960s because that was all the then available technology could support. Those early batch processing systems were of limited use and only large libraries could afford the high costs of experimenting with them.

Three major developments occurred in the early 1970s which had a profound and far reaching effects on the course of library automation and library management :

- Emergence of first cheap and powerful micro computers
- Coming of sophisticated On-line systems
- Development of powerful telecommunication capabilities

Commercial vendors like CS Systems Inc. started developing turnkey systems for mini computers, first for individual libraries and then for small clusters automation - turnkey systems. Presently DRA, VLTS, COBIT are some of the widely of affiliated libraries. They laid the ground work for this decades' dominant trend in known large packages.

4.7 LIBRARY AUTOMATION IN INDIA

Library automation in India is relatively recent phenomenon. The special libraries notably at BHEL R&D, SAIL, ICRISAT, NIC, INSDOC, DESIDOC, IITs in Kanpur, Bombay, Karaghpur, have successfully developed software internally for library applications. Book and serials acquisition, cataloging, union catalog, SDI, Current Awareness Service are some of the applications developed by these libraries.

Introduction of CDS/ISIS, a generalized textual database management system has come as a boon to the Indian library community. This software developed with specific needs of libraries in mind has been distributed free by Department of Science and Technology, New Delhi. More and more libraries have taken up to computerize their catalog database and information retrieval. DESIDOC has built an integrated application called SANJAY using the PASCAL interface on this public domain software. There have also been similar attempts by other libraries.

In the past decade more than a dozen library application software has been introduced in the Indian library market. LIBSYS, TULIPS, MAITREYI, LIBRIS are the better known among them. Some of these are available in both Unix and DOS platforms.

However, it has to be noted that only MAITREYI developed by CMC Corporation supports the MARC records.

Library Application software in the west are increasingly emphasizing the end user friendly interfaces, and provision of OPACs. Indian packages, however, are still oriented mainly to use by the librarians and information specialists and not by the occasional end users, students and teachers.

During the past decade several Library and Information Networks also have come into existence. DELNET, CALIBNET, INFLIBNET BONET, MALIBET, MYLIBNET are come of these networks. Libraries in institutions affiliated to the CSIR, ICMR, ICAR, DRDO and Government Departments are also attempting to get linked up to each other. ERNET has connected more than 650 CSIR laboratories via Email and Internet. (Unit 12 deals with Library and Computer Networks in detail).

INFLBNET has played a moor role in helping University Libraries purchase computer systems, needed software, get their people trained etc. Nearly 140 universities have been provided with grants and help – including "do-how" and "know-how".

Introduction of Internet during the second half of nineties has changed the scenario in the country. Many libraries have set up their own we sites and have even provided connectivity to their library catalogs via Internet. All IITs, IIMs, IISC, NCL, BARC are some notable ones. British Library and the American Library have also made their catalogs searchable via Internet.

Appendix to this Unit gives short descriptions of some popular Library packages used in Indian Libraries. It is suggested that you read through the appendix once again **after** you have completed Units 5 to 8. You can get a good list of Library Application Software from the Directory of Indian software published in CD by NASSCOM, New Delhi.

4.8 HOW TO SELECT A SOFTWARE PACKAGE ?

Locally developed systems are becoming less and less popular and libraries these days generally acquire the turnkey systems as these systems bring in years of research and are also often pre-tested in the real life library situations. It is essential that system requirements are clearly understood and put down on paper before alternative systems are identified and evaluated.

A system requirement is a statement which defines some desirable aspect of an automated system or specifies what a system must do, how it must perform, or how it is to be operated and maintained.

Selecting an automated library system is a complex activity made more difficult by the number of similar systems available and the conflicting and often overstated claims made by the vendors. A set of requirements developed by the library will enable it to obtain a clear picture of the system wanted before the available alternatives are examined

A focal point must be established for process of developing requirements for an automated system. This could be goal of the library automation project. For example: The goal of this project is to acquire and install an automated, integrated library system, consisting of acquisition, circulation and on line catalog.

A goal could also be more specific, like: The goal f acquisitions system is to acquire books and other materials efficiently for the library through purchase, gifts and exchanges and provide a reliable means of controlling and reporting the expenditure of acquisition funds.

It is helpful to set up a small group to develop the requirements of the system to be acquired. Some of the general types of requirements are -

1) FUNCTIONAL REQUIREMENTS

The bulk of requirements to be established for an automated system will be of a functional nature - defining what the system must be able to do and how it must operate. For this purpose the system must be broken into its component sub systems, to facilitate preparation of its functional requirements such as acquisition, cataloging etc., and each of these can be further broken down into its components.

2) DATABASE REQUIREMENTS

Considerable thought must be given to the database that will support the automated system. The database can consist of one or several related files. The database of the automated acquisition system shall be a file of acquisition records - suggested titles, ordered titles, etc. - a file of fund accounting records and a vendor file. Database requirements may also include data field specifications, file size, etc.

3) GENERAL FILE CHARACTERISTICS

Under these specifications may include whether the files accept and differentiate MARC records. Or whether the system provides for monitoring books received on approval, etc.

4) DATA FIELD REQUIREMENTS

Data fields to be included for each record can be specified.

5) CONVERSION NEEDS

If the library has requirements of converting data from one system to another these needs should be defined. Example Whether the system allows import of MARC records to catalog files

6) REPORT REQUIREMENTS

Automated systems are expected to provide a variety of management reports that can be used for evaluating the library operations. These reports have to be identified. So also possibilities of generating ad hoc reports should also be explored.

7) PERFORMANCE REQUIREMENTS

It is also required to establish how rapidly or accurately an automated system should process data or perform operations. These specifications could include response time on OPAC etc.

Other software facilities such as operating system, system security and database integrity features, software maintenance must also be laid down clearly before the system selection.

Standard bid specifications are available in published sources. These can at best be guidelines for specifying the local requirements.

4.9 LET US SUM UP

Let us recapitulate briefly what has been dealt with in this unit.

- Computer software are sets of step-by-step instructions that command the machine to perform operations on information.

- Application software is the computer programme developed to perform tasks specific to the individual user.
- The application software that is specifically developed for use in library operations and services may be called 'Library Application Software'.
- Developing an application software for an automated library system may be developed locally, through turnkey system, adopted system or shared system.
- The essential features expected from a library application software are repeatable fields, sorting and indexing facilities, search capability, standardisation, import and export facilities, backup and upgradation facilities.
- There are several library application packages available in India. Some of them are CDS/ISIS, MINISIS, Techlib plus, LIBSYS, LIBRIS, TULIPS, Maitreyi, etc.

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4.11 ASSIGNMENT

Consult a computer software directory and list out Library application software produced in India. Collect maximum details of any one package by observing its usage in any of the libraries in Hyderabad.

4.12 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1. What is an Application Software? How I different from System Software? What are the steps in developing an application Software?
2. What are the peculiar requirements of a Library application software? What points are to be considered when evaluating a software package?
3. List Important Library Application Software Packages available in India. Describe salient features of any two of them.

II. SHORT NOTES

a) Application Software

b) Turnkey System

c) Shared software

4.13 APPENDIX : SOME INDIAN LIBRARY SOFTWARE PACKAGES

1. VIRTUA ILS

Virtua ILS is a comprehensive well-integrated Library Software Package from VTLS Inc, Virgenia, USA. ILS stands for Integrated Library System. It has all the Library Modules: Acquisition and Fund management, Circulation, Cataloging, Serials Control etc.

There are several features that are unique to VTLS Virtua ILS.

- It is a fully parameterized software: User Library can configure the setting to its maximum flexibility.
- It adopts UNICODE and as a result can support number of language fonts not normally supported by others.
- ILS has Z39.0 built into the software As a result, ILS users can reach external library catalogs easily and conduct searches. Converse is also true, if other libraries permit access to reach external databases. [For information on Z39.50 see Unit on OPAC].
- There is a powerful Language Editor to input records in different languages
- It has provision for RFID tags and labels (see note below on RFID)
- It comes with a Chameleon Gateway: With the help of this gateway, the user's screen can be customized according to his needs.
- It has an exhaustive Statistics and Reporting module.
- It comes with heavy security possibilities: Security of access can be monitored at User, User Group, Patron, Patron Group and Location Library levels. Depending upon security rights granted to you, the tool bar on your screen contains only those icons that are usable by you.

A Note on RFD Technology:

RFD stands for Radio Frequency Identification. Labels which are as thin as paper contain electronic chip embedded with details of the patron, accession number of a boo etc. These are pasted onto books, user's cards etc. RFD sensing devices 'read' these RFD labels or Tags remotely from a distance, that is, no line of sight positioning of the reader is needed.. As a result, a number of advantages arise.

i) Stock verification ad Inventory control could be carried out using hand held reading devices. Just wave the Reader across the shelf, all accession numbers are read in.

ii) Theft detection is possible if a reader is fitted to the exit door. When a user unauthorizedly takes out a book, RFD scanner detects it and raises an alarm

iii) Un-manned self-service counters can be maintained for checking in and checking out books. After scanning incoming books, software automatically "cancels" the Issue

iv) Identification of mis-placed items will become easy.

v) Greater availability of books because wrong shelving can be avoided corrected.

vi) Greater efficiency and productivity in library

New Hanovar County Public Library in North Carolina has started using RFD technology from Jan 2001 work. In Hyderabad, the Central University of Hyderabad has procured Virtua VTLs for automating their Digital Library.

2. CDS/ISIS

Purpose and objectives

CDS/ISIS stands for Computerised Documentation Services/Integrated Set of Information Systems. CDS/ISIS is an advanced non-numerical information storage and retrieval software developed by UNESCO since 1985 to satisfy the need expressed by many institutions, especially in developing countries, to be able to streamline their information processing activities by using modern (and relatively inexpensive) technologies. The software was originally based on the Mainframe version of CDS/ISIS, started in the late '60s, thus taking advantage of several years of experience acquired in database management software development. CDS/ISIS is available for DOS, Windows and Unix.

This software package is selected and used by libraries, documentalists and archivists in more than 130 countries. In India, NISSAT is the authorised National Distributor for Mini and Micro CDS/ISIS.. It is a menu-driven and generalised information storage and retrieval system designed specially for the computerised management of structured non-numerical (ie textual) databases. Along with GIST CARD, the package can also handle Indian scripts.

MS-DOS version IBM PC or compatible micro computer with at least 640k RAM, 2 Mb hard disk space, 3 1/2 inch High Density diskette unit, MS-DOS version 3.0 or higher.

Salient Features of CDS/ISIS are:

1. The handling of variable length records, fields and sub fields, thus saving disk space and making it possible to store greater amounts of information;
2. The handling of repeatable fields;
3. A data base definition component allowing the user to define the data to be processed for a particular application;

4. A data entry component for entering and modifying data through user-created data base specific worksheets;
5. An information retrieval component using a powerful search language providing for field-level and proximity search operators, in addition to the traditional and/or/not operators, as well as free-text searching;
6. A powerful sort and report generation facility allowing the user to easily create any desired printed products, such as catalogues, indexes, directories, etc.;
7. A data interchange function based on the ISO 2709 international standard used by leading data base producers;
8. An integrated application programming language (CDS/ISIS Pascal and the ISIS_DLL), allowing the user to tailor the software to specific needs; functions allowing the user to build relational data bases, though CDS/ISIS is not based over a relational model;
9. Powerful hypertext functions allow to design complex user interfaces.

From the outset, CDS/ISIS was created as a multi-lingual software, providing integrated facilities for the development of local linguistic versions. Thus, although UNESCO distributes only the English, French and Spanish versions of the user-developed versions exist in virtually all languages, including special versions which UNESCO helped in developing, for Arabic, Chinese and Korean.

CDS/ISIS : the Windows Version

The Windows version (compatible with Windows 3.1x, 95, 98, Me, NT4 and Win2000). (version 1.4 was released in Jan 2001) . The hardware and software requirements are given below:

Windows version: Intel Pentium processor, at least 16Mb RAM, 10 Mb hard disk space, 3 1/2 inch High Density diskette unit, Windows 3.1x or Windows 95/98/Me, Windows NT or Windows 2000.

Windows version has been totally re-written in C++ language (as against Pascal in DOS and Unix versions); this move provides a common standardized language for all platforms - DOS, Windows, UNIX etc). This reduces maintenance costs, increases portability, and renders implementation of client-server architecture easy.

No conversion is needed when moving from CDS/ISIS DOS to CDS/ISIS for Windows. Same database and inverted files of DOS can be used here. Some changes in Formatting language and displays however occur.

3. SLIM (=System for Library Information Management)

SLIM is a Library software Package from Algorithms, Pune. SLIM is an integrated, multi-user library information software. It helps the librarian catalogue books, films, sound recordings, drawings, clippings, articles, reports, letters, pamphlets, serials publications... all those things that contain information so vital to a library.

SLIM cataloguing adheres to popular international standards. This means you can exchange your data with the world. Retrieval of the data is simple, fast and efficient. Even a catchy phrase in the description of the catalogued item can be used for searching.

In addition to Cataloguing, SLIM contains modules for Circulation, Acquisition, Serials Control, Usage Statistics, Funds Monitoring, etc. SLIM can be configured for your specific requirements by choosing one or more of these standard and add-on modules. These modules work on the same data from different nodes of a network. SLIM works just as well on a stand-alone machine as it does in a network of computers.

SLIM is a widely used software many schools, colleges, research institutes, public libraries, corporate houses, etc. SLIM is upgraded continuously to meet the technological advances in the field of data storage, retrieval, user interaction and communications. SLIM++, highly revised version, has been introduced in May 2001.

SLIM is user friendly, menu driven, and highly interactive software. To operate SLIM no prior knowledge of computers is required. On-site training and high quality reference manuals ensure smooth transition from the current computerized or manual system to SLIM.

4. **ALICE from SOFTLINK, (AUSTRALIA) for Library Management**

Softlink's Alice is a fully integrated library management solution, with modular components. It can be configured to suit libraries ranging from small primary schools up to National Libraries. There are different versions for Primary Schools, Secondary Schools, Tertiary Schools, Special, National and other Libraries. Being a product from Australia, it caters to most needs of highly developed libraries. Softlink Alice is designed to operate on industry standard hardware using Microsoft Windows. With feedback from thousands of librarians around the world, and with extensive ongoing research and development, Softlink Alice is very sophisticated, though remains easy to use.

The multilingual nature of the software allows new languages to be supported with minimum of effort. At present Alice has been translated for English, French, Spanish Chinese (simplified) Chinese (traditional), Japanese, Thai, Vietnamese, Malaysian and Hebrew. Arabic and Urdu will soon be available. Versions being sold in India (through Softlink Asia P Lmited, Delhi) take care of Indian Languages as well. In Hyderabad Indian School of Business has an installation of ALICE. More Information on ALICE can be had by writing to: info@softlink.net.au

5. SOUL (Software for University Libraries)

University libraries are complex entities, having large collections and serving a huge clientele. To carry out various operations in a library effectively, there is a need for automation. Computer and communication Technologies have brought revolutionary changes in the information acquisition, processing, storage, retrieval and dissemination. Keeping in view the latest trends in Information Technology (IT), INFLIBNET Center has developed a Windows based Library Management Software "SOUL", which provides total solution for Library Automation. SOUL is designed using Client-Server Architecture which imparts extra strength to storage capacity, multiple access to single database, various levels of security, back up and storage facilities etc. This software has been designed after a comprehensive study of different library related functions practised in university libraries. It has MS-SQL Server 6.5 RDBMS as the back end. This user friendly software is quite easy to work with. The software comprises following modules :-

Acquisition

Catalogue

Circulation

OPAC

Serial Control

Administration

The in-built network feature of the software will allow multiple libraries of the same university to function together as well as access to the distributed databases installed at various university libraries and union catalogue mounted at INFLIBNET using VSAT network.

ACQUISITION : The Acquisition module enables library staff to handle the following : major functions related to acquisition of library material:

Suggestions management

Ordering cancellation and reminders

Receiving

Payment including fund control

Master file management such as currency table, vendors, publisher, user etc.

Through this module library staff can search the entire database of ibrary holdings for the purpose of duplicate check etc. Using various combinations, number of reports could be generated.

CATALOGUE : This module is used for retrospective conversion of books, technical processing of books received from Acquisition Section, printing a range of records for verification, searching by title and accession numbers, authority files for publishers etc. One of the unique features of SOUL is accessing to authority files on screen as well as selection box in various fields of records. Once the proposed VSAT Network by INFLIBNET is commissioned this module will take care of automatic replication of data into union catalogue. This will avoid exchange of library data on physical media i.e. floppy, tape etc. This module covers following functions:

Cataloguing Process

Catalogue Search

User Services

Catalogue card generation

Authority file maintenance

Retro conversion

Stock verification

Report Generation

Union database maintenance (local level)

Export/Import of records

CIRCULATION : This module will take care of all possible functions dealt in a university library setup. Starting from membership management, maintenance of status of library items can be handled using SOUL. The circulation transactions viz. issue, return, renewal, reserve, recall, hold can be successfully done. The complex functions like fine management for each category of user and material-wise can also be effectively managed. Inter library loan, searching the status of every member or library item is possible. Reminders for overdue material, generation of various reports have also been covered.

OPAC : The On-line Public Access Catalogue (OPAC) of SOUL is a window to the library collection. Using the user friendly menus, user can search for an item available in the library by author, title, corporate author, conference name, subject descriptors, class number etc. The boolean search enables the user to conduct the search using all combinations including type of material, language, year etc. Besides, this will serve as first point of information about the library and also gateway for accessing INTERNET, union databases, or any other external sources.

SERIAL CONTROL : The complex job of keeping track of serials can easily and effectively be handled using SOUL through its Serial Control module. This module broadly handles following functions.

Suggestions

Subscription (renewal and new subscription)

Payment including fund control etc.

Check in of issues including prediction of issues arrival

Reminder generation

Binding management

Search status of every item

Master database management

Reports generation etc.

ADMINISTRATION : User administration facility in this module is used for creating new users and giving them right for accessing different modules.

BENEFITS OF USING SOUL : 1) developed exclusively to work under university environment. 2) Network feature of the software will allow multiple libraries of university to function together. 3) Exhaustive training at INFLIBNET supported by comprehensive manual. 4) On-site training. 5) Free updation/modification. 6) Free technical assistance. 7) Follows INFLIBNET's recommended standards and formats such as CCF, AACR2, LCSH.

MINIMUM REQUIREMENTS FOR HARDWARE AND SOFTWARE :

Server :

Pentium @233 MHz with 64 MB RAM

1.2 GB HDD

32 x CDROM Drive

1.44" Floppy Drive

Colour Monitor (SVGA)

Windows-NT Operating System

MS-SQL Server 6.5

Client :

Pentium @233 MHz with 32 MB RAM

1.2 GB HDD with 10 MB Free space

1.44" Floppy Drive

Colour Monitor (SVGA)

Windows-95 Operating System

6. SANJAY

Sanjay is developed by DESIDC and supported by NISSAT. This package is an extension of CDS/ISIS capabilities through the PASCAL interface. It has a set of 70 Pascal programs and 25 special menus. It has a faster response time - 1 minute for a query on 12000 documents. It interlinks effectively two or more databases and also handles numeric calculations. It is user-friendly for library house-keeping operations.

The salient feature of the package include maintenance module, user module and database. The Maintenance Module restricts the access rights to a limited set of user as authorised by the Database Administrator. The User Module helps the library staff to carry out daily routine and assist the library users in circulation control, acquisition control, online catalogue and serials control. The Databases interlinked to computerise the circulation, acquisition and cataloguing activities. The major databases linked by it include books database, members database, acquisition database, vendors database, budget database and serials database. Any standard PC available nowadays can be used to run this software.

7) BASISPlus and TECHLIBPlus

BASISPlus and TECHLIBPlus are trade marks of Information Dimensions Inc.,USA. The National Informatics Center (NIC) is the value-added reseller of these products in India. The BASISplus provides facilities for the storage, retrieval and electronic management of documents. It is based on relational technology and supports client-server architecture. The software has the following integrated application features:

- Relational DBMS support
- Full Text search Capability
- Mixed Object Management
- Intermediate and deferred updating (online and batch mode)
- Component level retrieval and management
- OLTP and Open API
- Network (LAN /WAN)
- GUI
- Thesaurus Manager
- Both structured and Unstructured data can be used
- Library Automation

Techlibplus is a library automation Package built over BASISPlus. It is designed to streamline the operations of a fully electronic library. This software package provides patron access, catalogue maintenance, circulation, serials management, acquisition processing, MARC cataloging and technical documentation. It provides also facilities for storing and accessing image references in its databases. TECHLIBplus also provides direct access to information in Current Contents. The MARC interface loads data from bibliographic utilities, such as OCLC and RLIN, that use standard MARC record formats. Therefore, it helps to load and store MARC data and produce MARC output. Multimedia applications, electronic publishing, patent information systems, etc are also included in the package.

Hardware requirements: This is not a problem nowadays as most PCs come with sufficient core and auxiliary memory at affordable cost. BASIS WEBserver takes care of all the significant issues of creating documents, home pages and hypertext webs. It has also advantage of using WWW technology for INTRANET applications.

One installation of BASISPLus can be seen at ICRISAT in Hyderabad.

8) LIBSYS

LIBSYS is an integrated multi-user package indigenously by Libsys Corporation, a unit of Info-Tek Consultants Private Limited, New Delhi. The salient features of Libsys include:

- Client-server based multi-user and stand-alone versions.
- Wide Range of Operating Systems: DS, Windows, UNIX
- Internet gateway to national and international databases (Z39.50 support)
- Integration of image and multi-media files with its search engines
- Built-in Java interface
- Bar code support for circulation.
- Web based OPAC
- Highly customizable to suit user's needs
- Most widely used Software in India

LIBSYS is a user-friendly package with integrated functions, interactive and screen oriented, menu-driven, and multi-user capabilities. It supports all library activities relating to acquisition, cataloguing, circulation, serials control and OPAC. The Articles Alert facilitates indexing and abstracting of articles from journals. Libsys package is used by libraries of various public and private organisations, scientific laboratories, universities and colleges and public libraries in India.

This package has been discussed as an example in Units 5 to 7.

9) LibEra

LibEra, is an Integrated Library Software Product from **Modelsoft Ltd, Hyderabad.** LibEra has been designed from the beginning to be web-enabled. It provides multi lingual support. It is comprehensive solution for all kinds of libraries. It covers all basic modules. It has basic features like:

- Customizable menu for staff of the library
- Supports multi-user and multiple security levels
- Provision for usage of wildcards and keywords in Inquiry
- Customizable look and feel of screens
- Clients machines may have any configuration (should have a browser)
- Easy portability onto any platform
- GUI based and very user friendly
- TWAIN compatible package, supports scanning of photos on any scanner (TWAIN compatible)
- Supports Barcode reader

Some advanced features are: auto-email dispatching, handling multiple libraries in an organization, and virtual keyboards. LibEra adheres to international standards like MARC21, AACR2R, ISO 2709 and Z39.50 v1995. Lib-Era has a website at: www.model-soft.com

10) Ananth GRANTHALAYA

Ananth GRANTHALAYA: A Library and Information System is an integrated library software package developed by Ananth Technologies Limited, Hyderabad. It handles large, text-intensive and unlimited number of records and provides fast access to free-text searches. The package has been developed using Visual Basic, HTML, DHTML, ASP and scripting languages like JavaScript, VBScript to make the application portable to many different

platforms and web browsers. It is also compatible to most popular databases like Oracle, MS-SQL Server, MS-Access and is available for both single user and multi-user with Client/Server environments. It works on platforms like Windows 95/98, NT, Unix and Linux.

Ananth GRANTHALAYA has five modules: Administration, Circulation, OPAC, Utilities and Web Inquiry. The other salient features of the package include - Bar code scanning, Photo Identification, Online Scanning, Multimedia, Internet/Intranet Access and Reports.

11) eLIBRARY

eLIBRARY is an integrated software package developed by Phoebus Infotec, Visakhapatnam. It runs on Windows 95/98 or NT operating systems with Pentium-based processor (atleast 200 MHz) with a minimum free disk space of 100 mb and 64 mb RAM. eLIBRARY can be modified to operate on any preferred database, such as MS-Access, Oracle, MS-SQL, etc.

eLIBRARY is a use-friendly software based on GUI. It has seven modules: Acquisition, Cataloguing, Circulation, Serials Control, Statistics, Reports and OPAC.

The salient features of the software are :

- User-friendly, interactive and screen-oriented
- Online and Menu-driven
- Minimum data entry or keyboarding effort
- Multi-user capabilities
- Keeps track of all the transactions made by the library staff
- Network model requires the interaction of both the librarian and the library member to complete any transaction
- User defined security
- Reports can be previewed on screen and printed
- Statistics are provided with Graphical Interfaces

eLIBRARY is equipped with functions that provide total security to the database, the library member and the library staff. Website: *www.phoebusinfotec.com*/s

UNIT- 5 : LIBRARY APPLICATION SOFTWARE - ACQUISITION AND CATALOGUING

Structure

5.0 Aims and Objectives

5.1 Introduction

5.2 Acquisitions

- 5.2.1 Workflow in Acquisition Section
- 5.2.2 Functions in Acquisitions System
- 5.2.3 Data Files in Acquisition Module
- 5.2.4 Advantages of Computerizing Acquisition Work
- 5.2.5 Implementation of Alternatives
- 5.2.6 Features to Look for Acquisition Module
- 5.2.7 Online Ordering Using Vendor's Ordering System

5.3 Cataloguing

- 5.3.1 Desired Characteristics of Computerised Catalogue Module
- 5.3.2 Workflow in Cataloguing
- 5.3.3 Data Elements in a Cataloguing Worksheet
- 5.3.4 How to Link Duplicate or Multiple Copy Records
- 5.3.5 Retro-Conversion of Catalog Records
- 5.3.6 Reports and other Features
- 5.3.7 Database Maintenance Routines
- 5.3.8 Features to Look for in Cataloguing Module

5.4 Let Us Sum Up

5.5 References

5.6 Assignment

5.7 Model Examination Questions

5.0 AIMS AND OBJECTIVES

This unit introduces you to various routines in computerised acquisition and cataloguing modules. It describes work flow, file management, and finer points to look for in these modules.

After studying this unit you should be able to

- appreciate the advantages of computerizing acquisition and cataloguing routines
- over the manual system
- describe work routines in acquisition, cataloguing modules of a library software
- learn about the implementation alternatives, screen formats, etc.
- appreciate the finer points of the library software as applied in these modules.

5.1 INTRODUCTION

Procuring reading materials and providing access to them through the library catalogue are most fundamental activities in any library. Automating these behind-the-screen functions would result in increased productivity and greater user-acceptance. Computerisation aspects of acquisitions control and cataloguing are discussed in detail in the following sections.

5.2 ACQUISITIONS

Purchasing material for a library's collection accounts for a large part of any library's budget. When computer based acquisition systems were first developed in the 1960s there were few options available for the designers of those systems. Most programs were developed in-house.

The basic functions of an acquisition system -- these are similar for most types of library include:

1) receiving recommendations of items selected for purchase;
2) removing duplication;
3) preparing and maintaining a file on order notes to be sent to book sellers;
4) maintaining a file of records of items on order or in process;
5) generating claims to be sent to book sellers for items to be received,
6) maintaining the accounts;
7) accessioning the item on arrival in the library; and
8) keeping statistics.

Acquisition funds represent a large and important component of the typical library budget, and library administration is accountable for their expenditure. Manual acquisition system cannot readily generate the financial and statistical information essential for scientific planning and management. In libraries where book budgets are allocated annually, for e.g., certain acquisition funds may remain characteristically under spent over a period of many months, necessitating intensified expenditures at the year's end. A situation not conducive to prudent selection practices. Similarly, certain funds may be expended too quickly leaving little reserve for important materials published later in the year. In either case, periodic reports of fund status can alert library administration to situations requiring attention and possible corrective action. The available labour in most manual acquisition systems is fully occupied in paper work processing and work routines pertaining to book orders.

5.2.1 Workflow in Acquisition Section

While differences in purchasing practices and procurement regulations may lead to local variations in acquisition systems, certain basic characteristics and work steps are commonplace in both manual or automated systems.

(i) Manual System

Depending on the type of library involved, a request to purchase a specific item may be transmitted to the acquisition department by library staff, users or others. Typically, the library's own acquisition files and catalogue are first consulted to determine whether the item is on order or already in the collection. Assuming that the item is not already owned or that an additional copy will be purchased the bibliographic information in the request must be verified, the item's availability determined, and a vendor selected.

Once a vendor has been selected, a purchase order is typed and issued. Libraries, which do not do their own purchasing will type a requisition for transmittal to their corporate or institutional purchasing department, which then issues a purchase order. In either case, the appropriate procurement document is typically prepared in multiple copies, several of which are retained by the acquisition department for inclusion in an outstanding order file arranged by title, a vendor file arranged by vendor name, and a fund file arranged by fund number or name. When an item is received, the appropriate documents are removed from files and updated as required to reflect the full or partial receipt of an order. Payment is than authorized and a cheque issued.

(ii) Computerised System

Automated acquisition system retains these basic characteristics but replaces typing, filing, and related manual work steps with data entry, searching and other computer oriented work routines. If the library has an online catalog or master circulation file it can be searched to determine whether a given item is already owned. Machine-readable databases simplify pre-order searching by providing access to bibliographic records by a variety of search parameters.

5.2.2 Functions in Acquisition Module

Typically acquisition module performs the following routines

- Online data entry using formatted screens.
- Getting requests/recommendations from Users
- Pre-order searching and notification of duplicates, creation of order records for extra copy using existing data.
- Send Inquiry letters for quotations from Vendors
- System generated purchase order on different types of orders.
- Budget monitoring and warning.
- Retrieve data from acquisition files on several keys such as: order number, author, title, vendor, publisher, etc.
- Provision to update records in acquisition module.
- Recording the books received against orders either in full or parts.
- Making out cheques for payments after verifying bills
- Follow up on over due orders by sending notifications.
- Cancellation of orders when necessary.
- Maintenance of varying number of funds.
- Calculation of actual and committed expenses.
- Providing budget balances on line with appropriate currency conversions.
- Indication of on order status on OPAC.
- Sending Intimation to user who requested it upon receipt.
- Print Additions List
- Print Vendor performance Report

5.2.3 Data Files in Acquisition Module

Automated acquisition system typically employs a combination of three data files:

i) Order/Title File

Title file or on order file - which contains one record of each item purchased. A vendor file - which contains one record for each vendor, and a fund file that contains one record for each account that supports the purchase. While specific details will necessarily vary from one system to another, most order files contain a combination of bibliographic and order specific data. These details generally include author, title, and imprint information, an order number, date, budget account number, vendor name, number of copies ordered, the price and service charges, currency type and estimated receipt time. Most systems likewise reserve a field for a designation of the order type such as a firm order, standing order, prepayment, etc.

ii) Vendor File

Vendor files contain vendor details, terms, a claim period indicator, and publishers he may represent. Some vendor files also include performance statistics, including average time each vendor requires to fill an order.

iii) Fund File

Most fund files contain one record for each account. From the information available in this file, amount allocated, commitments, actual expenditure and balance available for each department / program can be calculated. Vendor, fund and requester files are typically established in advance

5.2.4 Advantages of Computerizing Acquisition Work

One of the principal advantages of acquisition systems is the substitution of the computer based file maintenance for the labour intensive storing, filing, and other paper handling procedures associated with manual acquisition systems. When the order record is entered most systems will automatically commit the estimated purchase price in the indicated fund account. Most systems will likewise produce claiming and cancellation notices.

As items are received, order records are searched and their status updated to reflect full or partial shipments. When an order is closed, the corresponding records can be automatically purged from the online order file to a historical file on magnetic tape, while the bibliographic information associated with a received item can be automatically transferred to a catalog data file for revision or enhancement as required.

(i) Query Possibilities

Superior query possibilities and order tracking capabilities further distinguish automated acquisition systems from their manual counter parts. The most advanced systems permit the online retrieval order records by such parameters as the order control number, purchase order number, order date, vendor name, requester name, fund number, or author, title, publisher of the title ordered. Retrieved records typically include brief bibliographic data accompanied by a summary of the order essential characteristics and status including vendor and fund information. Such enquiry capabilities help in avoiding duplicate orders.

(ii) Reports

In addition to supporting online queries a typical automated acquisition system will generate three broad group of printed outputs products: 1) procurement documents 2) notices, and 3) reports. Procurement documents include purchase order, payment slips, return titles, titles on approval, etc. Notices include reminders for overdue orders, availability enquiries,

and others. Various reports that facilitate monitoring of acquisitions and management decision making, such as: budget status, subject-wise acquisition of books, vendor performance reports, list of titles gifted, etc. fall in the general reports category.

Following reports are worth special mention:

- A fund account report showing the allocation, commitment, expenditure and the balance for each fund.
- A vendor's performance report showing how vendors have fared between any two dates. The report shows the number of books supplied by the vendors between 1 to 15 days, 16-30 days, 31-45 days and so on. The report also gives the total number of books ordered during the period and the total amount paid to the vendors. The vendor performance reports have been used to apprise vendors of their performance and in some cases to drop vendors whose performance has been poor.
- A fund activity report, i.e., a report showing how many books were ordered, how many received, the amount committed and amount spent for each of the funds between any two dates.

5.2.5 Implementation Alternatives

An acquisition software package can be custom developed or a library can purchase an acquisition specific software package or turnkey system. Also, acquisition can be implemented as an application module within a multifunctional library system. Acquisition system as with serials control could be effectively implemented both as independent module or as an integrated system equally effectively as acquisition is the initial process in the library work. However, integrated systems have the advantage of built-in duplicate checking thereby helping budget management and also collection development.

5.2.6 Features to Look for in Acquisitions Module

Boss and Marcum provide an outline of an ideal acquisition system which would be on line and would include:

- The ability to search via a variety of access points, the library's bibliographic file to determine the status of any particular item.
- The ability to search a file of book seller details in a predetermined order of preference to determine which book-seller would be able to supply a given item.
- The ability to provide very detailed financial information in a variety of ways.
- The maintenance of a comprehensive file giving complete information of all items on order or in process and to alert the library staff when expected items do not arrive.
- The ability to deal with all the financial transactions and adjust the files accordingly.
- The ability to accommodate a variety of materials including monographs, government documents, gifts and exchanges, audio-visual materials, etc.

5.2.7 Online Ordering Using Vendors Ordering Systems

While we are discussing Library Acquisition module, it is worth looking into the facilities provided by booksellers from their computer systems or via their web sites for book ordering activity. Many online bookstores like *Satyam Online, Fabmart, Tata McGraw-Hill, Rediff, KK Books* etc. allow us to browse and search their online book catalogues. After locating the titles we need we can place order for the titles directly from the web site itself. In

some cases orders are sent via separate email. In many cases orders are accepted via order form filled up on the NET.

For example, in the case of Tata McGraw-Hill web site, one can search titles by author, title etc. India residents can pay in rupees and outsiders can pay in Dollar. Orders may be placed online. As and when you select a book for purchase, you can add it to a 'cart' similar to buying in a super market. Just before confirming the order, you can delete whatever titles you may decide to withdraw. You can do this after finding out total amount involved as the pro-forma invoice shows you instantly what would be the total cost. If you confirm an order, an immediate invoice is generated and sent by email. Books are delivered via courier. Bills are collected through credit card, demand drafts, cheques etc. It is possible to verify the status of orders placed at any time. Orders and payment particulars are transmitted over secure highly secure networks involving tight encryption, signature verification etc. With the passing of Information Technology act in May 2001, commercial transactions over the computer network like Internet is legally valid.

The best known web site for online purchases of Books, Music CDs, and gifts is Amazon.com. This site (as of September 2001) used to make online business worth $11000/- every two minutes! There are several advantages in ordering Online. One can read Table of Contents, Book Reviews etc before ordering. Using International credit cards (now available easily in India) payments can be made in equivalent Indian Rupees. You can set up a sort of SDI service that will let you know new books added on the subject of your interest. Amazon even suggests: "People who have ordered title XX have also ordered the following titles..". This is an effective reminder on what else is available in the stores. Moreover you need not go to a bookstore and ordering can be done from home as well. Librarians can use the search facility to check bibliographic details of books needed by them.

5.3 CATALOGUING

C.A. Cutter, writing in 1876, defined a library catalogue as an efficient instrument intended to achieve the following objectives:

a) To enable a person to find a book of which either the author, the title or the subject is known;

b) To show what the library has by a given author or on a given subject or in a given kind of literature;

c) To assist in the choice of a book as to its edition (bibliographically) or as to its character.

5.3.1 Desired Characteristics of Computerised Cataloguing

All these objectives are still valid today. To achieve these goals an ideal computer based cataloguing system would include the following characteristics:

- A consistently high quality of bibliographic records in the database and a conformity with the latest cataloguing and classification codes.
- Online authority control.
- Ability to do original cataloguing online when necessary and to assist the process with appropriate prompts, etc.
- Ability for the records in the catalogue to be accessed in a variety of ways and in an appropriate physical form.
- Online access to a database of potentially needed bibliographic records.

We must hasten to note that in the context of manual operations the term cataloguing is used to include the public access card catalogue. However, in the present context catalogue record maintained by the library could also be appended to from circulation and other files. In the integrated system catalogue record is the central feature which takes the basic data from acquisition module and the catalogue data is used in OPAC, circulation control and various other house keeping operations.

5.3.2 Workflow in Cataloguing

(i) Manual System

Typically in the manual cataloguing the cataloger with his prior knowledge of cataloguing procedures would examine the title page and colophon of the book to ascertain various components of a catalogue record - title, author, imprint, etc. A cataloguer may consult a standard national bibliography like BNB, INB, ABPR and other sources to get leads from these sources about the cataloguing data such as author rendering, subject authority, etc. However, the cataloger has to cross check with the authority files maintained in the library and also allow for local variations that are adopted which are usually noted in the library cataloguing manual. The cataloger has to additionally determine the entry element, specifications regarding indentions and the possible approach points. All these processes call for various checks and cross checks with the existing catalog records to avoid inconsistencies. At the end comes the labour intensive filing in the catalog cabinets.

(ii) Computerized System

The cataloguing process does not differ much in case of computerized systems. Recognition of the appropriate data elements, authority control, appropriate name and subject renderings are required in computerised cataloguing when a document needs original cataloguing. However, provision of list values help in efficient maintenance of authority control. Also, the cataloger need not worry about the catalog card print formats - particularly indentions - as reports can be routinised to take care of the same. Typically as the data is input in the catalog worksheet that is formatted screen with appropriate prompts) the system checks for the uniqueness of the accession number. There usually would be a routine to determine whether the title input is a duplicate copy. This feature is often parameterized so individual libraries can have varying fields - call number, title or combination of title and author - to identify a duplicate entry and treat them separately. Some worksheets call for using the MARC tags and input identifiers and field and sub-field tags. Others will build this feature in export routine, and the cataloguer will be provided with appropriate prompts to input information. The state-of-the-art cataloguing module allows for defining the catalog fields and sub-field break up as is required in a library situation.

5.3.3 Data Elements in a Catalogue Module

Typically a catalogue card has details about accession number, call number, author, (including editor, translator, etc. up to a certain limit), title, sub-title, imprint, collation, series, notes, tracings. Shelf list maintains all these information in addition to details on purchase date, vendor, etc. It is only a crude database design which would stop with these details in an automated environment. Considering the bibliographic record is central to OPAC, circulation and a variety of catalog operations, not just the completeness of the entry but also appropriate break up of the elements are important for effective data management.

FORMATTED CATALOG SCREEN IN TULIPS

```
TULIPS/CATALOG                  BOOK DATA ENTRY                  SCREEN 1 OF 3

MAX. ACC. NO.:_____   LIBRARY CODE:____   REF. NO.:_____   _____
ACCESSION NO.:_____   CALL NO.:_____
TITLE         :
SUB-TITLE     :
SEQ AUTHOR                                          DATE        AUTH.TYPE
__ _____________________________________________ _____ _____
__ _____________________________________________ _____ _____
CONF/CORP     :
UNIFORM TITLE:
AUTHOR STMT.  :
PLACE         :                          PUBLISHER:
YEAR          :____ YEAR (Copyright):_____ YEAR (Reprint):_____

| Sh-F1 HELP | Sh-F2 LIST VALUES | F2 NXT SCR | Sh-F8 PRVFLD | F4 QUIT

MESSAGE:

| _ADD | _MOD | _DEL | _QUERY | _HELP | _EXIT

PRESS F3 TO CHOOSE THIS OPTION OR ENTER TO GO TO NEXT CHOICE.
Count: *0                                                    <Replace
nge>
Alt: H=Help M=Menu, Cntl: D=Diacon    sDSR=VT100    CsrMd=Nml   KpMd=Num
```

```
TULIPS/CATALOG                  BOOK DATA ENTRY                  SCREEN 2 OF 3

ACC. NO.:__98695 TITLE:"...AND THERE WAS LIGHT"                    MODIFY
EDITION :_____ LANG.:____ VOL:_____ VOL.TITLE:_____
PART NO.:_____ PART TITLE:_____ PAGES:_____
SERIES
__ _____

SEQ NOTES
__ _____

PHY. DETAILS:_____ CUR.CODE:S__ COST:_____0.00 BINDING COST:_____
LOCATION    :_____ ISBN:_____ VENDOR:_____ TYPE:B__
BINDING TYPE:_____ SUB-CODE:700_____ SOURCE OF CATG:_____
TOTAL COPIES:1___ REP.COPIES:___ PULO COPIES:___ CIRC. COPIES:___
CLASS CODE  :___ CATG. BY:AD_____ DATA ENTERED BY:GSS_____ DATE:27-OCT-9

| Sh-F1 HELP | Sh-F2 LIST VALUES | F1 QUERY | Sh-F8 PRV FLD | F4 QUIT

MESSAGE:

ENTER YEAR OF EDITION.
Count: 1                                                     <Replace
```



```
TULIPS/CATALOG                  BOOK DATA ENTRY                  SCREEN 3 OF 3

ACC. NO.:_____ TITLE:_____                                         MODIFY
SEQ SUBJECT KEYS
 0_ RATTNER,_ABRAHAM,_1895-
 0_ ARTISTS'_PREPARATORY_STUDIES_-_EXHIBITIONS
 0_ CREATION_IN_ART
 0_ CHICAGO_LOOP_SYNAGOGUE
__ _____

OTHER KEYS
SMITHSONIAN_INSTITUTION_NATIONAL_COLLECTION_OF_FINE_ARTS
_____
REMARKS:
_____
   DO YOU WANT TO ENTER ABSTRACT NOW ?(Y/N/F3)_   CONFIRM:_

| Sh-F1 HELP | Sh-F2 LIST VALUES | F1 QUERY | F3 COMMIT | F4 QUIT

MESSAGE:

ENTER SUBJECT KEY.(Max._120_CHARACTERS)
Count: 64                                                    <Replace
```

Fig: Data entry screen for cataloguing in libsys

(i) Machine Readable Catalog (MARC)

In the early 1960s, libraries became increasingly aware that cataloguing tasks might be simplified if copy of the catalogue information could be obtained in machine readable computer processible form. The Library of Congress in the U.S.A. commissioned several studies on the potential problems inherent in the development of such an alternative bibliographic product. These studies, which indicated the feasibility and potential advantages of recording LC cataloguing data in machine readable form, were discussed at a series of conferences in 1965 and 1966. The outcome of these conferences was the MARC pilot project. This pilot project established a format for the recording of bibliographic data in machine readable form (MARC-I). Using this format bibliographic records were distributed to 16 participating libraries in the U.S.A. The MARC I format required to be revised before the LC and other libraries could develop extensive programs based on the interchange of bibliographic data in machine readable form. These revisions are embodied in the MARC II format introduced in 1967. The MARC II format specifies a basic record structure for machine readable bibliographic records which consists of three components - leader, directory, variable fields.

1. A leader, made up of fixed length fields, provides information about the length, type, and bibliographic level of record. Record types are distinguished by codes which identify the record as a printed book, manuscripts, microform, map, music or other entity. Codes for bibliographic level indicate whether the work is a self-contained monograph, part of a series, a serial publication, an analytic component within a large bibliographic work, or a collection of manuscript, pamphlets or other items cataloged as a single unit.

2. A record directory indicates the location of specific variable fields within each record. It is analogous to the table of contents of a book. Each record directory entry consists of a content designator, a tag which identifies the variable field within the record, an indication of the length of the variable field, and the position of the first character within the record. The record directory facilitates the retrieval of selected fields from within a MARC record.

3. The variable fields within each MARC record contains bibliographic data accompanied by numeric labels called tags which reflect the content of the fields and any sub-fields into which they may have divided. MARC format accommodates hundreds of variable fields most of which are repeatable. These variable fields are further classified into mandatory, mandatory if applicable, and optional. Most of the softwares in the cataloguing module incorporate only minimal MARC as defined in the MARC manual or even confine only to fields they think appropriate to serve as MARC compatible records. The MARC record structure has been adopted by ANSI and ISO. These organizations have not, however, standardized the content designators or tags which identify the elements within records or rules for the creation of the data content of the records themselves. Bibliographic record formats developed by other organizations have widely adopted the MARC record structure, although they may differ in the content of their variable fields and in the specific tags used as content designators.

Considerable variation in content designators is also characteristic of MARC format developed by national libraries of Canada, Great Britain, France, Germany, Italy, Australia, Japan, Malaysia and several other countries. The Indian Bureau of Standards has also adopted Indian MARC standard based on LC MARC.

SAMPLE MARC RECORD

MARC Tagged Format

Leader		*****cam__22*****__4500
001		73154339 /SA/r85
005		19850719000000.0
008		730326s1970_____ii_____ _____00010___eng_____
050	0_	$a z695.8 $b .R35
082	__	$a 025.3/2
100	10	$a Ranganathan, S. R. $q (Shiyali Ramamrita), $d 1892-1972.
245	10	$a Conflict of authorship; $b corporate body vs corporate body $c [by] S. R. Ranganathan and G. Bhattacharyya.
260	0_	$a Bangalore, $b Sarada Ranganathan Endowment for Library Science $c [c1970]
300	__	$a Corporate headings (cataloging)
700	10	$a Bhattacharyya, G., $e Joint author

ii) Common Communication Format (CCF)

The idea of Common communication Format is an outcome of Unesco/PGI sponsored symposium on bibliographic exchange formats. This symposium, organized by UNISIST International Centre for Bibliographic Descriptions in co-operation with International Council of Scientific Unions - Abstracting Board, the IFLA and International Organization for Standardisation, convened to study the desirability and feasibility of establishing maximum capability between existing bibliographic exchange formats.

CCF record consists of four major parts, namely: record label, directory, data fields, record separator. Each CCF record begins with a fixed label of 24 characters. Different character position in the label represent data pertaining to record length, record status, bibliographic level, indicator length, sub-field identifier length, base address data, length of the data field in the directory, length of the starting character position in the directory.

Major parts of a CCF Record

SN	Description	Length	Remarks
1	Record Label	24 characters	Fixed Length
2	Directory	14 characters	Variable: n fields
3	Data Field	Variable	
4	Record Separator	1 Character	

The Directory is a table containing a variable number of 14 character entries. The table is terminated by a field separator character. Each directory entry corresponds to an occurrence of a data field in the record, and is divided into five parts: tag, length of data field, starting character position, segment identifier, and occurrence identifier. Tag is a three character code identifying the data field which corresponds to the directory entry. Length of the data field is a four digit number showing how many characters are occupied by the data field, including indicators and data field separator but excluding the record separator code if the data field is the last field in the record. Starting character position is a five digit number giving the position of the first character of the data field relative to the base address of data,

that is the first character of the first of the data fields. Segment identifier is a single character which designates the data field as being a member of particular segment. And, occurrence identifier is a single character which differentiates multiple occurrences of data fields that carry the same tag within the same record segment.

Example of a directory entry:

30000330028910 (300-0033-00289-1-0)

In this example the tag encoded in the first three digits is '300' signifying that the data field identified here is a name of person. The next four digits '0033' shows that the data field is 33 characters in length. '00289' shows that the data field begins two-eighty-nine characters after the base address of the data. The digit '1' shows that this data field belongs to the second segment of the record. The final digit '0' indicates that this is the first occurrence of a data field tagged 300 in segment 1

Composition of a Directory entry in CCF

Sample Value: 30000230028911

Field Number	Field Length	Name	Sample Value	Meaning of Sample value
1	3	Tag	300	Name of Person
2	4	Length of data field	0033	33 characters in length
3	5	Starting position	00289	Data value occurs 289 positions after base value
4	1	Segment indicator	1	Belongs to second segment
5	1	Occurrence Identifier	0	First occurrence of data field tagged 300 in segment 1

Data fields consists of indicators, one or more sub-fields each of which is preceded by a sub-field identifier, and a data field separator. Record separator is the final character of the record. It follows the field separator of the final data field of the record. Indicators are two characters reserved for use as defined for each data field. These may supply further information about the contents of the data field, or about the action required in certain data manipulation processes. A subfield consists of a subfield identifier followed by a data string, which is terminated by either another subfield identifier or a field separator. A subfield identifier consists of a subfield identifier flag followed by one other character. The data field separator constitutes the final character of every data field

Example of a data field:

11@AStephenson@BM.S.@D1953-@E673

Tag for this data field is 300. The first character appearing in this data field '1' means this person has the primary responsibility for the contents of the item described in this segment of the record. The second '1' indicates the form of the name comes from the authority files of the agency creating the record. Subfield A preceded by its subfield identifier @ provides a significant element of the name of the person. Subfield B (@B) gives the reminder of the personal name. Subfield D (@D) gives the birth data. Subfield E (@E) gives a three digit code taken from a list of codes defined by CCF. This code indicates that the person identified in

this data field is the person who directed the research reported in the work. The data field is terminated by a unique character, the field separator.

The record separator is the final character of the record. It follows the field separator of the final data field of the record.

5.3.4 How to Link Duplicate or Multiple Copy Records ?

Libraries often acquire more than one copy of the titles. In manual cataloguing such a situation is handled by adding the corresponding accession number on the main cards and shelf list with any additional information going with the copy. Essentially there will be only one record. In the automated catalog the main record with full information about the title is expected to be unique. However, there is a need to link this record with accession numbers of the multiple copies with the circulation status of each copy. A feature is usually provided to accept succeeding serial numbers standing for copies will be usually provided in catalog module. It is also essential to provide for situations where accession numbers do not fall in a sequence. If the library maintains unique call numbers there is a need to record this information and also validate the same. It is important to establish this link with all necessary details as these are accessed during circulation of the multiple copies and the circulation status has to be displayed in OPAC.

5.3.5 Retro-Conversion of Catalogue Records

A major problem for any library designing and implementing a computerized catalog system is whether or not to convert the existing catalog records into machine readable form. In making this decision the proportion of the records likely to be covered by existing machine readable databases needs to be estimated as well as the time and cost required to create records for the reminder. A further problem is the likely inconsistency, especially if AACR-2 is being adopted, between the existing records and the new catalog system. If machine readable records are to be created then it has to be decided whether or not to re-catalog the items completely or to amend the existing catalog record.

Steps for Retro-Conversion

The general steps in a retrospective conversion program are:

1. To create a very basic search code (ISBN, LC Number, author/title, etc) in machine readable form for all existing catalogue records.
2. To use this search code to match against a database of bibliographic records.
3. To edit the matched records to conform to cataloguing practice in the library.
4. To create machine readable bibliographic records for the items not matched.
5. To merge the retrospective catalog with the new computer based catalog in order to provide a single entity.

In the Indian context many libraries have found it cost effective to input the data manually or contract this as a job work. However, in such situations one may not be able to get records in standardized bibliographic formats. Keyboarding errors is another problem in manual data entry.

The alternative to undertaking a retrospective conversion project is to 'close' the existing catalog. That is to operate with two files - one on machine and the other on cards. But this option could only be a temporary solution.

5.3.6 Reports and Other Features

Essential reports in catalog module include catalog cards, acquisition register, and directory of authors, subject headings, etc. It is also beneficial if the module can help generate current awareness listings like recent arrival lists for a given data range. *See* and *See also*

references have also to be provided in cataloguing module as subject heading records unlinked to any particular title.

Other features required in the catalog module include ability to monitor temporary withdrawal of copies from the library for binding and repair, or in cases of misplacement, long overdue, etc.

5.3.7 Database Maintenance Routines

Generally more than one database is supported by library systems. Obviously the most important of them is the book and journal collection database. Database maintenance routines include: taking care of data integrity in the files, and consistency of author, subject renderings, purging of old records, etc. Usually maintenance routines also extend to disk space management, database security, data backup, etc. In the context of the catalog record itself monitoring and updating subject headings, call numbers are required whenever the headings list or classification schedules are updated. Updation of year of birth and death, identification and correction of keyboarding errors, and such other tasks are also part of the database maintenance.

5.3.8 Features to Look for in Catalog Module

The following is a probable set of points to look for in catalog module.

Does the system:

- accept all field tags and sub field codes so that the records in MARC format can be reconstructed without manual editing.
- provide for export/import of catalog data from and to MARC/CCF format.
- accept all Roman alphabet characters and all Non-Roman language alphabets if transliterated.
- differentiate circulating and non-circulating copies.
- provide for linking up to 100 copies to a single master bibliographic record.
- include online interactive authority control system to establish a single, authoritative form for headings, personal names, corporate headings, subject headings
- provide for making global changes with a single command.
- include `See' and `See also' references to subject headings and authors.
- accommodate batch loading of records.
- automatically correct or delete all appropriate index entries as changes are made in bibliographic and copy records or as the records are deleted from the database.
- provide a variety of reports including list of authors, subjects, catalog cards, call numbers for inventory purposes, etc.

5.4 LET US SUM UP

In this unit we have seen in detail the complexities of computerizing acquisition and cataloguing routines. We also have presented details of MARC and CCF. Some details of using the Online ordering facility in online bookstores have been mentioned. The next unit takes care of Online Public Access Catalog (OPAC).

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5.6 ASSIGNMENT

Go to a library where the library uses LIBSYS or LIBRIS or some other package not discussed in this Unit. Obtain printouts of screen lay out for data addition and editing functions. Also collect some sample catalog output for various types of documents.

5.7 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) What are the advantages of computerising acquisition work?

2) Describe the work flow in acquisition module. Compare it with manual system. Discuss the advantages in automated system.

3) What the important essential features in acquisition module.

4) Describe the steps involved in retro-conversion of catalogue.

5) What reports are necessary in acquisition and cataloguing modules?

6) Describe the salient features CCF and MARC format

II. SHORT NOTES

a) Vendor Rating

b) Advantages of Acquisitions Automation

c) Formats similar to MARC in other countries

d) Budget Maintenance in Acquisition

e) Multilingual cataloguing.

UNIT - 6 : ONLINE PUBLIC ACCESS CATALOGUE (OPAC)

Structure

6.0 Aims and Objectives

6.1 Introduction

6.2 Online Vs Offline Catalogue

6.3 OPAC - Advantages, Features & Examples

- 6.3.1 Advantages
- 6.3.2 Implementation
- 6.3.3 Good Features of OPAC
- 6.3.4 Command-driven *Vs* Menu-oriented System
- 6.3.5 An Example of OPAC – Libsys

6.4 Search Strategy in OPAC

- 6.4.1 Field Based Searches
- 6.4.2 Keyword Search
- 6.4.3 Logical Operators
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6.5 WEB OPAC

- 6.5.1 Recent Phenomenon
- 6.5.2 Advantages of Web OPAC
- 6.5.3 Situation in India: Example of British Council Library
- 6.5.4 Software for Web OPAC

6.6 Z39.50 Standard

- 6.6.1 Servers, Clients and Gateways
- 6.6.2 An Example of Z39.50 implementation

6.7 Let Us Sum Up

6.8 References

6.9 Assignment

6.10 Model Examination Questions

6.0 AIMS AND OBJECTIVES

This unit introduces the features of an online public access catalogue (OPAC) including its features, advantages over the conventional card catalogue, and command-driven and menu-oriented systems in OPAC. This unit also discusses search strategy and information retrieval from online databases taking DIALOG as an example.

After going through this unit you should able to

- describe the features expected of a good of OPAC
- explain the advantages of OPAC over the conventional card catalogue

- learn how to search OPAC using simple and complex queries.
- discuss the latest trend in OPAC, viz., Web Based OPAC.

6.1 INTRODUCTION

Online Public Access Catalogue (OPAC) has been very popular in large Western libraries where a number of terminals are provided for patron's use. Situation in India too is changing rapidly as almost all Integrated Library Automation Packages have started provided OPAC as a standard module. This unit presents several salient aspects of OPAC. In Unit 6 we learnt about cataloguing various types of Library documents with the help of computers. This unit stresses on making the library catalogue accessible to large number of library users at their desktop via OPAC.

6.2 ONLINE *VS* OFFLINE CATALOGUE

An online catalogue is an organized, machine-readable accumulation of bibliographic records, which are maintained on disks or comparable direct access computer storage media for retrieval by library users and staff members working at interactive terminals or microcomputer workstations. If an online catalogue is primarily intended for library clientele (as opposed to library staff) it may be described as Online Public Access Catalogue. Integrated library application software generally maintains a separate module catering to information retrieval by public in place of card catalogue.

Off-line as opposed to online refers to a situation where there is no direct real time interaction with the computer on which the database is created. Off-line batch processed database search was widely prevalent in the 1970s when the computer time was valuable and much sought after. For an offline search users' information requirements are first delineated and search strategy, consisting of commands and search terms are formulated. The file with the search strings and appropriate commands are input for information search and retrieval.

6.3 OPAC - ADVANTAGES, FEATURES AND EXAMPLES

Before understanding how to search or use an OPAC, it is better to understand its advantages, implementation, good features and atleast one example.

6.3.1 Advantages of OPAC

When compared to card catalogue online catalogue offers a number of potential advantages:

- Online catalogues eliminate much of the labor-intensive filing and other routines associated with card catalogue.
- Authorized persons equipped with compatible terminals can access online catalogues from any location.
- If online workstations are equipped with printers check lists can be generated when required.
- Online catalogues can be updated in real time with records being added or removed as items are catalogued or weeded out.
- Online catalogues support retrieval operations which are not possible with card catalogues. Online catalogues typically support interactive searches involving the logical coordination of retrieval parameters.

- Online catalogues can be programmed to reflect the current circulation status of the books and inform the readers the availability of the copy for consultation.

6.3.2 Implementation of an OPAC

Online public access catalogue can be implemented in more than one way. The obvious and the easiest is to create and maintain a database locally and allow the users to access it. This objective can also be alternately achieved in a library network environment by subscribing to a bibliographic utility. Such an implementation mode requires a given library to input its holdings information on the central database of the network. Many library networks like OCLC, RLN, WLN offer information retrieval capabilities which support keyword searching, logical coordination of search parameters as well as conventional author, title, and subject searches.

6.3.3 Good Features of OPAC

Regardless of the access mode and terminals used, library users must be trained in the OPAC'S command and search procedures, as they are not uniform in all catalogues. A good OPAC features one or more introductory screens, which briefly explain the purpose of the system, describe search functions and retrieval operations available to the user, give examples of the way in which such functions and operations can be invoked, and indicate how additional help can be obtained. To facilitate user orientation, some systems feature a uniform display format, which place specified data elements in consistently recognizable locations within a video screen. Most library systems also provide context specific help facilities. The users can resume a search at the point of interruption having consulted the on line help.

A good interactive, user-friendly OPAC is a must for an efficient automated library. User impressions on the automated library mainly depend on what they see as OPAC. Apart from satisfactory access time this module should have the following features.

- Help screens for the users.
- Provide help in different languages
- Allow users to make book recommendations
- Prompt user action when required.
- Automatic return to the opening menu when a library set period has elapsed with no user activity.
- Collect statistics on the use of OPAC and record user searches and system responses without user identification.
- Allow use of Boolean operators in search formulations.
- Permit the use of truncation in search arguments.
- After displaying the initial response allow return to the search mode (with search string unaltered) or the display of records.
- Allow user to reserve books for items found in OPAC.
- Prompt user to 'SEE' 'SEE ALSO' and 'USE' references.
- Provide for the option of terminal printer to print the result of a search.
- Prevent unauthorized access to any function which would alter or delete information in the system files.
- Allow search results to be saved temporarily.

6.3.4 Command-driven and Menu-oriented Systems

Literature on online public access catalogue differentiates command driven and menu oriented systems. In case of command driven online catalogue the user enters a search string consisting of a field to be searched, followed by a specific value to be matched in the field. The Library of Congress system, for example use types 'au=', 'ti=' , 'sh=' depending on whether author, title, or subject search is desired.

Menu oriented catalogues display a series of screens containing a list of search commands and retrieval options for user perusal and selection. The typical menu-oriented catalogue access system begins with a list of searchable fields, followed by additional lists and prompts for specific search parameters. These screens are usually combined with formatted screens, which facilitate the entry of search parameters adjacent to appropriate field labels.

Though the distinction between command driven and menu oriented system is conceptually useful most systems these days provide both the access modes to facilitate varying user tastes and proficiencies.

Irrespective of command driven or menu oriented user interface, online catalogues utilize indexes to retrieve bibliographic records. Going with the search capabilities traditionally associated with card catalogues, all integrated systems maintain author, title and subject indexes. In fact, for efficient retrieval the system has to maintain indexes on all the search parameters including, publisher, publication data, language of publication, media type, etc.

LIBSYS OPAC SEARCH SCREEN

Indexes	Query
• Author • Title • Classified • Subject • Place • Publisher	• Query • Combination Search
OK	CANCEL

The picture above shows an OPAC screen in Libsys package. In the Main OPAC Screen (not shown here) there are four Options: Searches, Miscellaneous, New Additions and Exit on the Menu. Searches again provides search of different databases say : Books, Journals, CDs, Articles etc. After choosing one of these, you are presented with the above screen. As may be noticed, you can search by Author, Title, Class number, Subject, Place Publisher, Any word in the title or perform a Combination Search. Except Combination Search rest are Field oriented. The search is limited to the Field selected. In Combination Search you an combine a word occurring in any Field with other search similar search elements by Boolean operators like: AND OR NOT .

At first you are shown the number of Hits. Then a list of titles matching the query is displayed. Upon selecting any displayed Title, you get full bibliographic details. The display even links to the circulation module and tells whether a book is out on loan. The status of a

book (Lost, Written Off, Weeded out etc) can also be seen. The user can chose the format for display of details: Marc, Catalogue Card, Bibliographic entry

Librarian can configure all details as to how the OPAC behaves. For instance if you have several databases one each for books, journals, CDs, Videos etc you can state which of these can be searched via OPAC. You can say "how recent" (in terms of days) should "Recent Additions List" be when displayed. Should the member enter his ID number or name for gaining access? Can he send a Recommendation for books? What status items should be shown or linked—Reservation, Check out, lost etc.

6.4 SEARCH STRATEGY ON OPAC

OPAC offers mainly three methods of searching strategy, i.e., field-based, keyword-based and the use of logical operators like `and', `or' and `not'.

6.4.1 Field Based Searches

OPACs as a matter of default, allow searches by various bibliographic fields such as Author, (any word) in the Title, Publisher, Subject. Classification Number etc. Some OPACs would permit us to limit the results by Language, Year of acquisition also.

This has been discussed earlier in LIBSYS example above.

6.4.2 Keyword Search

Keyword searches based on titles, corporate names and conference names are supported with some variations by a growing number of online catalogue systems. Other systems also index keywords in other specified fields. Keywords are important words in a given field which could be used for retrieving a given record. In some systems you can specify how the key words are to be selected. The user can indicate key words or Key phrases by delimiting them by a special pair of delimiters, say, angular brackets, hash signs etc. Though there are devices to delimit such words, the systems usually resort to indexing all the words in a given title except the ones, which are listed in the `stop word' lists to exclude the unsought terms from keyword indexes. Examples of STO WORDS are: A An The OR etc.

6.4.3 Logical Operators

In addition to straightforward searches involving a single field value, most of the online catalogues support the formulation of complex retrieval specifications containing multiple field values linked by logical operators AND OR NOT. Users can usually limit searches by publication date, material type, language of the book and such other parameters.

i) Logical OR

The logical OR is the class union operator. The result of a logical OR between two search terms is the record bearing any of the term used for search. If the search string is -

Geography OR History

documents indexed under either Geography or History are retrieved. Logical OR is used to broaden the scope of the search.

ii) Logical AND

The logical AND is the class intersection operator. The result of a logical AND between two search terms is the records containing only those elements which are common to both classes. If the search string is –

India AND History

This retrieves only those records which are indexed simultaneously with both terms - India and History. AND operator restricts the quantity of output.

iii) Logical NOT

The logical NOT is the class exclusion operator. The result of a logical NOT between two terms is the records containing all the elements of the first term which do not also belong to the second term. If the search string is -

India NOT History

It retrieves those records which are indexed under India but not simultaneously with term History. Many complicated queries could be formulated using a combination of these logical operators. Some of these could be represented in diagrams as follows:

((A OR B) AND C)

(A OR (B AND C))

If you need a book on Indian History which does (should not , to be precise) not deal with Geography, the query will be: (India and History) not Geography

6.4.4 Other Search Features

A few systems permit proximity searches (where the search terms appear adjacent to one another in the search field), searches for embedded character strings, wild card searches (where some of the characters or words are left unspelt but filled with appropriate indicators), and other features. Most systems support right truncation of search terms where the user enters the beginning portion of a field value and system retrieves all catalogue records where the indicated field value begins with the specified character string.

As OPAC is essentially a searching tool, some details of search techniques have been included here. You can find more details of searching techniques in Unit 8.

6.4.5 Bibliographic Information Display

Most systems perform information display in two steps. At first level short title, call number, accession number, and author is displayed. Following this once suitable records are identified the searcher can instruct the catalogue access module to display them. Most systems also allow for more than one display format such as card catalogue format, short display, and display with prompts, etc. Circulation status of the book and the current availability are also in built into full display of information.

6.5 WEB OPAC

OPAC has gone through a series of developments. Initially there was command driven, text only screen (non–graphic, dumb terminals) based systems. These OPAC modules used to be accessed via a protocol called Telnet. Telnet would help you get connected to the host system via dial up lines. The OPAC software would run on / from the host system. Only character and line oriented commands could be used. Such systems were not very user friendly. Users had to learn and remember a lot of commands including as how to 'navigate' on the screen.

6.5.1 Recent Phenomenon

With the availability of Graphic terminals, GUI interfaces, Operating Systems like Windows X-windows etc, most of the application packages including OPAC became more user friendly. They could be learnt easily and intuitively. OPAC systems meant for single user

desktops and those for LAN or those that are hosted on mainframes or mini computers that be reached via special dial-up access across a WAN belong to this category.

Recently during the past few years Internet has suddenly become all pervading. Accessing information via Web on the Net is becoming a child's play. In this context a number of libraries have provided connectivity for their OPAC via Internet or the WEB in particular. In this section we will see some details of WEB OPAC. (For information on Internet and the WWW see Unit 11).

A Web OPAC is a powerful tool that links all electronic resources for easy access. Web Interface can display graphic files, multimedia files, rich text files etc. It can provide links to external sources, other search engines also. Web OPACs are also sometimes referred to as WEB CAT or Information Gateways.

6.5.2 Advantages of Web OPAC

The major advantages of Web OPAC include:

1) Web supports many protocols such as Telnet, ftp, gopher, Wais, mailto etc.
2) Many different document formats like SGML, pdf, doc, HTML are supported
3) Access to bibliographic records, full text resources, external resources – all can be linked
4) Seamless linking from resource to resource is possible (full text summary picture etc)
5) Multiple electronic and document formats
6) GUI display provides more help and ease of use

There are special advantages for the Library Staff from OPACs of other libraries:

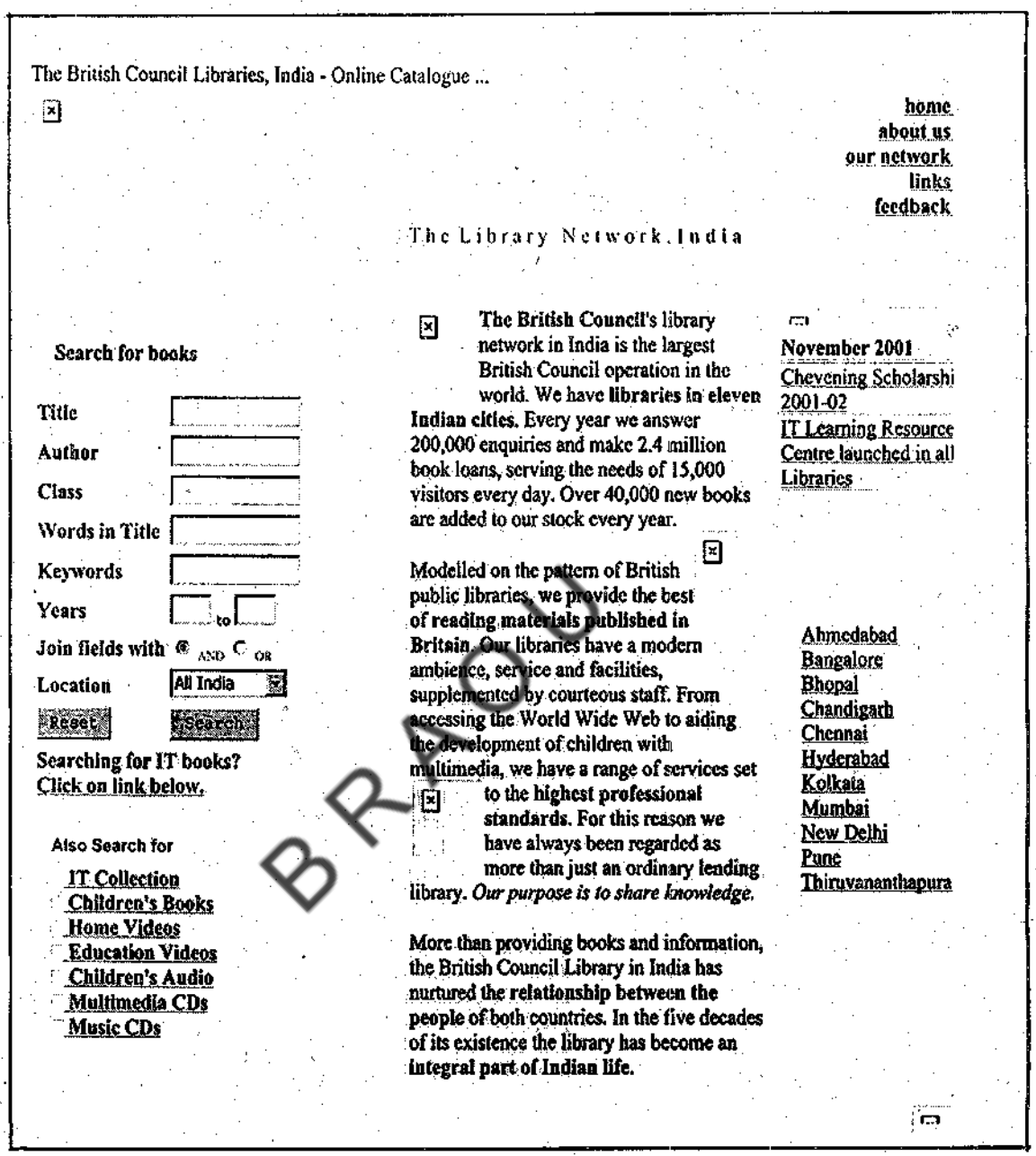
1) Cataloger can access other libraries resources for cataloging work
2) Call Numbers and Subject Headings can be assigned by looking into others' catalogs
3) Notes present in catalogue Entries will be useful
4) Can link up t other resources from within the catalogue Entry
5) Hardcopy and electronic resources can be linked up.

6.5.3 Situation India : Example of British Library OPAC

In India, Library Application Packages like LIBSYS, LibEra, SIMS++ provide WEB OPAC Interface. An Excellent example of WEB OPAC is that of British Library found at http://www.bclindia.org/. The picture below gives a screen shot of the WEB OPAC of the British Library Network in India. As might be seen, the catalogue covers collections of eleven libraries situated in the cities: Ahmedabad, Bangalore, Bhopal, Chandigarh, Chennai, Hyderabad, Kolkata, Mumbai, New Delhi, Pune and Thiruvananthapuram.

User can search Special Collections like:

1) Home Videos
2) Education Videos
3) Children's Audio
4) Multimedia CDs
5) Music CDs
6) IT Collection
7) Children's Books


The British Council Libraries, India - Online Catalogue ...

home
about us
our network
links
feedback

The Library Network India

Search for books

Title
Author
Class
Words in Title
Keywords
Years to
Join fields with AND OR
Location All India
Reset Search

Searching for IT books?
Click on link below.

Also Search for
IT Collection
Children's Books
Home Videos
Education Videos
Children's Audio
Multimedia CDs
Music CDs

The British Council's library network in India is the largest British Council operation in the world. We have libraries in eleven Indian cities. Every year we answer 200,000 enquiries and make 2.4 million book loans, serving the needs of 15,000 visitors every day. Over 40,000 new books are added to our stock every year.

Modelled on the pattern of British public libraries, we provide the best of reading materials published in Britain. Our libraries have a modern ambience, service and facilities, supplemented by courteous staff. From accessing the World Wide Web to aiding the development of children with multimedia, we have a range of services set to the highest professional standards. For this reason we have always been regarded as more than just an ordinary lending library. *Our purpose is to share knowledge.*

More than providing books and information, the British Council Library in India has nurtured the relationship between the people of both countries. In the five decades of its existence the library has become an integral part of Indian life.

November 2001
Chevening Scholarshi 2001-02
IT Learning Resource Centre launched in all Libraries

Ahmedabad
Bangalore
Bhopal
Chandigarh
Chennai
Hyderabad
Kolkata
Mumbai
New Delhi
Pune
Thiruvananthapura

The user can specify Author, any word in the title, Keywords, exact title, range of years (of publication) and as well use Boolean operators to combine these elements. The results are shown in two steps: First step gives you just titles and authors; Specific selection yields you complete details including information as to which of the Libraries in the Network have the title. The facility is very easy to use, fast and reliable.

6.5.4 Software for Creating Web OPAC

GLAS is an acronym for Graphical Library Automation System developed by Electronic Online systems, California. It is a simple interface to convert your online catalogue and render it web accessible. CDS/ISIS of UNESCO has developed GenSIS Web Interface Wizard to help you convert CDS/ISIS database for the Web. GenISIS helps development of HTML web forms for CDS/ISIS database searching. A software Component called ISIS_DLL provides the necessary Application program interface needed by programmers.

Details and demos of web based commercial catalogue software from vendors like : NOTIS, DRA Web Search, VTLS (This product has been acquired by Hyderabad University Library), Sirsi Web are available at:

http://www.mum.ca/library/cat/opac.html#webopacs/.

A good listing of Web and Telnet based OPAC is also available here.

6.6 Z39.50 STANDARD

Z39.50 is a North American Standard ANSI/NISO Z39.50 – 1995 Information Retrieval (Z39.50) Application Service Definition and Protocol Specification. It is equal to ISO: 23950-1998. Version 3 is the current version. It may be relevant to know about this important Standard while we are discussing Web based OPACs.

Library databases may be organized using any of the available DBMS software packages like Ms SQL, Ms Access, Sybase, Oracle, Ingress etc. Each DBMS has it own format, and may operate in different Operating Systems and Environments. Z39.50 is a protocol that enables communication among computes of different types and platforms. By adhering to Z39.50 standards it would be possible to query different databases in different DBMS systems through a single Interface. Some Vendors may be offering OPAC and other Library Software Packages that are Z39.50 Compatible.

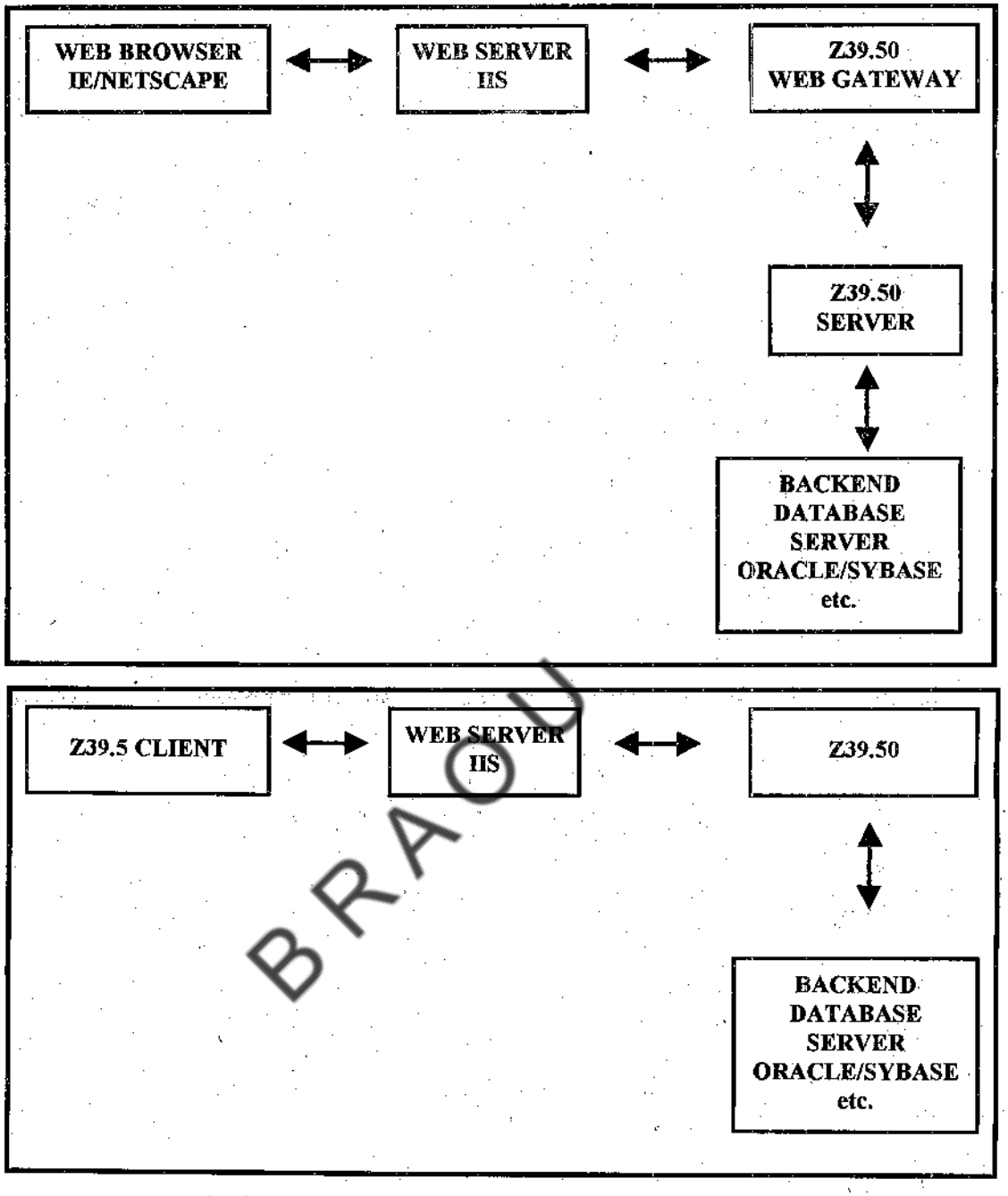
6.6.1 Servers, Clients and Gateways

Z39.0 Server, Z39.50 Client and Z39.50 Web Gateway are important components. As the access is via Internet (Web) Web Server (like Internet Information Server of MicroSoft) should also be there. Actual bibliographic data is held in Back-end database servers hosting DBMS systems like Oracle, Ingress, Ms SQL etc.

The Z39.50 Server is also called Z39.50 "Bolt-On"s. This Server translates the Database application into a format suitable for transfer and query via Z39.50. A "Profile" (residing on Z39.50 server, contains information needed to carry out such activity. There could be Profiles for each user community. For Libraries, BIB1 is a commonly used Profile.

Z39.50 Client is the software you need at the user's end. When you search a Database connected to Z39.50 Server (in turn connected to DBMS server) you use this client instead of Netscape or Internet Explorer or other Web browsers. If you want to eliminate the need for a special browser, then we need to add Z39.50 Web Gateway. This Gateway sits between the Internet Web Server and the Z39.50 server.

Accompanying Figure illustrates the set up of different components of a typical Z39.50 system.



(Figure: Z39.50 Client Server Set UP)

Of late, XML (Extensible Mark Up Language) and RDF (Resource Description Framework) have been gaining importance and are competing with Z39.50 in achieving similar purposes.

6.6.2 Example

There is a Gateway called AHDS (Arts and Humanities Data Service) in the UK. Using this gateway, it is possible to query at the same time, using a single Query frame, five different databases; these are: Archaeology in York, History in Colchester, Performing Arts in Glasgow, Visual Arts in New Castle and Textual Studies in Oxford. All these databases and the operating systems are different and they are situated in different locations. However they appear to be just one database to the end user, thanks to Z3.50 adherence.

In the example of British Library OPAC on the Web mentioned above, if the constituent libraries are following different database standards for various libraries (some in Foxpro of Libsys Some using Ms SQL etc), and if you are able to consult all their library catalogs in a single stroke

through one web interface, they must be adhering to Z39.5 standards and be using a Z39.50 server etc.

6.7 LET US SUM UP

We have seen several important aspects of OPAC, including its advantages over manual system, good features expected of an OPAC etc. Searching methods and search commands and methods in so far as they are concerned with OPACs have been discussed. Most recent Tend in OPAC - WEB OPAC- has been mentioned in brief. Mention has been made of Z39.50 standard and its relevance to OPAC.

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6.9 ASSIGNMENT

Visit one of the libraries having OPAC. Libraries of Hyderabad University, ICRISAT, MANAGE, British Council, ASCI, NIRD, CCMB etc have OPACs. Observe, discuss and submit a short overview of the salient points of their OPACs.

6.10 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) How online public access catalogue differs from conventional card catalogue?
2) What are the features of an online public access catalogue?
3) What is a search strategy? Explain with examples with special reference to OPAC.
4) Explain Boolean operators and how do they help in narrowing or broadening the search. Give examples.

II. SHORT NOTES

a) Web OPAC
b) Querying on OPAC
c) Z39.50

UNIT-7 : LIBRARY APPLICATION SOFTWARE - SERIALS CONTROL AND CIRCULATION

Structure

7.0 Aims and Objectives

7.1 Introduction

7.2 Serials Control

- 7.2.1 Peculiarities of Serials Management
- 7.2.2 Workflow in Serials Control
- 7.2.3 Predictive Algorithm for Claims Management
- 7.2.4 Features to Look for in Serials Module

7.3 Circulation Control

- 7.3.1 Automated Circulation Functions
- 7.3.2 Circulation Data Management
- 7.3.3 Circulation Parameters
- 7.3.4 Workflow in Circulation Control
- 7.3.5 Users vis-a-vis Circulation Control
- 7.3.6 How Does the Barcode System Works
- 7.3.7 Query Possibilities in Circulation
- 7.3.8 Features to Look for in a Software Package

7.4 Let Us Sum Up

7.5 References

7.6 Assignments

7.7 Model Examination Questions

7.0 AIMS AND OBJECTIVES

This unit introduces various routines in computerized serials control and circulation modules. The unit also describes work flow, file management, and finer points to look for in these modules.

After studying this unit you should be able to

- describe work routines in circulation, and serials control modules of a computer software
- bring out the advantages in a computerized circulation system and serials control
- appreciate the finer points of the library software as used in these modules.

7.1 INTRODUCTION

Serials form an important part of the collection of any library and substantial funds are allocated for its acquisition, control and usage. Automating serials Management activity is relatively very complex. Circulation of reading materials to patrons of the library is the most visible activity and the most basic function also. However computerization of circulation tasks is relatively very simple and easy. A thorough look into various aspects of these two important activities with a view to automate the manual processes will be very helpful. Succeeding sections deal with specific aspects of serials control and circulation control.

7.2 SERIALS CONTROL

A serial is a publication in any medium issued in successive parts bearing numerical or chronological designations and intended to be continued indefinitely. Serials include periodicals, newspapers, annuals (reports, year books, etc.) the journals, memoirs, proceedings, transactions, etc. of societies, and the numbered monographic series. The question of controlling the serials by computer produces mixed reactions from librarians and information people. Some believe that it is one of the most difficult house keeping operations to perform by computer because of the unpredictable nature of the serials, while others claim that it is this unpredictability which makes serials a good candidate for control by computer.

While we discuss Serials control two distinctly different issues are to be taken into account. The first concerns bibliographic control of serials. This work involves maintaining a registry of all serials published in a country so that thee could be good bibliographic control. Assigning ISSN number for example would come under this category. Such activities, which we can consider are of Bibliographic Control or Management of Serials can best be done by National Apex Libraries and are not the main concern of Individual libraries. The second type deals with Procurement, renewal, registering receipt of, controlling payments relating to serials etc. These activities are of interest and concern of Individual libraries. In this Unit we are talking about Computerization of Serials Procurement and usage etc.

7.2.1 Peculiarities of Serials Management

The inherent problems of controlling serials are various and include:

- the exclusiveness of serials, as most of them are not published by commercial organization.
- the tendency of serials to change name, divide into two or three separate publications, die and lay dormant for several years
- the difficulty in being aware of which issues have not yet been received although they have been published and whether or not a claim should be made to the supplier.
- possible changes in publisher.
- the appearance of special issues, supplements, indexes, etc.
- the fact that some serials are gifts or exchanges.
- the physical problem of storing or circulating individual issues.
- being aware of when all the issues of a volumes have been received and so need to be made ready to be sent to the binder.
- Changes in subscription rates

- Changes in coverage scope language format of publication etc
- Discontinuation of publication
- Cessation of or gaps in subscription to certain serials by the library
- Availability in CD, Online, Floppy or Print formats

Because of the several problems mentioned above, serials management is very difficult. Moreover I the case of a book, a book is purchased once and till its lifetime in the library one has to take care of issues and returns only. But in the case of serials, after payment of subscription, each and every issue poses problems like a book.

Despite such inconsistencies, computers were first used to assist in the control of serials in the 1960s with most systems depending on punched cards and being batch processed. In 1970s some libraries in U.S.A. demonstrated that online real-time serials control systems, which covered a variety of functions could work and be cost effective. Presently Integrated Library Application Packages take care of Serial Management requirements and these work on Desktops and PCs.

7.2.2 Workflow in Serials Control

The basic requirements of a serials control system are similar to, but more complex than those of controlling a collection of monograph. These requirements include:

- selecting suitable titles for purchase.
- generating purchase orders. As majority of serials subscription are renewals of previous orders and so an automatic prompt indicating when a subscription is due.
- financial matters and charging the appropriate accounts.
- receiving issues and claiming for issues not received.
- keeping current and accurate details of serials holdings.
- allowing access to details of current holdings.
- allowing individual issues or bound volumes to be borrowed from the collection.
- organizing for completed volumes of serials to be bound.
- producing management information reports.
- Allowing individual issues to be sent on circulation
- Preparing recent list of additions of serials

The majority of computer-based serials systems are designed to produce lists sorted on titles, subject, location, supplier, etc.

(i) Serials Check-In

The general steps for any serials check-in system include:

1. identifying the serial and finding a local record for it.
2. recording the receipt of the issue which has arrived.
3. marking the issue as appropriate.
4. updating the master file of serials holding.
5. sending the claim for an issue which has not arrived.
6. dispatching all the issues of a volume when complete for binding.
7. circulating or routing the issue to those who wish to receive it.

(ii) Subscription Routines

As with conventional book acquisitions, computer can be used to minimize or eliminate the labour intensive sorting, filing, and other paper handling work routines associated with manual serial processing. Most serials control systems support some combination of order preparation, check-in of received issues, claiming of missing issues, preparation of bindery orders, and reports. Order and renewal preparation are typically performed online, although purchase orders and renewal orders are usually printed in batches. Received issues are checked in at terminals by retrieving the appropriate serial record and modifying designated holdings fields. The most flexible systems simplify data entry by displaying information about an exceptional issue, including the volume and issue number, cover date and number of copies anticipated. The workstation simply modifies those data elements requiring correction when all modifications are completed, the new record enters the serials data file.

(iii) Budget Maintenance

Budget maintenance is an important component of the serials management. Serials module must provide for maintenance of more than one budget category in varying currencies. It is also expected to provide for dynamic conversion to local currency before committing the expenditure. Budget files must have query facilities. Routines must be so written that when required an order could be processed by drawing funds from more than one budget head.

(iv) Other Feature of Serials Control System

Unlike circulation control and to a lesser extent acquisition, which are characterized by a well defined predictable sequence of work steps performed in a predetermined order on a regular basis, serials pose certain problems. Serials processing tasks are complicated by a variety of exceptional circumstances, which must be anticipated in the design of any automated system. While bibliographic and other data pertaining to monographs remain relatively stable once entered into computer storage, it is a rare serial record that will not eventually require some change in title, publisher, issuing agent, frequency of publication, numbering sequence, or other attributes. Such changes can make obsolete a computer printed union list, complicate the development of an automated claims production system, or alter previously established binding practices for a given serial. However, computer systems can be designed to accommodate such changes with such exceptional conditions, but the design effort and cost are correspondingly increased.

7.2.3 Predictive Algorithm for Claims Management

Predicting when the issues of a serial are due in a library is difficult. Most serials control systems alert the serials librarian to the fact that certain issues have not yet arrived and leave the librarian to decide whether or not a claim for that issue be sent to the supplier. It is relatively easy to alert the serials librarian in the journal issue registering process. It is done by checking whether the number of previous issue registered is one less than the present one within a given volume. In most practical situations this will not be sufficient as non receipt of several issues in a sequence would mean not being alerted over a long time. This may result in non-availability of missing issues for replacement.

Some systems generate the expected dates of the journal issues whenever an order is processed. The journal periodicity, subscription start and end date are supplied either at the time of generating this file or these variables are taken from other master files. For actual claim generation these dates are used in conjunction with another file where allowed grace periods are stored for different journal frequencies. That is grace period for claim generation for monthlies may be one month and for quarterlies two or three months. Some systems require the operators to key in the expected arrival dates in the journal master file. This may

prove to be cumbersome in case of journals with higher frequency, that too when the total journal subscription figures run in thousands. Based on information stored in serials holding records most serials control system will also prepare bindery orders, print subscription slips, check in items on their return, and print claiming notices for items that have not been returned from the bindery on schedule

7.2.4 Features to Look for in a Serials Module

Apart from the usual routines of serials control a good serials control module is expected to fulfil some of the following requirements.

The system must provide:

- within serials records for issue chronology, enumeration, and receipt date.
- for the receipt of multiple issues in a single transaction.
- operator override of expected issue number and date.
- a routing list for each copy of each issue received.
- automatic generation of claim notices when a missing issue is identified.
- automatic generation of bindery orders either on demand or automatically when the volume is complete.
- automatic generation of renewal alert notice several months in advance before the expiry of a subscription.
- complete budget accounting for serial subscriptions.
- `see' and `see also' pointers in OPAC for previous and subsequent titles.
- processing supplementary bills and credit notes given by vendors.
- reports of accounting, subject-wise titles, holdings data, and other listings.
- Report on serials in various stages: on display, under routing or circulation, ready for issue, with binder etc
- Provide for procuring serials against standing orders
- Ability to switch from within a module to another area easily and get back.

7.3 CIRCULATION CONTROL

Circulation control is one of the most widely automated library operations. It is often the first activity that library considers automating. It could be because library circulation control system has an obvious resemblance to inventory management processing systems which has been successfully automated in general business applications. While specific circulation policies and procedures may be subject to considerable local variation, the major component of circulation control - issues and returns - is typically performed in a straight forward manner that is relatively easy to understand by system analysts lacking formal library training. Even from the library side its interest in automated circulation control is in large part based on a long standing awareness of the problems inherent in manual circulation systems. These include labour intensive and time consuming record keeping work routines, inaccuracy, high personnel turnover, inability to generate statistics about circulation activity, and the lack

of interface between circulation files and the library files which contain much of the same bibliographic data

7.3.1 Automated Circulation Functions

John Corbin gives the chart below in his book *Implementing the Automated Library System* and classifies issues, returns, renewals, recalls, fines, queries, overdue books, and database maintenance as the activities and the specific tasks that are listed against each of them as tasks. These functions are not an end in itself. There are other functions specific to types of libraries that circulation module will perform such as allotment of carrels, printing no-due-certificates, automated attendance registration, etc. Data management in circulation module varies with the module design.

AUTOMATED CIRCULATION FUNCTIONS

No	Function	Sub-Category
	Charge	Regular Special
	Discharge	With Item Without Item
	Renewals	With Item Without Item
	Reservation	Reserve Item Update Reservation Delete Reservation Print reservation Notices
	Recalls	Enter Recall Notices Update Recall Notices Delete Recall notices Print Recall Notices
	Fines	Enter Fines Update Fines Delete Fines Print Notices
	Queries	Borrower's Name / Number Author Title Call Number
	Overdue Books	Compile List Print
	Database Maintenance	Add Borrower Update Borrower Delete Borrower

7.3.2 Circulation Data Management

All computerized circulation control systems maintain files of machine readable data pertaining to a library's circulating collection and its borrowers. Collection related information includes both bibliographic and data on number of copies.

(i) Item Data File

Bibliographic data files typically contain one record for each title, regardless of the number of copies in the library's collection. An item data file contain records pertaining to the individual copies of specific titles which the library owns. Such item records - which may include copy numbers, barcode numbers and copy location - are essential to the circulation activity since the libraries circulate copies rather than bibliographic entities. While integrated systems can effectively utilize the catalogue data file for circulation transactions as well, the single purpose circulation systems achieve the same by creating the short records either in advance or at the time of circulation.

(ii) Borrower File

While specific file structures and contents will vary from product to product all pre-written circulation software packages and turnkey systems support a borrower file which contains one machine readable record for each authorized library user. Common data fields in this file include - borrowers' name, address, the registration date, expiry date, date of last circulation activity, borrowers category, borrower number, an indication of the delinquency status with a reason for delinquency, a count of the number of items circulated, and message field with a provision for a few lines of text.

(iii) When to Input Borrowers' Data

Bibliographic and borrower files can be established in either of the two ways - before circulating any item or as individual items are circulated for the first time. Though the former alternative is preferred it may prove to be impractical or economically impossible in case of large university systems or public libraries.

Absence *vs* Inventory Systems:

When the entire Library holdings are available in the database of books, the system of circulation control is called Inventory system. This is most useful feature. In earlier days, Circulation Systems used to make note of books that are on loan. That is details of a book issued our are noted into the system during the first time a book is issued. Such a system is called Absence System (the book is absent in the Library).

7.3.3 Circulation Parameters

We have noted earlier that all circulation system - pre-written or turnkey - support three broad types of operations: charging and discharging, on line file enquiries and off line report production. Most circulation systems these days provide flexible support for the wide range of requirements encountered in libraries of all types and sizes. Newer products are highly parameterized so the individual libraries can specify loan periods, fine procedures, reservation and recall limits, reminder frequency in case of late returns, management of erring members, etc.

7.3.4 Work Flow in Circulation Control

If circulation control is implemented as one of the application module in a multifunctional integrated system it is usually accorded the highest priority so that charging and discharging will be performed before catalogue searches or other operations.

i) Charging and Discharging

Charging procedures are typically straight forward. After running a command or choosing a menu option to put the circulation control system in the charge out mode, an operator first scans the barcode labels on the borrower identification and individual items. When the bar code label is absent or damaged these identifiers can be key entered, as item and borrower identification are entered. Most circulation programs automatically check for exceptional conditions, which will temporarily or permanently block the charge out

transactions. Such exceptional conditions include borrowers with over due items or outstanding fines, borrowers who have exceeded the library predefined charge-out limits, items reserved for other users, and items which were never properly charged out. To reflect the in-house use of library materials in statistical reports some systems permit the discharging of items removed from shelves for in-library reading.

ii) Overdue Items

When overdue items are checked-in, systems typically calculate fines for immediate collection. If borrower is unavailable at the time of return it is added to his account, and the library can specify the amount of fines which borrower the will incur before circulation privileges are revoked.

iii) On Line Display of Records

To facilitate completion of specific instructions all systems support the online retrieval and display of bibliographic and borrower records by barcodes. In case, the circulation control is implemented as an integrated system of components, bibliographic records are usually retrievable by accession number, borrower data retrieved is usually combined with information derived from the bibliographic and copy records with which borrower records are lined during the charge out activity.

iv) Reservation

Most circulation software also supports the title reservation at copy level. Statistical reports provide information that is useful for knowledgeable collection development as well as management of the circulation activity itself. One of the important reports in this category could be the one that provides circulating titles by specific call number ranges which can be generated for specific time intervals. The circulation software is expected to generate, recall, overdue, fine, and similar borrower notices.

7.3.5 Users *vis-a-vis* Circulation Control

Manual circulation system places much of the work load on borrower who usually fills out charge slips. There is typically little or no relationship between a manual circulation system card files and a library's catalogue or other records which contain much of the same bibliographic information. In addition, computerized system can validate the transaction in a wide variety of ways which can only be done in the manual system with considerable difficulty. The earliest pre-written circulation software packages and turnkey circulation system were single purpose products designed specifically and exclusively for circulation control. While such single purpose systems remain available, system analysts increasingly emphasize 'integrated' turnkey systems and software packages which combine circulation control and other capabilities.

An integrated system utilizes a single bibliographic database to support multiple library operations. However, in actual practice integrated systems encompasses a variety of multifunctional products, some of which employ multiple databases to support different tasks

7.3.6 How Does the Barcode Works?

Barcode is a way of symbolically representing digits and alphabets through a series of bars. There are several types of barcodes like Codabar, Code 39, Interleaved 2 of 5, Code 128, etc. These varying barcode types can be printed opting low, medium or high density bars. When a decoder wand or a laser gun is run on barcode the coded digits/alphabets appear on the computer screen after being decoded by an interface to the keyboard. Once the accession number or other decoded information appears in a specific field, the software takes over and performs a set of commands, such as display the title corresponding to the number and validate its circulation status, etc.

Generally the Accession Number or such Unique number is used to identify a item (book, journal issue or CD etc). Bar Code labels are pasted in convenient places in the book (say, spine or inside last page etc) such that optical scanning is easy. Software system allows for manual entry of the accession number in circulation or other work. This becomes very essential when bar code labels may be absent o damaged during wear and tear.

Advantages of Using Bar Codes are:

- It automates data Entry and minimizes manual work
- Eliminates data entry errors
- Speeds up circulation process.

7.3.7 Query Possibilities

Typically circulation module should answer queries such as:

1. What titles are on loan to a given user
2. Which borrower has a particular title;
3. What are the titles due for return;
4. What books are overdue;
5. What titles are reserved for users;
6. When is a reserved title expected

Manual circulation system cannot readily give answers to these questions. Automated systems generally answer all these questions and more, serving both the librarians and the users better.

7.3.8 Features to Look for in Circulation Software

The above description shows the general procedures in a circulation module. However, these features are implemented in different library software in varying degrees. The following are finer points that add value to a circulation module.

Does the circulation system :

- As part of the integrated library system interface with the OPAC.
- Deal efficiently with the peak issue rate with an acceptable response time.
- Allow for parameterization and to what extent.
- Allow to create, modify or delete borrower record on-line at the issue terminal.
- Check borrower status and provide clear visual/auditory signals to the operator of any exceptional condition, including excessive number of book issues, fines/fees owed and permit supervisory override.
- Validate whether the material presented at the circulation counter is allowed to circulate before it is issued and also verify whether it is reserved for another person.
- Calculate loan periods and due-dates according to the types of borrower, types of material allowing for holdings.
- Allow due-dates to be changed on-line.

- Calculate and display new due dates for renewals and in the process validate whether the said title is on reservation and act accordingly.
- Allow modification of reservation data, including cancellat on of reservation at library discretion and produce notice to be sent to borrowers.
- Purge cleared transactions on a regular basis with the retention of historical data for management information only.
- Calculate fines beginning with a specified minimum amount and ending with a specified maximum.
- Allow to specify the number of days to wait between generation of overdue notices.
- Provide statistical reports about issues, returns, reservations for a given period and number of unique titles borrowed and also number of times a given title was issued.

7.4 LET US SUM UP

We have seen the importance and need for automating of serials management and circulation activities in a library. Features expected in a good package have been listed. Details of Work flow, functions that could be automated wee discussed. Some information on Predictive Algorithms, use of Bar coded labels etc have been seen. LIBSYS has been given as an example.

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7.6 ASIGNMENT

Visit a Library where both serials Control as well as Circulation Control have been effectively Computerized. Collect a complete set of Reports generated there. Make a brief description of each of the reports.

7.7 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) Why computerizing the serials control is difficult? Describe the work flow in serials control. What reports are essential reports in a serials module?

2) What are the circulation parameters required in circulation module? Explain how barcodes help in circulation work. Give reasons why Computerised circulation control is superior to Manual system.

3) Computerisation of Circulation Control is easy while Computerisation of serials Management is very difficult. Explain describing the features of an automated system and its requirements.

II. SHORT NOTES

a) Predictive algorithm

b) Barcodes in Circulation work

c) Absence and Inventory systems

d) Vagaries or unpredictability of Serials

UNIT - 8: USE OF COMPUTERS IN INFORMATION SERVICES

Structure

8.0 Aims and Objectives

8.1 Introduction

8.2 Classification, Indexing and Thesaurus Construction

- 8.2.1 Computers in Classification Work
- 8.2.2 Automatic Indexing
- 8.2.3 Thesaurus Construction

8.3 CAS, SDI, Translation and Reference Service

- 8.3.1 Current Awareness Service
- 8.3.2 Selective Dissemination of Information
- 8.3.3 Translation Service
- 8.3.4 Reference Service

8.4 Databases and Literature Searching

- 8.4.1 Databases
- 8.4.2 Literature Searching

8.5 Let Us Sum Up

8.6 References

8.7 Model Examination Papers

8.0 AIMS AND OBJECTIVES

Computer based information services provide faster access to information. Libraries and information centres are slowly replacing the manual based classification, indexing, information retrieval systems etc., with the automated systems. In this Unit you will learn about the computer usage in information service related activities.

At the end of this unit you will be able to:

- appreciate the need for using computers in these areas
- explain the role of IT in library classification, indexing and thesaurus construction
- describe how computes can be useful in CAS, SDI, reference & translation work
- explain the basics of bibliographic and library catalogue based databases
- discuss the intricacies of literature searching Using Online and On-disc databases

8.1 INTRODUCTION

In this Unit we shall discuss the role played by computers in rendering various Information Service related activities in a library. As we have seen earlier, House keeping functions such as Acquisitions Control, Serials Control, Circulation Control, Cataloguing, Binding and similar "behind-the-screen-activities" are generally discussed under the heading Library Automation. Most of these tasks do not call for much of brainwork and are normally clerical, mechanical and routine in nature. There is another group of activities in the library that fall under the category: "Information Services". Items under this group are - Current Awareness Service, Selective Dissemination of Information, Reference Service, Classification, Indexing, Thesaurus Construction, Information retrieval based on Databases, Translation etc.

Though Intelligence related activities are difficult to be processed with computers there are very many areas where computers can simplify our work. Keeping this in mind, let us look into some details of each one of the above mentioned Information service related activities.

8.2 CLASSIFICATION, INDEXING AND THESAURUS

Computers are used for a number of library operations and services, like classification work, indexing and thesaurus construction.

8.2.1 Computers in Classification Work

As a result of extensive availability of computers, librarians stand to gain Classification work also. Classifying is an intelligence oriented human task. Looking up the DDC Edition 21 in paper book format is pretty difficult and time consuming. DDC21 is available in CD as Dewey for Windows (V2.10) from OCLC Forest Press. Using this CD one can search the DDC book under:

1) Relative Index (Words or Phrases);
2) Captions (Words or Phrases);
3) Library of Congress Subject Headings (Words or Phrases);
4) Dewey Numbers
5) Basic Index (Except LCSH).

One can have a display of the screen under four user friendly modes: Browse, scan, search, Summary. The CD comes with context sensitive help also. While using the system you can add your own annotations also to take care o local variations. Thus DDC21 CD for Windows is a great help for classifiers.

Many experiments have been carried out in automatic book classification but as of now computers can only be some additional help.

8.2.2 Automatic Indexing

Automatic text analysis became a subject for serious research in the late 1950s and a major focus of activity within the then emerging field of Information Science. There was the desire to provide faster and more complete access to the scientific and engineering literature and to control the information explosion. A second factor was the availability of computers and the recognition that these machines were symbol manipulators capable of processing

words as well as numbers. Studies on automatic indexing blossomed during this period, as did studies on automatic abstracting, automatic (machine) translation, and various other information processing and retrieval activities.

What constitutes Automatic Indexing?

For computational purposes, a word is defined as a sequence of symbols, either alphabetic, numeric or punctuative ,separated by spaces on both sides. Assuming that the words are in machine readable code, the computer can be programmed to process these words in a variety of ways. Programs can count the number of words in a document and calculate the mean number of words in the average sentence of the document. Programs can count the number of times a given word appears in a document or in the entire data base and can print list of words, ordered alphabetically or by frequency of occurrence.

Truncation (removal of prefixes and suffixes from the stems of words) makes it possible to count all appearances of the same stem as one word type. For example, programs can combine the counts of the stem 'index' with the counts of indexes, indexer, indexing.

The term automatic indexing means the mechanized selection of index headings from a natural language text that has not been specially edited. If the index terms are selected manually, the computer can play a significant role in the production of book and journal indexes.

Procedure for Automatic Indexing

A number of investigators have developed procedures to aid the human indexer by automating the clerical tasks associated with producing an index once the subject headings have been selected. First, an indexer marks the text to identify the subject headings. The indexer then prepares a separate list of them. The entries need not be listed in the order of their appearance in the text, they may be scrambled, as long as their identifying numbers are correct. New entries may be added and old ones deleted. Cross references need to be indicated and worded correctly. Proper names have to be inverted and listed in full. These are then input into the computer. It is necessary to distinguish headings from modifications; to bracket words and phrases that would interfere with alphabetisation (such as introductory articles, conjunctions, prepositions and some pronouns). The list is processed by a computer program that alphabetises the entries, coordinates and arranges the component parts of the entries, eliminates redundancies, places cross references in the proper places and provides appropriate punctuation.

Indexing in BNB using PRECIS

Indexing is very important in an information retrieval system. British National Bibliography (BNB) has developed a computer-aided system to provide subject index data for UK/MARC records and to produce a subject index for the National Bibliography. The system is called PRECIS (Preserved Context Index System). The indexer examines a document, decides what it is about and records

a) a string of terms that paraphrases the subject

b) the accession number of the document

c) the PRECIS instruction codes and role operators to ensure that correct index

d) entries are generated

e) Reference Indicator Numbers (RINS) which instruct the computer to extract,

f) from a computer stored thesaurus, the *See* and *See also* references appropriate

g) to the terms in the string and

h) a subject indicator Number (SIN) which identifies the location at which the

i) indexing data will be stored for future use.

The implements the indexer's computer decision, generates the index entries and references, sorts these alphabetically and generates a magnetic tape that can be used for searching and phototypesetting.

The manual indexing of documents for input into computer based information storage and retrieval systems contributes greatly to the cost of such systems. Machine processing of text and production of word indexes is relatively inexpensive. Many bibliographic data bases can now be searched on-line, and retrieval services being offered by Lockheed, System Development Corporation etc., mentioned under the section "Databases and Literature searching" are using automatic indexing methods.

Indexing as a part of Word Processing

We often prepare multi page documents, say a manuscript for a book with several chapters, using popular Word Processing Software like MS-Word. In such cases, we can always find some utility to prepare Table of Contents, Indexes etc automatically.

In MS-Word, for example, you can prepare an Index for an entire book in a matter of minutes. One can mark words or phrases or paragraph headings as Indexable entries. Whether Index has to be presented in Indented style or Merged and whether presentation should be in single or multiple columns etc can be mentioned. Similarly Table of Contents can also be prepared. One important advantage of automatic Indexing here is that when a new section paragraph or chapter is added, only the index entries for updated pages need to be made.

8.2.3 Thesaurus Construction

A thesaurus is an organised list of terms from a specialised vocabulary arranged to facilitate the selection of synonyms and of words that are otherwise related. For reference retrieval systems, the thesaurus is used to bring the vocabulary of the searcher into coincidence with that of the index.

Thesaurus design is complex and may be approached from several directions. Most thesauri (plural of thesaurus) are special purpose in the sense that their terms are chosen from the vocabulary of a particular discipline or database. For each listed term some relations may be included to indicate other terms that have identical meaning and are called synonyms, terms that are narrower or broader in meaning, terms that are related in meaning, and so forth. Bracketed or footnoted scope notes may be included for further explanation and are often used to indicate homonyms, which are words that may be used with several different meanings. A thesaurus does not necessarily contain definition of terms. When used with a particular data base the purpose of a thesaurus is to acquaint the user with the relevant vocabulary and with any rules that have governed the choice of descriptor vocabulary within the data base.

Processing of data for compilation of thesauri is greatly facilitated by the use of computers since the programming involved for sorting, determining cross references is of a fairly simple nature. For discussion of the problems involved in production of thesauri, the student is expected to be familiar through the' unit cataloguing and indexing'. Hence the same is not discussed here. Only a few examples are given here from a *Thesaurus of Engineering and Scientific Terms* (TEST) issued by Engineers Joint Council.

Most of the bibliographic databases develop their own thesaurus and provide descriptors based on thesaurus in each record to enable access to the record through the descriptors.

EXAMPLES OF THESARUS DISPLAYS

Example 1	Example 2
Coaxial Cables 0901 UF Coaxial lines Liquid filled coaxial cables BT Transmission lines RT Power lines Submarine cables Telegraph cables Telephone cables Coaxial lines USE Coaxial cables	Cobalt Isotopes 1802 BT Isotopes Nucleides NT Cobalt 60 RT Cobalt
	UF – Used For BT – Broader Term NT – Narrower Term RT – Related Term and USE - Preferred term

8.3 CAS, SDI, TRANSLATION AND REFRENCE SERVICE

Computers are extensively used for information services like Current Awareness Service (CAS), Selective Dissemination of Information (SDI), Reference Service and for providing Translation Services.

8.3.1 Current Awareness Service (CAS)

Current Awareness Service consists of alerting the reader about important and interesting documents, news, non book materials etc on current topics of interest at periodic intervals. This can be done manually or using computes. In this section we will see some aspects of computer generated Current Awareness Services.

Most libraries keep their customers informed of latest acquisitions through Current Awareness Bulletins. This could vary from simple Monthly List of Additions to sophisticated Documentation Lists. Manual preparation of lists involves time consuming and are error prone. In the case of automated libraries, Library Acquisitions Module generally provides for the preparation and distribution of "List of Additions". Here one can specify the range of Accession Numbers or the period to be covered and what fields are to be included etc. A tailor made Additions List can be printed out at periodic intervals and many systems even permit direct dispatch of the List via email to patrons concerned.

The circulation module of Library Software Packages normally allows one to prepare a list of new arrivals of specific journals and newsletters in a library. This could be done on a daily basis of on weekly basis ad the Lists circulated or displayed. Computer generated Lists are accurate, timely and are amenable for corrections, dispatch via email etc. Many journal producers make available on their web sites Table of Contents or Contents Pages of their journals. The Contents Pages are sent by email to interested individuals. One such example is the Contents Direct Service from Elsevier Publishing Company. Libraries could subscribe to these services and make copies available locally to all users.

Institute of Information Science, Philadelphia, USA brings out several well known journals under the series, *Current Contents*. These are available on subscription in floppies as well. Libraries could provide current awareness service through Current Content Floppy based search also. For example, you could search for only those journal titles that are subscribed by the library or only those that are in English Language.

8.3.2 Selective Dissemination of Information (SDI)

Selective Dissemination of Information, or SDI for short, is one of the important Information Services. Automation of this activity either partially or fully leads to a number of benefits. SDI consists of several steps: User's profiles describe and define the users literature requirements in detail. This could be in the form of keywords, Boolean search expressions, specification of language, geographic or format limitations etc. A database of Currently available or procurable documents is also made available. This database has special fields for keywords, descriptors, thesaurus terms, language etc. Through a search mechanism, for each user, documents matching his specific needs, as per user profile description, are retrieved and listed out. The list is then distributed via ordinary mail or email. Users generally provide feedback on the usefulness of the service. Corrections to be made in the user profile are received and the profiles are updated accordingly. The process of refining the user profile with the help of feedback continues till a perfect SDI Profile is made for each user.

Some Issues Concerning SDI Automation

Most standard Library Integrated software solutions (as compared with individual modules for Circulation, acquisition etc) provide SDI service. Libsys, a well-known Library package offers SDI as a routine service. The Librarian can define the users interests in the SDI profiles in terms or keywords to be matched. The periodicity of running SDI, the bibliographic data set that must be searched (Books, journal articles, patents etc)

Time Language and geographic limitations are all specified here. If a scheduler is linked to the software module the SDI task is run at specified intervals automatically ad results are dispatched or printed out. Feedback from the users is usually obtained via paper messages and updating of user profiles is also carried out manually on routine basis.

Advantages and Disadvantages:

Advantages of Computer generated SDI services are: Uninterrupted timely service; automatic matching of user needs, routinisation of clerical work, locating items scattered in different journals.

Another distinct advantage is in terms of Matching. Matching of document profile with User Profile, with the help of a computer can be achieved in many ways. If a user's profile say, contains, ten keywords, you can specify that if at least three out of ten keywords match then a hit occurs. You may say that all the ten key words must match with keywords of the document profile. Or you might prefer to provide a full-fledged Boolean expression combining keywords with operators like AND NOT OR etc. Sophisticated searching techniques using artificial Intelligence techniques, probabilistic searches, concept based

searching, searching based on statistical methods etc are all possible. Computer matching, especially sophisticated methods, are feasible and practical. Manually this is not possible.

However, there are certain disadvantages too. Matching being keyword oriented, possibility of 'noise' in output cannot be ruled out. Search logic may add to too few or too many items to be retrieved. If the user fed back is not taken care of quickly, user is likely to be frustrated in getting useless output.

Alternate ways of Providing SDI Service:

A library can think in terms of providing SDI service either doing it in house or buying such services from external agencies. For instance, National Centre for Science Information, Bangalore offers SDI service for Research Scholars in Science and Technology. Many bibliographic databases are available in CDOM format. They are updated at frequent intervals of a month or three months. The CD database search software usually provides for standard queries (well defined user profiles) to be stored and run periodically against the updated part of the database. This service is nothing but SDI. WINSPIRS is one such CDROM database searching software providing SDI facility.

Differences between SDI and Information Retrieval

In the case of Information retrieval a large database of past data is searched for a specific user's requirements or a query. His requirements could vary from time to time. Therefore different questions are posed at different times. In SDI, currency of information is important. Therefore only a small set of updated current records are searched. User's information needs are more or less static for a certain length of time say for a year or till a project is completed. In both the cases of SDI and IR, the searching process is similar.

8.3.3 Translation Service

A library may have documents in more than one language. Often it is necessary to translate research papers, patents, standards, etc from English into another language and vice-versa. Translators need to be very proficient in both the languages (source and the target) and also possess adequate subject knowledge of the document in question. Human translations are therefore very time consuming, difficult and costly. Computers can play an important role in this area also.

Language Fonts: Pre-requisite for Translation

Before thinking of using computes for translation, it is necessary to have the facility on the computer system to display, edit and use foreign language characters in different fonts. Word processors for Indian and Foreign languages are available. MS-WORD, a popular Word processing software from Microsoft, has a facility to configure the software to handle different language character sets. It follows a Coding system called UNICODE which permits defining a large number of different language fonts. Web based Internet portal Rediff allows you to compose send and receive electronic mail messages in different Indian Languages including Hindi, Tamil, Telugu, Kannada, Malayalam, Oriya, Punjabi, Marathi, Assamese, Bengali and of course English.

Center for Development of Advanced Technology (C-DAC) has developed GIST (Graphics and Intelligence based Script Technology) and as a result most of Indian languages are available through their hard ware and software based solutions. ILEAP is an Internet based Indian Language Word Processor for Windows.

Computer Aided Translation and Automatic Translation

Computers can be of great help in language translation. Computer Aided Translation, automatic machine translations are talked about in this connection. In the first case computer simplifies the task of the translator by providing on line dictionaries to give instant help. For

example, the are pocket sized calculator type of Translators intended for travelers. Such devices help translate most commonly used words and phrases needed by a traveler in a foreign country. It serves as an Instant Dictionary giving equivalents I many languages.

Ready Made Translation Solutions

Certain systems provide rough and quick translation of words ad phrases. This cuts down the translator's task considerably. There are sites on the Internet like www.altavista.com that help you get translations of text from and into several European languages including English, French, German, Spanish, Italian and Portuguese. However the amounts of text you can get translate is limited. Another web site on the net where high quality, small quantity, free translation service is available is: www.reverso.net.

There are a number of commercially available sturdy translation software. iTRANS is one such software. Complete text-to-text automatic machine translations have also been tried out without human intervention. But their success is dubious. Librarians need to bother about sources for translations, Language dictionaries on the Web or on CDs, Directories of Translators etc. Computers are of great help in these areas too.

8.3.4 Reference Service

Traditional reference service provided by librarians to their clientele requires face-to-face contact, conversations and discussions, understanding the query, searching the library holdings and finally giving what the user wants. Thus it is highly human oriented and can not be replaced by computers.

The reference librarian has to rely upon reference sources and most of these reference book are nowadays available in soft copy in computers. His task becomes much simpler at the searching stage, especially for short range queries. Moreover, as an intermediary training in the art of searching, the librarian does a better job than the reader himself.

One of the important resource types on the Net is FAQ. FAQ stands for Frequently Asked Questions. An FAQ contains a large number of frequently asked questions and answers too on selected topics. The arrangement of questions follows some useful order. A collection of FAQs and compilation of FAQs resulting from active reference service will be very useful in this task. Organization of large FAQs in themselves pose a lot of problems and a librarian is equipped to handle such jobs. FAQs help in shortening the time needed in Long Range Reference service.

8.4 DATABASES AND LITERATURE SEARCHING

Databases are created for storing large quantity of data. The information searching and retrieval is done using the databases as per the user needs.

8.4.1 Databases

A Bibliographic Database is an organized collection of a large number of files. Each file contains a number of records. A record may contain a number for fields, each field representing a small bit of information, say, author, title, publisher etc. There exists a logical relationship among various records and different files. Data that had been stored in numerous, totally independent files are combined into one file system that is called a *database*. Databases are created for information retrieval purposes. Vast data that is generated is stored in a database for its eventual retrieval. On line searching and information retrieval is based on a database. These databases are the result of mutual efforts of like minded information collecting agencies.

Databases are grouped into two types. Bibliographic citation retrieval systems and cooperative cataloguing systems. Bibliographic Citation retrieval databases are the ones

offered on commercial basis like Lockheed Missile Corporation, System Development Corporation and Bibliographic Retrieval Service (BRS). All of these systems provide access to large subject files, commonly termed as databases. The other group of databases are those represented by cooperative cataloguing systems. These include Open Access Catalogue System (OPACS). OPAC is discussed fully in a separate Unit.

Databases are created for various bibliographic records so that the data can be stored and retrieved against specific request. For example library's card catalogue can be a database of library holdings. An automated library system helps in creating a number of in-house databases for the library holdings. There can be independent databases for different types of documents like Books, Serials, Reports etc., or there can be an integrated database which contains complete holdings of a particular library. These databases can be queried by the users for various answers. List of books on a particular subject, List of books by a particular author, and various other questions are answered.

Database Producers and Vendors

In case of bibliographic databases, information is stored in abstract form, abstracted from books, newspapers, professional journals. Hundreds of these databases are maintained by its producers. Many producers choose to sell the distribution rights to an online information retrieval organisation. This service organisation typically stores the databases in its main frame computer systems. It then allows subscribers to use off-the-shelf communications packages to dial phone numbers, enter passwords (identification numbers) and access the stored information. Producers are paid royalties when subscribers access their data. Information from over 9000 public databases is now stored and maintained in over 600 information retrieval systems in the United States. Some of the largest distributors of bibliographic data are Dialog Information Services, SDC Information services and Bibliographic Retrieval service mentioned above. EBSCO, PROQUEST, NISC have become popular in recent times.

On-Disc Databases

In addition to the on line access to the databases, the distributors provide on disc databases. The databases are brought out on an optical disc called CD-ROM (Compact Disc Read Only Memory) and are distributed on subscription basis. The only difference between the on line access and on disc are:

1. For the CD no communication links are needed
2. There is no limit for the number of literature searches conducted
3. There is no extra cost for the searches other than the annual subscription cost.

In all these databases the information is available in abstract form from the original text with bibliographic citation to enable the user to refer to the full text if required.

A computer accessible library data base contain files of user names, books outstanding, books on order, conventional card catalogue of complete library holdings. The result is an integrated library database and is operational in an integrated library automation system.

8.4.2 Literature Searching

The user of an information retrieval service wishes to obtain a list of documents that relate to a particular interest. As mentioned earlier, the user selects a database for literature searching and information retrieval relevant to his interest. The user's interest may not be well defined and an inexperienced user may have difficulty in formulating a question that is sufficiently well expressed for use in a computer search of a data base.

The first step in retrieval process is therefore the formulation of a question that is both simple enough for initiation of a computer search and yet sufficiently comprehensive to describe adequately the interest of the user. Following this, it may be advisable to consult a thesaurus in order to expand the question by inclusion of some related terms.

Once the terms are selected from the thesaurus a search strategy on their relationship is arranged. This is required for making any modifications of combining or disjoining the terms based on number of references output. The next step is to select the relevant database and to know the command language to search quickly and properly to get the optimum output. Before conducting a literature search, we should know the provisions available in a database for combining descriptors, eliminating some descriptors, truncating the terms. If a descriptor is not exactly known to the users all the words without suffixes can be used to retrieve complete data with regard to that word.

Most of the databases offer Boolean search provision. In this three operators AND, OR, NOT, called Boolean operators are employed to combine descriptors. In a truncated term the stem of the word is employed to search the literature.

Example :

Topic: *Corrosion of steam turbine blades*

The user is interested in the literature pertaining to the above topic. It is understood that in a manual search it is rather difficult to get all aspects of the above topic in one source or in one place or in one search. Instead a computer based literature search will retrieve information in a few minutes, say 20 minutes for 20 years literature, from all the sources in the world irrespective of the type of document.

? Corrosion

S1 437 Corrosion

? Turb ?

Turbines 527

Turbomachinery 1372

S2 1899 Turb ?

? Steam

S3 17352 Steam

?S2 AND S3

S2 1899

S3 17352

S4 367

? Blades

S5 15962 Blades

? S4 AND S5

S4 367

S5 15962

S6 167

? C S1 AND S6

S1 437

S6 167

S7 35

? T S7

Print S7/ 1-35 items.

In this example a typical search conducted on COMPENDEX (Computerised Engineering Index) database is shown with the strategy and retrieval.

Here ? command is for search followed by the word from the search expression prepared earlier.

S1 is the set number and 437 is the number of items available in that particular database on corrosion. Turb? is the truncated expression for all the items starting with turb.

S1, S2, S3.....are all set numbers. S2 AND S3 denotes combination of S2 (Turbo?) and S3 (Steam) to get Steam Turbines by Boolean operator AND.C denotes combine and T denotes type or display of set S7.

In set S7, 35 items are retrieved.

When this set is asked to be displayed, it goes on displaying each record with full bibliographical citation and an abstract. Copying to another disk or on to a paper is possible.

With the popularity of online databases and developments in literature search methods, modern researchers are greatly benefited. They are now capable of completing their research projects much earlier than their counter parts in mid seventies.

8.5 LET US SUM UP

In this Unit you have learnt the scope of the term Library Automation and its restricted meaning. Emphasis in this unit has been Information Service related tasks. Some services described in detail were : Classification, Indexing, Thesaurus Construction, CAS, SDI, Reference Service, database searching . How Internet related resources in this area of Library operation are becoming increasingly important has also been highlighted.

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8.7 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1. Describe how computers can be helpful in Library classification, Indexing and Thesaurus Construction?
2. Discuss the role of Computers in Information Services especially SDI and CAS.
3. Briefly describe all important activities in the area of Information Services. Discuss the use of computers in any two of them.

II. SHORT NOTES

1. CAS and use of computers
2. SDI
3. Translation Services
4. Types of Databases
5. Thesaurus development using Computers

BLOCK - III : DATABASES AND NETWORKS

With the knowledge gained in Block II, a librarian can automate most of the important tasks in a library: acquisitions, circulation, cataloguing, and serials control. He can also appreciate the use of computers in various types of Information Service activities. This Block moves over to use of larger resources like databases and sharing of resources via networking of computers.

Unit 9 provides an Introduction to Databases. Information on computer based databases – designing and developing them- are given. Database concepts, types, database components etc are covered. An overview of databases is expected to help students appreciate the value of bibliographic, online and CD-ROM databases and hence these aspects are covered.

In addition to books and periodicals, a library acquires or provides access to databases in online or CD-ROM format. Unit 10 discusses all about Online and CDROM databases: advantages and disadvantages of both and how to search such databases. One has to be familiar with the User Interfaces used in Search Software. Therefore they are also covered in this Unit.

Linking up of computers in a network increases the power and utility of computer systems. Unit 11 deals with Computer Networks and Networking. Basic concepts are explained, types of networks (LAN, WAN, MAN etc) are discussed; Role of telecommunication in linking computes is explained; Internet being the most important of network of networks, it is also discussed.

Unit 12 deals with Library and Information Networks. It shows how a network can be used for sharing of resources available in different libraries. Several examples of library networks like: INFLIBNE, DELET, BONET, CALIBET, MALIBET etc are given.

UNIT - 9 : INTRODUCTION TO DATABASES

Structure

9.0 Aims and Objectives

9.1 Introduction

9.2 Database - Definition, Structure and Components

- 9.2.1 Definition
- 9.2.2 Data Modeling
- 9.2.3 Data Abstraction
- 9.2.4 Components

9.3 Database Management Systems (DBMS)

- 9.3.1 Facilities
- 9.3.2 Structure
- 9.3.3 Data Models

9.4 Database : Design and Development

- 9.4.1 Defining the Problem
- 9.4.2 Analysis of the Existing Systems and Procedures
- 9.4.3 Preliminary Design
- 9.4.4 Hardware and Software selection
- 9.4.5 Final Design
- 9.4.6 Implementation and Testing
- 9.4.7 Operation and Fine Tuning

9.5 Data Security

9.6 Database System - Advantages & Disadvantages

- 9.6.1 Advantages
- 9.6.2 Disadvantages

9.7 Let us Sum Up

9.8 Recommended Books

9.9 Model Examination Questions

9.0 AIMS AND OBJECTIVES

The present unit aims to introduce you to the significant features of databases and their structure. It also focuses on the basic concepts, theoretical principles of database design and the salient features of database management systems.

After studying the unit, you should be in a position to

- explain the basic concepts, the theoretical principles of database design by
- providing suitable examples

- provide exposure to various features of database management systems
- discuss the advantages and disadvantages of DBMS
- explain the methodology for designing databases.

9.1 INTRODUCTION

Today's information conscious world demands accurate and reliable data for effective decision making. To meet this demand more efficiently, computers have been applied in organizing large quantities of data. Data can be organized in computers in various forms (e.g. tables, continuous text files, databases etc) to suit specific needs of users. Databases are one such form where data is organized centrally in the form of records. In a sense any organized collection of data can be considered a database. e.g. a telephone directory where entries are arranged alphabetically with the address and phone number details; a library catalogue maintained in author/title/subject sequences. But the term database is mostly used to represent centralized computer-based record keeping systems.

9.2 DATABASE - DEFINITION, STRUCTURE AND COMPONENTS

An understanding of the structure and the components of a database is very much essential for those involved in the design and development of databases.

9.2.1 Definition

A database can be defined as a "computer-based record keeping system whose overall purpose is to store information vital to the organization and to assist the higher management by providing this information when necessary" (C.J.Date).

A database system is an integrated collection of related files, along with details of interpretation of data contained therein. A Database Management System (DBMS) is a software system that allows access to data contained in a database in a convenient and effective manner. The DBMS provides a method of defining, storing, and retrieving information in the database. It exerts centralised control of the database, prevents fraudulent and unauthorized users from accessing the data and ensures the privacy of data.

9.2.2 Data Modeling For A Database

Database are designed to store information useful to a specific organisation (e.g. a library that desires to store information about its holdings, suppliers of books etc.; a personnel department keeps files of employees of the organization.

(1) Fields, Records and Files

Information useful to an organisation can be organized by examining the entities, i.e, objects which are of interest to the organisation. For instance, a library interested in information about books that it holds. Other entities of interest to a library are patents, serials, transactions, (issues, returns) pertaining to books, etc. In order to describe an entity, it is necessary to examine their properties or attributes of that entity which are also called fields or data elements. When all the data elements of a particular instance of an entity (e.g., a specific book) are described, we then say

that a record has been created. Several records (one for each instance) together constitute a file. We thus have a hierarchy of concepts, viz.,

FIELDS ⟶ RECORDS ⟶ FILE

However, in any given organisation there will be several entities of interest and thus there is need for several files to store information on different entities of interest. All such files together constitute a database. Further each of these entities may be related to one or more of the other entities of interest. The inter-relationship of the different entities and how they may be modeled (i.e. represented in a computer) is of interest from the point of data processing, storage and retrieval of information. If a database can be modeled (i.e. relationships between entities explicitly spelled out), computer programs (DBMS) can efficiently manage (store, process, and retrieve) the data to produce useful outputs on demand. We thus need to understand the fundamental concepts in data modeling.

(2) Entities and Attributes

The components used in data modeling are basically limited to objects i.e., entities of interest to the organization and the relationships among the objects. Entities are the basic units used in modeling classes of concrete (i.e, building, room, chair etc.,) or abstract (e.g. transaction in an organization, courses offered by an institute etc) objects. One of the first steps in data modeling is to identify and select the entity sets that will best organise useful information for the database application. In a library environment, the entities can be the various types of documents like monographs, theses, patents etc., the suppliers/ vendors, the various departments of the institute and users of the library.

(3) Attributes

Each category of objects/entities has certain characteristics or properties, called its attributes. Not all the attributes of an entity may be of importance to an organization (e.g. The author, title, and publisher details of a document may be useful in locating a document in a library while the color and quality of paper used for the document may be immaterial). So a certain amount of selectivity is required while describing the entities in terms of attributes An attribute is also referred to by the terms data item, data element, data field, item, elementary item or object property.

(4) Domains

Each attribute of an entity set has a particular value. The set of possible values that a given attribute can have is called its domain. (e.g. The publication date of all the entries in a bibliography compiled for a specific period i.e., 1990-95 should be between 1990-1995) Similarly, the salaries paid to employees may take a positive number between 0.00 to 9,999.00. Defining domains helps to validate data that is supposed to become part of the database. It is also possible for different attributes to share a single domain, where these values seem to be identical.

(5) Keys

The description of each entity through its attributes is called an instance/occurrence. To uniquely identify each occurrence in an entity set, a single attribute or combination of attributes is used as a key. In some cases, the keys assigned may be artificial numbers (e.g. employee numbers in an payroll unit, unique accession numbers assigned to each document in a library etc.) The keys used to uniquely identify an instance of an entity set are called primary keys. Secondary keys are made up of a single attribute/combination of attributes to help classify an entity set in to specific groups (e.g. department names in an organization; classification numbers used in libraries).

(6) Entities and Relationships

As already explained, relationship exist among entity sets. Relationships may be between entity sets or within an entity set. For example, in the entity set EMPLOYEES, an attribute. NAME-OF-SUPERVISOR denotes the relationship of the specific employee with another instance of the same entity set i.e. supervisor. In a library, usually two entity sets are maintained, one for corporate names and another for document descriptions. The two attributes of the document-corporate author and publisher relate the document to the second entity set corporate names. (*See* Figure 1)

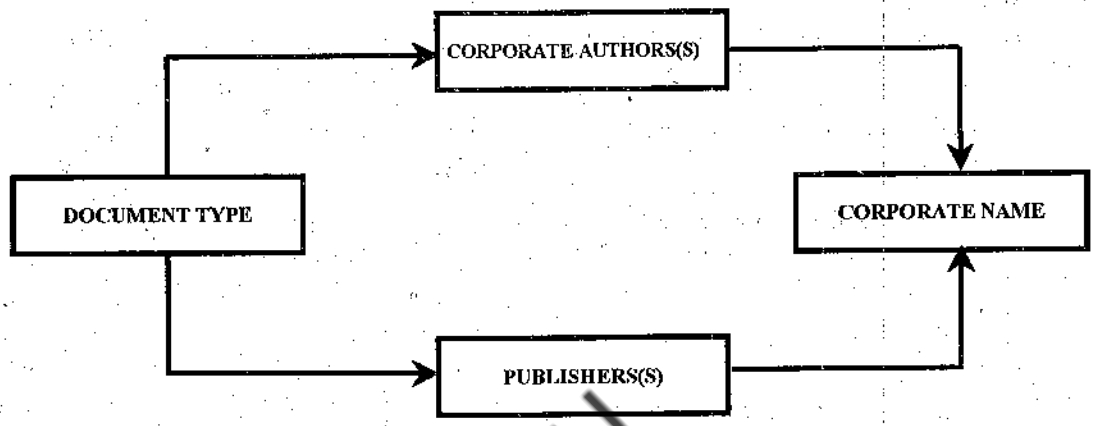

Figure 1 – Entities and Relationships

The relationships among entities can be categorized as one-to-one, one-to-many, and many-to-many.

e.g., Employee <—> Employee Number

Employee <<—> Department

Employee <<—>> Projects

In the first example, the employee number assigned to each employee is unique and there is a one-to-one relationship. One/more employees work for a department and the relation is one-to-many. In the third case, one or more employees may be working in a project and it is likely that an employee works on more than one project i.e. leading to a many-to-many relationship.

9.2.3 Data Abstraction

In a centralized database environment, data is to be shared by two or more users/ applications but in a non-database environment, the record viewed by the application program is identical to the record stored. But in a database environment, each application program may make use of a subset of the data stored in the database in the form of views. For example, an end-user in a library may wish to know the location details of a document i.e. the call number and accession numbers, while an acquisition librarian may need to know the cost and vendor details of the document. In a database environment, the data is organised in elements he is interested. Data abstraction is resorted to hide superfluous details of a set of objects, and allows one to concentrate on the properties that are of interest to the specific application by defining views at three levels.

(1) External Views

Each external/user view is described by means of a schema called the external schema. Any number of user external views may exist for a given global or conceptual view.

It is the highest level of database abstraction where only portion of the database of concern to a user/ application program are included. The view may simply be confined to a single entity, or selective portions of different entities may be considered while defining a view. For example, the acquisition librarians view of the database may include selective properties taken from document, vendor and budget entity sets.

(2) Conceptual or Global View

At this level all the database entities and the relationships among them are defined. One conceptual view represents the entire database. This conceptual view is defined by the conceptual schema. It contains the method of deriving objects ir the conceptual view from the objects in the internal view.

(3) Internal View

It is the lowest level of abstraction, closest to the physical storage method used in database. It describes the data structures and access methods to use used by the database and is expressed by the internal schema.

(4) Mapping between Views

Two mappings are required in database system with three different views. A mapping between the external and conceptual view gives the correspondence among the records and the relationships of the external and conceptual views. The user of the external view sees and manipulates a record corresponding to the external view.

Similarly, there is a mapping from a conceptual record to an internal record. The internal record may be split into two or more physical records but the complexity of addressing these multiple physical records is managed by the DBMS and the user need not be aware of the mechanisms used by it. Figure explains these concepts.

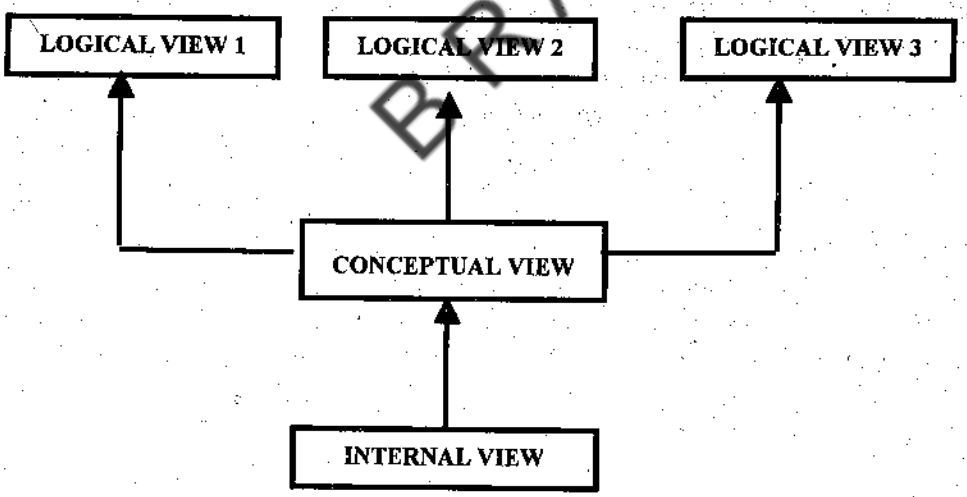

Fig.2 – Mapping of Views

9.2.4 Components of a Database

The three components of a database include 1) users, the 2) software and hardware and 3) the data stored. The hardware and software are basically selected on the basis of the quantity of information to be stored, the capabilities of the software in handling large quantities of data, response time etc.

The data to be stored in a database is selected based on the requirements of the organization which is to utilize it in decision making . The third component of a database is its users.

Users of a database can be classified into three groups - the end-users, application programmers and the database administrator. End-users are those for whom the database is designed, created and maintained. Usually, these users access the database through menu-driven systems and are provided with guidance at each step. Here comes the concept of user interfaces. A user interface can be defined as an interactive system through which the user can have access to information with minimum or no knowledge of the software used.

The second group includes professional programmers who are responsible for developing application programs or user interfaces to be used by the naive or end-user.

The person (or group of persons) who exerts a centralized control over the database is referred to as database administrator (DBA).

The DBA is fully conversant with the DBMS and is responsible for creating, modifying and maintaining the three levels of abstraction of the database. Changes to any of the three levels of abstraction necessitated by the growth in the organization or emerging technologies are controlled by the DBA. Mapping at the three levels i.e., between external and conceptual views, and between conceptual and internal views are also defined by the DBA. He ensures that appropriate measures are taken to maintain the integrity of the database. He is responsible for granting permission to the other two types of users with necessary privileges: for defining procedures to restore database from failures due to human, natural or hardware causes with minimal loss of data.

9.3 DATABASE MANAGEMENT SYSTEM (DBMS)

The three important aspects of study of a Database Management System are its facilities, structure and data models.

9.3.1 DBMS Facilities

There are two main types of facilities provided by a DBMS, which include DDL (Data Definition Language) and DML (Data Manipulation Language).

(1) Data Definition Language

It is used to define the conceptual schema and also gives some details on how to interpret this schema in the physical devices used to store the data. It includes all the entity sets and their associated attributes as well as the relationships among the entity sets. It also defines the domains used in a database. These definitions, described as metadata about the data stored in the database, are expressed in the DDL of the DBMS and maintained in complied form, known as the data dictionary or system catalogue. The data dictionary contains information on the data stored in database and is consulted by the DBMS before any data manipulation operation.

(2) Data Manipulation Language

Data manipulation involves retrieval of data from the database, insertion of new data and deletion or modification of existing data. The first of these data manipulation operations is called a query. The subset of DML used to query the database is known as the query language e.g SQL. The DML provides commands to select and retrieve data from the database. These commands can be used in an interactive manner or embedded in a conventional programming language such as assembler,COBOL or FORTRAN.

9.3.2 Structure of a DBMS

The major components of a DBMS system include DDL Complier, Data Manager, File Manager, Disk manager, Query processor, Data files and data dictionary

(1) Data Definition Language Compiler

The DDL compiler converts the data definition statements into a set of tables that contain metadata and are in turn used by other components of the DBMS

(2) Data Manager

The data manager is the central component of the DBMS. It converts the operations in the user queries coming directly in an interactive mode or via an application program from the user's logical view to a physical file system. It is responsible for interfacing with the physical file system. In addition, the tasks of maintaining data integrity and providing security measures are the responsibilities of data manager. It is also entrusted with backup and recovery operations.

(3) File Manager

Structure of the files are defined by the file manager and it is responsible for locating the block containing the record required and transmitting the required record to the data manager. It can be defined as an interface between the data manager and the operating system.

(4) Disk Manager

It is part of the operating system of the host computer and all physical input and output operations are performed by it. It transfers the block or page required by the file manager so that the latter may not be concerned with the physical characteristics of the underlying storage mechanisms.

(5) Query Processor

The query processor is used to implement user's query and convert it into an effective series of operations in a form acceptable to data manager for execution. It uses the data dictionary to find the structure of the relevant portion of the database and uses this information in interpreting the query and prepares an optimal plan to access the database.

(6) Data Files

The data portion of the database along with associated index forms part of this component.

(7) Data Dictionary

It stores information concerning external, conceptual and internal levels of the database. The metadata stored in a complied form in the data dictionary is used by other components of the DBMS.

(8) Telecommunication System

Even though a telecommunication system is not part of a DBMS, it works in close association with the DBMS particularly when distant on-line users wish to make use of the database.

9.3.3 Data Models

Three important data models considered include relation model, hierarchical model and network model.

(1) Relational Data Model

The relation that exists between entities is the only construct required to represent the association among different entities. This model has the advantage of being simple in principle. One of the main reasons for introducing this model was to increase the productivity of the application programmer by eliminating the need to change application programs when a change is made to the database. Users need not know the exact physical structure to use the database and are protected from any changes made to these structures. Each entity is described in the form of a table, where each row represents an instance of the entity type/record and are referred to as tuples. Columns in the tables represent fields/ attributes. When different entity sets are included, relations among these entities are defined and the unique keys identifying these relations are fixed , as may be seen from Figure 3:

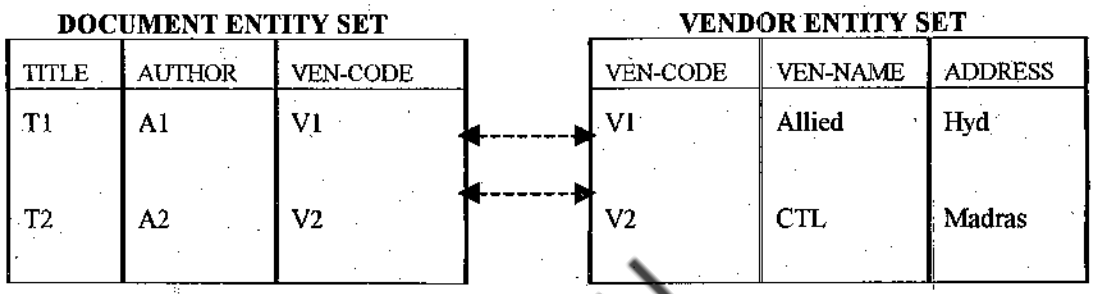

Figure 3 Relational data Model

In the above example there are two entity sets- documents and vendors, each representing a different type of entity in the form of a table. The relationship that exists between these two tables is the common vendor-code. The DBMS provides integrity checks so that a non-existing vendor code could not be added to the document table and no vendor record is deleted while there is at least one document record using the same vendor code.

(2) Network Data Model

The model uses two different data structures to represent the database entities and relationships among the entities namely record type and set type. A record type is used to represent an entity type, while a set type is used to represent a directed relationship between two record types, the so-called owner-record-type and the member-record-type. The set type specifies that there is a one-to-many relationship (1:M) between the owner and the member record types. For example, the vendor record can be defined as a set type/owner record and the records of documents supplied by the specific vendor can be considered as member-records. See Figure-4 for an example of one to many relationship.

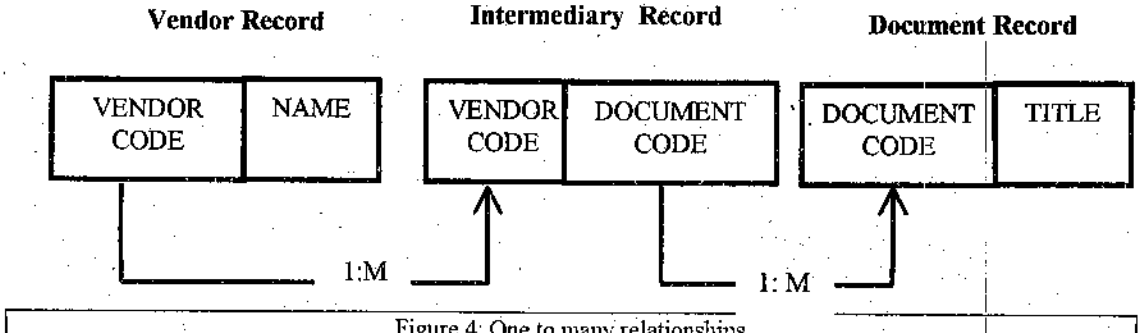

Figure 4: One to many relationships

Each of the many-to-many relationship between record types is handled by introducing a new record type to represent the relationship in a one-to-many form. In the network model the relationships as well as the navigation through the database are predefined at the database creation time.

(3) Hierarchical Data Model

In this model, the data is organized in a hierarchical or ordered tree structure. Each node of the tree represents a record type/entity. Like an organizational chart or a family tree, at the root of the tree is a single parent also known as root node. A parent/root node can have none, hierarchical tree type consists of one occurrence of the root child record types. or example, record type describing a conference proceedings at a monographic level can be considered a root/parent node, while records made for each individual paper can be considered as child nodes. A hierarchical data model can represent a one-to-many relationship between entities where the two are respectively parent and child nodes.

In this example the child records made for each of the papers need the parent record i.e. the record of the conference proceedings for proper identification. Integrity checks are embedded in the DBMS so that a child record is never added to a non-existing parent record and no parent record is deleted when there are depending child records.

9.4 DATABASE: DESIGN AND DEVELOPMENT

A database approach to meet the information requirements of an organization is recommended when quantity of data to be handled is large and the data changes frequently, where there is a need for interactive queries. A good example is a banking system where the employees have to deal with thousands of transactions all critical to the very existence of the organization. The steps involved in designing a database are described below.

9.4.1 Defining the Problem

The first step in the design cycle is the rough outline and scope of the project. Estimates of costs, including initial set up and operational costs, and the risks versus benefits are examined. The initial costs include acquiring the suitable software and hardware, converting from a manual or file-based system and training the personnel. Time scales for various stages of the development cycle are estimated. Once the decision is made to proceed with a database solution, the design of the database begins.

9.4.2 Analysis of Existing Systems and Procedures

The second phase in designing the database is a thorough study of the existing system and procedures through surveys of users. The user surveys could be in the form of questionnaires or personal interviews. A detailed study of the system may reveal inefficiencies, duplications and desired changes in procedures, as well as the possible effect of the proposed database system on the existing system and procedures. Data flow diagrams may be used to graphically depict the data needs of the processes and how processes are interconnected.

Information requirements which include the entities, their selective attributes and relationships among them are identified. Processing requirements define the data-manipulation capabilities of the system and must be semantically correct and constant, so that the processing does not violate any constraints imposed by the information requirements. The information and processing requirements form the entries in the data dictionary. To maintain system integrity, an entry for each data item defines it, provides any synonyms and gives characteristics of the data item and its domain.

9.4.3 Preliminary Design

Based on the information requirements, a preliminary design is derived and is evaluated against the initial requirements. The users are consulted and required changes are implemented. This cycle of steps consisting of the definition of the problem, procedure analysis and preliminary design is repeated until a satisfactory design is obtained. The design of the conceptual schema which comprises all entities, attributes and relationships for a database is initially DBMS independent and allows better understanding of the information requirements of the user community. In defining the conceptual schema, two approaches are generally followed.

i) Top-Down Approach

In this approach entities of interest, their attributes and their relationships for the database application are identified. Additional attributes where necessary may be added and the identified entities may be split into a number of specialized entities and the relationship among these specialized entities are defined. For example, in a library database a directory of organizations is kept. The major entity is the organization with address and other details as its attributes. This entity can be classified under specific groups like vendors, publishers, corporate authors based on the additional relationships.

ii) Bottom-Up Approach

In this approach the necessary attributes required to meet the information needs of the organisation are first identified and these attributes are grouped into entities and relationships among them. An attempt is also made to find higher level entities and locate relationships at higher level. In this case, we start with addresses of the organizations i.e. attributes. Based on the role by these organizations, these are grouped as vendors, corporate authors and publishers. As the basic data elements required to describe these group of entities are so similar, these can be grouped under a higher level entity i.e. directory of organizations.

Once the conceptual schema is defined, necessary logical views for each group of users are identified and defined

9.4.4 Hardware and Software Selection

The proposed database can be implemented on an existing system or an upgradation of hardware may be made where necessary. Consideration should be given to the processing speed, storage capacity, availability of software on a particular type of machine etc. Software selection usually depends on the requirements of the database and the features provided by the software like report generation facilities, utilities such as menu or form-based user interfaces, communication facilities, multi-user capabilities, etc. The expertise of the personnel involved in the database development and maintenance and their performance, the availability of services from the vendor of the software also play an important role in software selection.

9.4.5 Final Design

The preliminary design should usually be DBMS -independent using entity-relationship or other model. Once the DBMS is selected, the conceptual schema is translated into DBMS-specific conceptual schema, and the external views of each application are derived from it. The schema coded as statements in DDL is complied and stored in the data dictionary for further use by the other components of the database.

9.4.6 Implementation and Testing

In this phase, the physical database is created and loaded with test data. Application programs and transactions are written using appropriate high level language with embedded DML statements or query language. The system is put through a number of tests to verify its functioning. Procedures to be followed for regular operations and steps to be taken in the event of crisis or failures are well documented. Once the system is installed, it is usually given a dry run, which consists of using the new system along with the existing system and the operation of the system is monitored. Once the system is found to be functioning satisfactorily, it is kept for use in day-to-day operations.

9.4.7 Operation and Fine Tuning

In the final phase of the database design cycle, the performance of the system is compared to the existing system. If the performance is not satisfactory, fine tuning is called for. Fine tuning operations may include defining additional indexes, identifying response-critical operations and giving priority to them, increasing the number of buffers etc.

9.5 DATA SECURITY

Providing security measures to a database system comes under the purview of the Database Administration (DBA).

(1) User Identification

Different users are accorded different rights to different databases or different portions of the database. These rights include the reading of portions of the database, and the insertion, deletion, and modification of data. The most common way of identifying users is registering them for one or more databases through passwords known only to the system and the individual.

(2) Views as Protection Mechanisms

Each registered user is allowed to access the database through his/her password. Even then he may be allowed to access only the portions of the database i.e. his operations will be limited to the external view only. The over all conceptual view and internal view are made totally transparent to him. For example, an end-user of a public access catalogue is allowed only to access a subset of the library database which provides him with details of the holdings. The other details pertaining to acquisitions, circulation etc. are not accessible to him even though they form part of the same database.

(3) Security through Account Types

In some packages, each user registered is provided with a security code. The use of specific code either allows the user to insert, delete or modify data in the database or simply rejects his requests to the DBMS. These codes are usually assigned by the DBA based on the requirements of the users. For example, a cataloger can have access to acquisition data, but he is not allowed to make any modifications to the data.

(4) Security through Codes assigned to Records/Fields

The DBA may include security codes at record/field level, in the form of simple numbers like 0, 1, 2, etc. Each user of the database is assigned a code in a similar way and the user can have access to those portions of the database where the security codes are equal or less than the security code assigned to him. For example in an employee record, the attributes - personal history, family details are provided with a security code higher than the security code provided to the supervisor.

9.6 DATABASE SYSTEMS : ADVANTAGES AND DISADVANTAGES

Database systems provide various advantages as well as certain limitations or limitations, which will be discussed in this Section.

9.6.1 Advantages of Database Systems

Among the various advantages of database systems, data independence, sharing, integrity, security, reduction of redundancies, conflict resolution, etc are the major advantages.

(1) Data Independence

The organization can exert centralized management and control on the data through DBA. Applications requiring a change in the structure of a data record, can get the modification implemented through the DBA without effecting other application or the users of the record in question.

Data independence is usually considered from two points of view: physical data independence and logical data independence. Physical data independence indicates that the physical storage structures or devices used for storing the data could be changed without necessitating a change in the conceptual view or any of the external views. Logical data independence implies that application programs need not be changed if fields are added to the existing record, nor do they have to be changed if fields not used by the application programs are deleted.

(2) Reduction of Redundancies

Centralized control avoids unnecessary duplication of data; effectively reduces the total amount of data storage required; eliminates the extra processing necessary to trace the required data in a large mass of data; eliminates inconsistencies that tend to be present in redundant data files.

(3) Data Sharing

A well maintained database allows the sharing of data under its control by any number of application programs or users (e.g. A catalogue record of a document held in the library can be used by acquisition librarian to check for duplicates before ordering; by the reference librarian to answer a query; by the circulation department while charging.

(4) Data Integrity

Centralized control ensures that adequate checks are incorporated in the DBMS to provide data integrity i.e. the data contained in the database is both accurate and consistent. Data validation procedures can be introduced at the entry where necessary to maintain integrity (e.g. validation of ISBN, ISSN numbers, checking for specific details like conference name, place and date while the document deals with a conference proceedings etc.

(5) Data Security

In some organizations, confidential or sensitive data is maintained. In a centralized control system, the DBA incorporate security measures so that the confidential data is not accessed by unauthorized persons. Some details have been discussed in section 9.5 earlier.

(6) Conflict Resolution

The DBA chooses the best file structures and access methods to get optimal performance for the response-time critical applications, while permitting less critical applications to continue to use the database, although with a slower response.

9.6.2 Disadvantages of Database Systems

The major limitations of the database systems include cost, slow response rate and complexity in backup and recovery.

(1) Cost

A significant disadvantage of the database system is cost. In addition to the cost of purchasing or developing the software, the hardware may have to be upgraded. Cost of migrating from traditionally separate application environment to an integrated one may sometimes be exorbitant.

(2) Slow Response

The processing overheads introduced by the DBMS to implement security, integrity and sharing of data causes a degradation of the response and through - put times.

(3) Complex Backup/ Recovery

While centralized database systems reduce duplication, there is need for regular backups so that in case of failure the data can be recovered. Backup and recovery operations are fairly complex in a DBMS environment and this is exacerbated in a concurrent multi-user system.

9.7 LET US SUM UP

The unit explains the basic concepts related to database design, how to identify the data elements and the conceptual relationships that exist between the data elements. Describes the various components and features of database management systems. Introduces how the conceptual relationships could be expressed as models while discussing the principles of hierarchic, relational and network models. Further it describes the methodology for designing and implementing a database management system and the advantages and disadvantages of database management systems.

9.8 RECOMMENDED BOOKS

DATE, C.J. *An introduction to database systems*. Reading (Massachusetts, USA): Addison-Wesley, 1985. 2v.

DESAI, Bipin.C: *An introduction to database systems*. New Delhi. Galgotia. 1996.

ELMASRI, Ramez and Shamkant. B. Navathe. *Fundamentals of database systems*. 3rd ed., Delhi: Addison – Wesley, 2000.

HASEN, Gary W. and James V. Hansen. *Database management and design*. New Delhi : Prentice – Hall of India, 1999.

MARTIN, James. *Computer data-base organization*. 2nd ed. New Delhi: Prentice-Hall India, 1984.

ULLMAN, Jeffery D. *Principles of database systems*. Potomac (Maryland, USA): Computer Science Press, 1980.

9.9 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) Write an essay on basic concepts of a database. (Include in your answer: data modeling data abstraction, components and structure of a database).

2) Discuss various steps involved in designing and developing a database.

II. SHORT NOTES

a) Data Security

b) Different Types of Data Models

c) Advantage/Disadvantage of Database Approach.

d) Data Integrity

UNIT - 10 : BIBLIO GRAPHIC DATABASES AND SEARCH TECHNIQUES

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10.0 AIMS AND OBJECTIVES

This unit aims to provide an overview of the availability and accessibility of global computerised information products and services, especially bibliographic databases, and also provide a basic understanding of how these products could be searched and required information retrieved.

After studying this unit, you should be able to

- Explain features of commercial online databases
- Tell how bibliographic databases are searched
- Appreciate the value of CD-ROM databases
- Compare and contrast Online and CD-ROM databases
- Discuss user interfaces provided in such systems.
- Explore on your own some India Database Products Listed

10.1 INTRODUCTION

In the 1970s the producers of secondary information sources like indexing and abstracting services initially made use of computers for producing indexes. At the same time the conversion of high volume information sources into bibliographic databases by information producers led to a new group of information providers who are called the vendors or hosts. The vendors made these databases available on their large computers and also developed search software for accessing them.

10.2 ONLINE SYSTEMS

The marriage of computers and communication technologies led to the emergence of a new type of online bibliographic retrieval systems. The development of packet switching technology (See Unit 11 for a short description of Packet Switching) for transmission of data over leased telephone lines at relatively high speeds with high reliability and at reasonable costs paved the way for computer- communication networks. The communication networks facilitate access to several computer resources on the network. The host or the vendor's computers on which the database is made available is accessible through these networks. The access to these networks from a particular country is possible via the local node in that country which provides access to these networks through a international gateway service. After the popularization of Internet, connectivity has become a child's play.

10.2.1 Online Vendors

The vendors of these databases also provided the search software with easy command language to enable online searching of the databases. The services are termed 'Online', because the databases are accessed and searched interactively from remote locations and the search results are obtained immediately at the location from where the search is being carried out. The demand and use of the online services encouraged the

various groups of information producers dealing with business information and numeric data to make the bibliographic databases and databanks available with the vendor of online service.

10.2.2 End-Users as Targets

The vendors too realising the great potential of such services made special efforts to target them to end-users. The efforts included providing databases and databanks on diversified topics, ensuring update of in phenomenally quick time, making use of state of the art technology needed for quick processing and most importantly, making the command language simple to use but at the same time offering many advanced facilities for formulating complex searches necessary for representing multidimensional information requirements. Their efforts highlighted the versatility of the computer as a tool in creating bibliographic retrieval systems and were like a model for designers of in-house information retrieval systems in the libraries and information centres.

10.2.3 Popular Vendors

The most popular online service has been DIALOG (earlier provided by Lockheed Corporate and presently taken over by Knight & Ridder). Other most popular vendors of Online services are ESA-IRS Services (European Space Agency), whose computer is located at Frascati (Rome), National Library of Medicine (Washington), EBSCO, USA, Bibliographic Retrieval Services (BRS) acquired by CD-Plus technologies . Some of the other major providers of commercial database services are: BLAISE (U.K.), SDC, CAS-ONLINE, DIMDI (Germany). There are several other vendors who are involved in providing online services.

Online Industry in India is still in its infancy. Hardly a handful of database producers, especially in commerce/trade sectors have come up. Table 1 gives information about some Indian vendors and their databases.

Table 1: Some Indian Databases : Both Online and CD based

SNo	Database Producer	Product	Description
	NIC, Delhi	JUDIS	Legal Database of Acts and Rules of Center and States
	Spectrum, Mumbai	JURIX	Legal database of SC cases. CD; updates to CD online
	Informatics, Bangalore	IBID India Business Intelligence Database	Abstracts of News Items from 90 Indian periodicals. CD & Online
	Vans Communication, Mumbai	VSL Database	Records of Books and articles from ET, FE and economic journals
	Vans Communication, Mumbai	Vanscomm	Summary of Environmental Info. Business journal Index
	CMIE, Mumbai	India Trades	Export Import Data from GOI
	CMIE, Mumbai	Prowess	Financial Information, very exhaustive and reliable, on 8000 plus Indian limited Companies.

10.2.4 Types of Databases

As far as the subject coverage is concerned the databases offered were initially in the area of Science & Technology, primarily, machine readable versions of indexing and abstracting services. As the demand grew, the databases relevant for Humanities, Business, Trade were also available. Presently, databases are available on every major subject and discipline.

The types of databases are: abstracting and index databases, full-text databases, full image databases and integrated reference packages and numeric or statistical databases. While Abstracting and Indexing databases contain mostly summaries only, full text databases give complete text of original along with tables, graphics etc. That is there is no need to subscribe for the print version in the case or full text databases. Numeric databases give out factual data. For example PROWESS of Center for Monitoring Indian Economy, Mumbai is a statistical / Numerical database as it offers varied types of financial, production and market data of thousands of companies in India.

The databases also differ in treatment and coverage. The databases range and diversity is aimed at meeting the demands of all disciplines and industry. The types of databases are relevant for trade and industry are: business information, company information, industry analysis, newspapers - full-text, all reference texts, government information.

The most important aspects about these database are:

- comprehensive (ten year, fifteen year cumulation)
- current (update monthly, weekly and some even daily); Some are continuously update such as commodity prices or foreign exchange rates or global news.
- highly interactive, and can provide specific as well as comprehensive information in response to need based queries.

10.2.5 Access Methodology

To access these resources, diversity of the choice of the host or vendor could be based on the choice of databases the vendor is offering. The ease of use of the command language is another important factor. The existence of any local distributor of services who can guide in providing link to the vendor should be explored.

The equipment needed is a computer with a hard disk, a telephone line and a modem which converts the analog signals into the digital signals.

A connection is established between computer, the modem and the telephone line . The signals from the computer, after being converted to analog signals, are carried to the local node and(via the gateway) to the international networks in the country where the vendor's computer is located. Thus vendor's computer ultimately receives the signals. In India, the local I-NET node is accessed first which will provide access to Videsh Sanchar Nigam's (VSNL) gateway packet switching service (GPSS) or I-net of department of Telecommunications which will in turn switch the call to international communication networks of the country where the vendor is located. (*See* Fig 1).

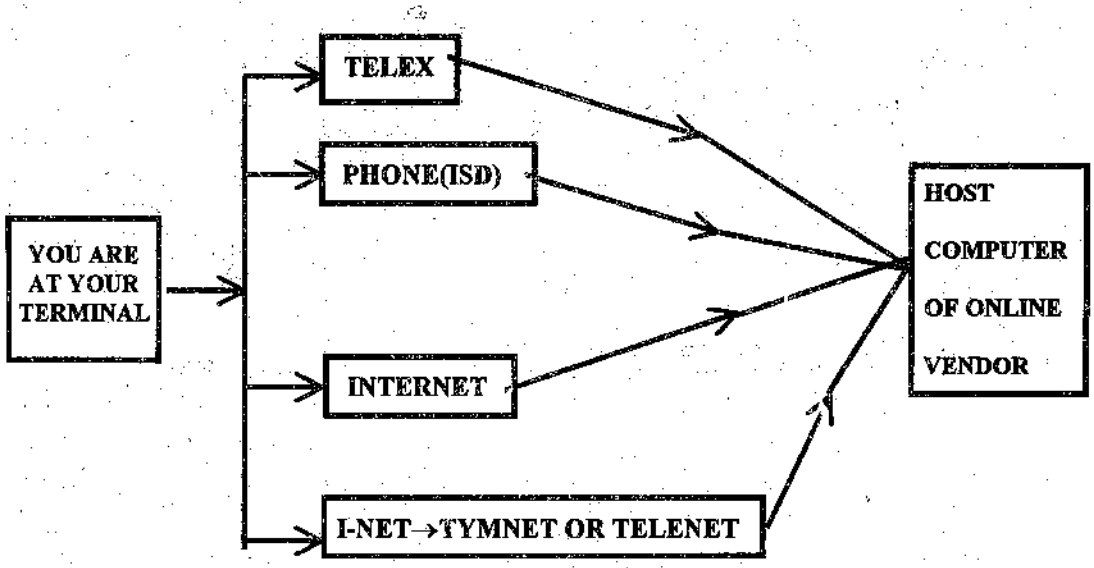

Figure 1 Different Routes To Online Databases

For example, the user could log on to the host computer at DIALOG ONLINE Services, U.S.A in the following steps:

- establishing a link with the local I-Net node
- Accessing packet switched communication networks
- like TELENET or TYMNET available in USA via VSNL's
- gateway service
- finally accessing DIALOG host computer available on
- the networks of Telenet or Tymnet

The access to the computer is provided to a valid user who has the password to use the computer. Informatics India, an information service provider conducts commissioned searches and also is the agency identified by DIALOG Services to facilitate organising the provision of passwords and other requirements and the billing services. After obtaining access to the computer, the user chooses the database/databanks to be searched, and searches interactively, based on the search statement prepared. Looking at the results, the search strategy is modified to suit the requirement. The final set of search results are obtained on the local computer in the display format desired.

The method of connectivity described above holds good in the case of a few vendors who are still providing their services via TELNET, AT&T, TYMNET and such other proprietary data networks. However nowadays almost all vendors allow Internet based connectivity. Therefore a simple Internet connection is all that is needed now.

10.2.6 Costs

The costs of the search include computer connect hour costs, communication costs and the search output costs. The computer connect hour costs are the vendor charges for the duration of the time the database has been accessed on the computer. The search output cost are charged based on the number of hits one needs to print and also the degree of detail (abstract, full text etc) in each bibliographical reference. The communication costs are the telecommunication costs charged by the BSNL and VSNL

In case of internet connectivity ISP collects the charges in addition to BSNL.

Among the various costs involved the fee charged by the Online vendor is the highest. It may range from $0.25 per record to $ 65/- per record. Again if the items (results) are seen on the screen you pay a certain fee, if they are printed at vendors site and posted to you, you pay another fee, if the results are faxed or emailed to you end up paying more! Connect fee (irrespective of results being useful or not) for the database varies from DB to DB. It can be free are as high as $300 an hour.

In general a three minute search yielding about ten relevant items from a medium-priced database (Example: Chemical Abstracts) may cost around Rs.4000/-. But, with the charges of the databases not being high, and low rates tariff offered by VSNL, communication costs also will not be a serious bottleneck. Especially, with the availability of online services libraries can aim to provide access to vast resources of information instead of acquiring these resources in paper media and building up under-utilized collection which are space intensive as well as low in terms of retrieval efficiency.

10.3 CD-ROM DATABASES

With the advances in optical storage technology most of the databases are now available on compact discs. The following sections will discuss the merits and limitations of using compact discs for databases.

10.3.1 Compact Discs (CDs)

In the early 1980s the extensive use of optical storage got stabilised and by the mid 80s options of using high density optical storage devices resulted in another media ideal for storing bibliographic information, the device called CD-ROM (Compact Disk - Read Only Memory). Initially the devices were used for audio signals and later for digital signals, which has resulted in diversified applications. The new devices store 600 MB of data of which 10% is used for error checking; net capacity is equivalent to 200,000 pages of information on a small disc which is 12cm in diameter and weighs about 16 gms. The most important feature is their storage capacity.

Other salient features are its durability and quality. The Data once created on them cannot be tampered with. It does not wear out easily as there is no device which creates friction when it is played. The data is read by using a laser beam which is the reason for its high life. One of the limitations of the device is that the data cannot be written on to the disk and it can be only read or accessed from the disk, hence the name: "Read Only Memory" devices. Most of the producers of database and databanks started offering their products on this media and many publishers are choosing it as their preferred medium especially for large voluminous publications. Moreover, with the ever increasing computer literate population who are prepared to even have home computers, the producers of information, are increasingly making their products available in multimedia making use of the high density storage device. Currently there are more than 10,000 CD-ROM titles available internationally with new titles being announced everyday (2).

Initially, the production of the CD-ROM products i.e, creating the Master copy was highly cost intensive and also making multiple copies was time consuming. With the computer hardware costs coming down rapidly these products have become cheaper.

Lack of standardisation of hardware, low retrieval speeds, lack of sophisticated search software did affect the acceptance of the product. Low data transfer rate and access time were considered as serious limitations. Improved hardware has resulted in data being retrieved faster. Compared to hard disks, CDROM drives are slower for searching and retrieval. There has been a significant improvement in seek access time (the time required to locate and retrieve a specific piece of data i.e. time taken by laser beam to move from one

part of the disk to the other and measured in milliseconds). The present products from University Microfilms International (UMI) and Silverplatter have excellent software support facilities and reasonable amount of standardisation has been achieved in hardware. Most importantly, this medium is increasingly being preferred by libraries which are always looking for products and services which can afford comprehensive coverage and efficient retrieval as well as savings in space.

Most of the producers are offering their products on subscription with a mechanism for quarterly updates in most of the cases.

10.3.2 CD-ROM Products

The CD-ROM databases are general and reference texts, bibliographic tools, like Books-in-Print directories, indexing and abstracting services and some of the sources have several additional information when compared to their equivalent products in paper media. Not only these products have resulted in popularising indexing techniques but also resulted in the development of sophisticated user interfaces.

For a detailed discussion on CD-ROM titles, sources and method of selecti etc see the Unit 15 on Multi-Media as most CD titles are now-a-days multi-media.

10.3.3 Hardware Options

A. Though initially single user system, CD-ROM technology has entered into multi access systems.

B. There are single disc drives and also multi disc drives which can switch one disc to another without physically swapping them.

C. There are systems now which could be provided on a network. CD-ROM network products can be configured in a LAN environment. The products are CD-Net, Optinet, LANtastic, Jukebox.

Silver Platter is a firm which promotes the product called Multiplatter, which is a CD-NET developed by Maridian Data Networks and can be made accessible in a LAN environment.

The Jukebox promoted by University Microfilms International's *Proquest* multiple access systems does all the disk swapping and can work in a network environment. Each Jukebox supports one to four CD-ROM drives and upto seven Jukeboxes can be configured to a single computer. The software, Jukebox manager helps in managing the resources on the Jukebox.

10.3.4 Other Optical Storage Devices

The emergence of WORM products which are Write-Once and Read-Many times and also erasable optical disks are the new type of products emerging, but, they are expensive. CD-ROM is being considered a publishing medium and WORMs are being best characterised as an archiving medium.

10.3.5 Compact Disc Interactive

CD-I uses perfect digital imaging to visualise information. Models of complex information are presented in friendly, easy to understand simulations, animation and digital video clips and still photos are produced in their original vivid colors. The compact disc quality sound effects keep the users attention keen. The disc is played using a T.V and comes with a system which has a hardware component CD-Drive with built in devices to facilitate cursor movements with a mouse to select options.

The type of products becoming available on this media are generally the ones which facilitate self learning. The databases integrate moving image of persons speaking and

explaining the concept, texts elaborating a point and various points provide self test modules which is really the interactive component. This is one of the products which offers user interface which integrate advanced options like choosing from graphics, icons etc.

10.3.6 Multimedia Products

The information products and databases are increasingly becoming available as Multimedia products. The producers of knowledge products are integrating the powerful features of different types of messages in packaging information. The information is being presented in the form of textual information, graphics, sounds, still as well as motion pictures, animation all integrated into one. The availability of high density storage devices, the CD-ROMs have become the ideal medium for these information products and services.

The versatility of the products can be illustrated with the following example. Micrsoft's *Cinemania 96*, an encyclopedia of world cinema, contains thousands of movie scenes, pictures of stars, video and sound clips, biographies and articles on assorted topics, definitions of film terms, and reviews by three movie critics, all held together with an easy-to navigate hypertext design (selecting a word in the text displayed leads to another text discussing the word in detail).

Similarly for accessing the information available on this products, the search software offers user friendly interfaces. The interfaces are affording various methods of input such as commands, menus, natural language, voice, graphics (pictorial) and icons.

Commands and menus are the usual type of interfaces offered by Online services. In other words, these are the ones preferred by experienced users due to several reasons, firstly to get quick response, secondly, to reduce the Online access time thereby costs and thirdly due to lack of high quality network channels.

The graphics and icons are being mostly offered by stand alone systems and the natural language and voice interfaces are in various stages of development and sophistication.

Some of the types of more popular user friendly interfaces being offered for using the database products and services are being briefly discussed in the section on User interfaces.

10.4 ONLINE *vs* CD-ROM

Online searching did take back seat with the emergence of CD-ROM technology which offered vast resources of information on the desk top without the hassle of telecommunication links. But the tremendous reach of the INTERNET has again brought ONLINE searching into focus.

Ideally, ONLINE searching is essential where the currency of the information is crucial. In other words, Online searching is being preferred for databases whose currency is measured in hours and minutes rather than weeks or months or for information more recent than that on the disc. The library could also adopt a strategy of judiciously using the databases available Online as well as CD-ROMs. Whatever is required frequently, for instance, single most comprehensive information service such as an indexing and abstracting service could be acquired on CD-ROM and whichever database needs to be searched occasionally could be searched online. Most importantly, the biggest advantage of CD-ROM is that it could be searched repeatedly without incurring any extra costs whereas every online transaction means additional costs.

The following table compares and contrasts Online and CDROM databases.

Table-2: ONLINE *vs* CDROM

SNo	ONLINE	CDROM
1	Based on Accessing Database as and when needed.	Based on acquiring and possessing data
2	As online searches are time-related in terms of charges, there is pressure on time; one tends to hurry up while searching	In-house facility : no pressure on time
3	Set up costs are minimal	Set up costs are minimal. Multimedia PC is needed.
4	Cost of searching varies and depends upon: Database; Online connectivity time; output cost and Annual subscription fees	Cost of searching is almost nil
5	Database need not be purchased	DB is licensed for use for a year or so
6	Search features vary from DB to DB	Search facilities are dictated by DB providers and search software coming with CD
7	Search Command vary from Vendor to vendor	Search commands are uniform for one CDROM publisher: example Silverline
8	Information is updated fast	Updates are slow say once a month or quarter
9	Data available for few years only	Generally available for larger number of years
10	Mostly bibliographical abstracts	Mulimedia and Full-text are common
11	Connect to DB vendor as and when needed	Always available in house
12	Search service can not be loaned; but one can conduct searches for others and charge a fee	CDs can be given on loan
13	Wider choice of databases and vendors	Restricted to CDs you buy
14	Amount of data online is very huge (several tera bytes per vendor)	Limited to a set of CDs.

10.5 SEARCHING INFORMATION RETRIEVAL SYSTEMS

Using information retrieval systems for searching for information depends on factors like document characteristics, indexing language, user requirements and searching methodology.

10.5.1 Document Characteristics

A bibliographic database will have several characteristics which are searchable, e.g., author, ISBN, ISSN, type of document, author affiliation, year of publication, title etc. The database may include several types of documents like books, periodical articles, reports, patents, theses etc. Some of the characteristics are common to different types of documents, e.g., author, title. Some of the characteristics may be unique to the type of document such as patent number in a patent, report number in a Technical report. The subject characteristics are

expressed in the form of a notation which is the class number and the alphabetical equivalent of the notation is included as a subject heading. The subject content is analysed to a greater depth and the ideas, concepts, processes , methodologies discussed in the source considered significant for satisfying user approaches and requirements are identified and represented in the form of keywords, descriptors, identifiers etc.

10.5.2 Indexing Languages

The language of the system which is generally referred to as indexing language, sometimes also referred to as matching language could be based on controlled vocabulary or on uncontrolled vocabulary. An uncontrolled vocabulary is the one in which the terms may be of any natural language word. In a controlled vocabulary the conceptual meaning is encapsulated in a unique term with also guidance to related terms.

The increased development of information storage and retrieval systems based on uncontrolled vocabulary and natural language indexing make them more conducive for end user searching. At the same time they may result in missing out some other relevant items or generating a lot of search output because of lack of precision.

10.5.3 User Requirements

Based on the enquiry statement, initial background study of the topic needs to be done by the searcher in case the searcher is an intermediary like librarian. After the initial study the searcher has to interact and seek clarifications and also discuss the search strategy with the user. It is also better to seek list of highly relevant references from the which he can choose some for the purpose of selecting the search terms. It is also essential to clarify what he may not want (a particular concept, a type of publication, language of the text, period of coverage in years). This is particularly helpful in case of too many references are retrieved by the system.

10.5.4 Matching of Records

When the search statement is executed the retrieval system retrieves the records which are matching the search statement. The presence of a term which is being searched in a record in the d tabase would result in a hit. In other words, the matching records are hits which are having this term and the others are misses. Similarly when a combination of terms is searched the presence of these terms in the records will identify them as probable hits. However, the ultimate retrieval of these records would be based on the choices expressed in the search statement.

10.5.5 Searching Methodology

Getting satisfactory results for approaches by subject is by far the most critical component in a retrieval system. The effectiveness and efficiency of the retrieval system would depend broadly on the following factors: a) The indexing language of the system whether it is based on the controlled vocabulary or uncontrolled vocabulary, b) the search software features, c) flexibility and ease of use of the software, d) the knowledge of the searcher regarding the indexing language of the system, e) the skills of the searcher in translating the user's requirements into search statements which closely match with the indexing language of the system, and most importantly, f) the searcher's knowledge of the search software features.

In case of online systems, based on the requirements the relevant databases/databanks need to be chosen. The search statement needs to be made after examining the indexing language of the database which is to be searched. This can be done by making use of the vocabulary tools available for each database. Eg: Subject Headings in Engineering (SHE) for COMPENDEX. Based on the vocabulary the search statement needs to be formulated and the search strategy finalized in consultation with the user. In other words, the

process would involve identifying the broader subject categories, the logical combination of terms and the limiting factors (Eg: only periodical articles etc.) and most importantly making use of the search software facilities which are being discussed in the following sections.

Various search facilities could be used and options like EXPAND which display online the terminology of the system. As the search process is interactive, the strategy could be modified based on the results obtained with the earlier search statement. i.e. though the search strategy is worked out in advance, based on the feedback during the search, the search statement is reformulated and fine tuned to get the desired results. This is the biggest advantage of a online searching. But, at the same time one has to prepare adequately in advance as, longer the duration of the search, higher would be the cost of the search.

10.6 SEARCH FACILITIES

The search software may offer certain facilities which are commonly provided such as simple search by terms, searching by some portions of the terms, searching by a combination of terms, and searching by methods which would avoid unnecessary retrieval of records and retrieval of highly relevant records. Complex search strategies could be formulated based on the requirements and use of Boolean logic and weighting operations. The techniques are discussed individually for clarification and better understanding.

Each search software will have commands which would carry out various operations like executing the search statement, displaying and printing records, to go forward and back while displaying records, to show listing of terms included in the indexing language, saving searches and most importantly providing ONLINE help. The type of search facilities offered primarily depends on the database structure and organisation of the indexing language of the system, for instance whether the terms have been extracted for inclusion from various fields and whether each term's occurrence in the record is precisely identified. But in general most of the search software offer similar facilities with some variations in the command language.

10.6.1 Common Command Language

To overcome the variations in the command language and to achieve some amount of standardisation the Euronet Diane, which is a European Online service has evolved a common command language. The language facilitates search on different retrieval systems using one language. The advantages of such language have been to avoid users being forced to learning different search languages, and facilitating ease of use due to the familiarity. The common command language has its own syntax and makes provision for various search options which are not always implemented on all systems.

10.6.2 Common Search Facilities

Some of the search facilities which are commonly offered by majority of the search software are being discussed below:

i) Searching by Simple Terms

This is by far the most simple and straightforward way of searching the database. The term could be a word or a phrase and is searched in the indexing language of the system. All the records having the term are considered as hits and would be retrieved. E.g.: Economic reforms

ii) Boolean Logic

By far the most powerful facility in any search software is the provision of search formulation by using Boolean logic. Complex search statements involving combination of several terms could be created using this logic.

This logic uses three operators, namely OR, AND, NOT. In some of the software the logical operators are represented by the following signs:

plus sign (+) for OR

asterisk sign (*) for AND

minus sign (-) for NOT

Whenever several terms are connected to each other by a logical OR operator, presence of any of the terms in the record will retrieve the record.

Whenever terms are connected to each other by a logical AND operator then only those records which have all the terms are retrieved.

When the logical operator NOT is present before a term it would not retrieve the record(s) though the term is present in the records. The order of precedence for the logical operators is: NOT precedes AND precedes OR. Expressions in the brackets are worked out first, starting from the innermost brackets. The logic is explained in the following example:

There are five Documents in the database. They are: 1,2,3,4,5

The concepts discussed in these documents are : A, B

The documents 1, 2 discuss only A.

The documents 3, 4 discuss only B.

The document 5 discusses both A as well as B

The relationships could be expressed by Venn Diagrams.

(Please refer to Figures 2-4).

The search expression A OR B (the document should have either the term A or term B) would retrieve documents 1,2,3,4,5

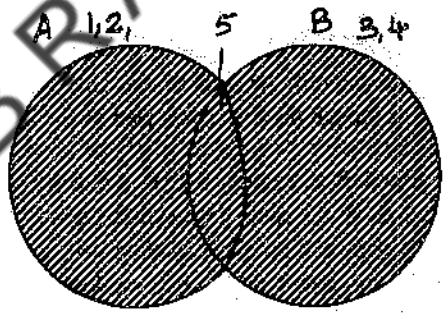

Figure-2: Boolean OR

The search expression A AND B (the document should have both the terms) would retrieve document only 5

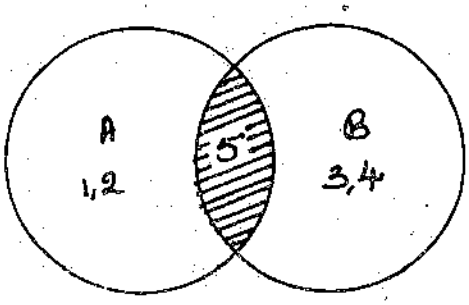

Figure-3:Boolean AND

The search expression A NOT B (the document should not have the term B. Even though A is there rejects the document if there is B) would retrieve documents 1,2.

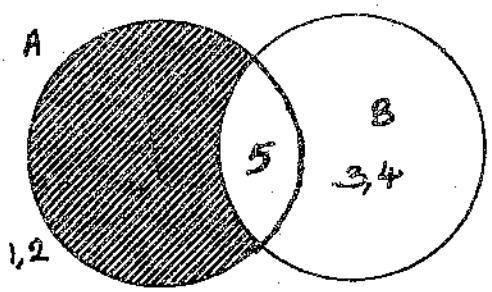

Figure-4: Boolean And NOT

iii) Truncation

The facility allows searching by portions of terms and always enhances the number of records for retrieval. Searching by word stems by using the facility of truncation operator retrieves all the records having the word stem. eg.Catal+. The truncation operator may be represented by different special characters in different systems (+,$). This is particularly useful when the searcher is not sure of the full term and also when he wants to search by all the forms of the term (adjectival, singular and plural forms). For example, Organisation+ would retrieve organisation, organisations, organisational etc.

Similarly, to retrieve all documents dealing with cataloguing, the search term could be Catal+. This sort of truncated term searches may also retrieve unnecessary terms which may happen to have the same stem but are not relevant for the search. Eg. records with the term catalyst, catalytic would be retrieved. The problem may be overcome by selecting the terms from the dictionary of terms created for the database and selecting only relevant stems. The terms generated as a result of searching by word stem will be processed as though they are connected by the logical operator

Some of the systems offer left truncation. eg. + structuring would retrieve restructuring. Some offer both left and right truncation on the same term simultaneously. Some facilitate middle truncation i.e. provide facility to search for terms which have spelling variants not at the beginning and end but in the middle of the term. eg. cataloguing would retrieve cataloguing and also cataloging. By putting an appropriate symbol in the portion of the term where there could be variation all the variant spellings could be retrieved (American and British spelling variants. Another feature could be availability of two truncation symbols one of which represents a single character while the other represents any number of characters.

To avoid irrelevant retrieval it is better to have a look at the related terms in the database before finalising the search statement. The command which is used for the purpose is EXPAND which displays all the terms which start with the word stem being searched onwards. Similarly there is generally a feature to look at all the related terms in the thesauri displays.

iv) Adjacency

For this operator to be functional the system should have a built-in feature to store details of position of the words in the record. The facility is logically closer to an AND operator. The adjacency operator helps in specifying how a particular combination of terms could occur in a record in a particular field. Eg. Abstract, title.

The search statement is formulated using the adjacency operators to search for the records where the two terms or adjacent to each other, or separated from each other by specific number of words. Eg.: Organisation (W) behaviour, Appropriate (W) Technology.

Research (W3) expenditure where 3 indicates that no. of words apart the adjacent word may be. the records having Research and Development Expenditure would be a hit. The use of (W) specifies the order of the words and looks for the words in the same sequence as given in the search statement. eg. Technology(W) Transfer would only retrieve records which have terms in the same sequence i.e. Technology Transfer and not Transfer Technology .

Another adjacency operator (N) which is offered by some systems can be used to retrieve records having both the terms adjacent to each other but not necessarily in the order of the sequence of the terms in the search statement. eg. Information(N) Systems would be matched by records having terms Information systems and also systems information.

v) String Searching

This facility is also sometimes referred to as free text searching . The facility enables matching of group of characters mentioned in the search statement with the same sequence of characters occurring in a record. This is particularly used as a last resort and generally for the terms which may occur in a field for which the index file has not been created. Eg: Publisher's name. For example all the records with term Academic press could be searched. As a rule string searching is slow as the searching is done sequentially i.e., record by record and looking for a matching pattern of characters somewhere in the record.

vi) Field Limit Searching

This facility allows the searcher to specify in the search statement the field or fields in which a particular term should be there. Only those records which have the term in the specified field are retrieved.

For example, each record in the database could have a field called descriptors or keywords The terms denoting an aspect are included if that particular aspect is being chiefly discussed in the source. Hence, if a term is searched only in the field of descriptors it ensures matching of highly relevant material as that particular term though found in other fields like title in some other records would not be retrieved. Eg: Resettlement/ (DE).

vii) Limiting

Limiting is another facility which could be used in the search statement to ensure that only records falling in a specified range are retrieved. The types of limiting could be by type of language of the text, the year of publication etc. Eg. Pollution control * YP > 1990 to retrieve sources dealing with pollution control and whose publication year is greater than 1990.

viii) Weighting

The records in the database are analysed and the aspects considered significant are identified and are assigned values based on their relative importance. The term which represents the core essence of a document is assigned the highest weight. Similarly the terms in the search statement are also assigned weights. When retrieval decisions are taken by the system the total weight of the record is considered in relation to the search statement. Only those records which either match the total weight or exceed the total weight are retrieved. Sometimes the display may be in the order of decreasing order of weights which in other words means decreasing order of relevance.

10.6.3 *Winspirs* : An Example of a Search Software

Most CDROM databases come with search software included. For example, any CDROM databases from the Company Silver Platter, include Winspirs software. Some features of WINSPIRS are mentioned below:

1. It can search multiple databases (say in a CD stack facility)
2. Free Text as well as fielded searches are possible.
3. Search output can be 'Limited' by Accession Number, Period, Document Type, and a host of other database specified fields.
4. Sorting results is possible. Printing, Saving or downloading results is possible. The display format, fields to be included etc can be changed at will.
5. Wherever thesaurus is provided, terms can be expanded while searching.
6. Words in search output can be selected and in turn used as search terms: thus sharpening the search is intuitive and easy.
7. Complete and comprehensive, easily understandable Help is available online. Database specific help is also provided.

10.6.4 Librarian as an Intermediary

All these factors stressed the need for a Librarian to gain experience in searching various information systems and provide user services. The professional should play the role of a search intermediary and has to constantly update his knowledge regarding changing techniques, new search software and new methods of knowledge organization.

Librarian as a search intermediary becomes relevant when you consider:

a) diversity of these online information products

b) the traditional skills the Librarian has in formulating complex search statements quickly

c) lack of familiarity of the end user with every system

d) time sensitive aspects (cost) of online searching

e) special training needed in learning about databases features, search commands, complexities in manuals

f) the skills of librarian in using thesauri

However, any search would become very meaningful and successful only if there is close interaction between the end user and the librarian-searcher by way of understanding the query, validating temporary results, modifying the search strategy etc.

10.7 USER INTERFACES FOR SEARCHING

The most important change in the recent times has been the development of user friendly interfaces as database products and services are increasingly being targeted to end users rather than intermediaries. The falling costs of computer hardware and the tremendous spurt in the population of computer users are the major factors for these developments.

The man-machine interface is one of the most important components of the information storage and retrieval system. Several research studies have been conducted on the interfaces users prefer to use.

Some of the types of more popular user friendly interfaces being offered for using the database products and services are briefly discussed now.

10.7.1 Commands

The input involves expressing the query statement using the commands of the system. The command consists of two components viz., the command word or function (such as Find, List, Print) and the other the object of the command (the term, word, phrase which needs to be searched. E.g.: Library Classification).

Sometimes the commands could be abbreviated. They may have implicit values and may sometimes have default values. The advantages of command based input is that generally it is easier to formulate complex searches quickly.

The problem is the diversity and multiplicity of command languages and the efforts one has to make to gain familiarity with each. This problem has been addressed to by the International Standards Institution in standardizing these procedures (ISO/ TC/46/S64) and also emergence of a European common command language. Several successful efforts have been made to create front ends which converts the commands into the commands of the system being used.

This is the type of interface which is used by experienced users for accessing databases offered by commercial vendors remotely via telecommunication networks.

10.7.2 Menus

Menus present various options from which the user may choose an appropriate one. The user keys in a number or a letter or uses a mouse or a light pen to choose an option. Choosing the option from a menu may lead the user to another lower order menu. In such a case the original menu is referred to as pull-down menu. Menus are generally suitable for preferred by infrequent users and also naive users. Menus may be frustrating and time consuming for a frequent user of the system.

Another method of input could be asking the user to fill up the blanks. In such cases, the user has to be trained to give relevant responses.

10.7.3 Natural Language Interface

A natural language interface is one where the user will express his requirements in natural language and the retrieval system responds appropriately after processing the query statement. The interfaces for input could be at different levels of user friendliness. At one extreme end they may use recognisable words with prescription of unnatural and strict sequencing of the words. Middle category could be synonymous command words with the interface being capable of handling ambiguous expressions. At the most advanced end are the interfaces which accept queries in the form of natural sentences.

10.7.4 Voice

By far the most appropriate medium for expressing requirements in a natural language could be voice. Voice input is also possible now and extensive research is being carried out to make it accurate and appropriate. The requirements are recorded as audio signals and converted into digital signals and matched with the system's language in providing answers to the requirements.

10.7.5 Graphic Indexing

By far the most simple and attractive input preparation which is being offered to the users is the graphic indexing or the pictorial displays. These are being used by multimedia products CD-ROM systems and Compact Disk Interactive systems. They are targeted to the general public, incorporating features that are simple to use. In these systems the user chooses

a picture (eg. contents page) using a mouse or any pointing device. The picture may lead to another detailed picture which would give several other alternatives. Such devices retrieve pictorial information, textual information and sometimes accompanied by sounds.

10.7.6 Icons

Icons are group of images representing things or actions the user may choose based on the requirements. Icons can be considered equivalent to a menu but are more attractively presented. They also help the user to recall and express his requirements. The user chooses the graphic which represents his requirements.

10.7.7 Expert Interfaces

The interfaces use intelligent software to analyse and interpret and also tries to understand user's requirements to satisfy the user needs accurately. The software may also evaluate user perception levels and also decide user's styles based on the user's earlier interactions with the system. This information is used in creating appropriate search statements.

The preference of a particular type of user interface is dependent on the user's prior familiarity with the system. The experienced user such as a search intermediary would be happy with a command language which affords quick and complex search strategy formulation. Some systems offer interfaces which have a variety of input options like menus, commands, graphical displays. Based on his levels of familiarity the interface invokes appropriate options.

10.8 SEARCHING THE INTERNET

While on the topic of searching databases online and CDROM it is pertinent to mention about searching for information on the Internet. As the information provided on the Net is coming from varied types of individuals, institutions etc there is nothing standardized about its contents. Format, presentation, style, language, authenticity, credibility, up-to-date-ness, reliability are all subject to question. The unit of retrieval is the complete web page as against a well defined and structured records found in online databases familiar to the librarian. Moreover the information on the web can also vanish.

To search the web contents there are a number of search engines like Yahoo, Alta Vista, Google, Infoseek, Web Crawler etc. Most search engines have their own ways of indicating truncation, wild cards, Boolean Operations etc. Some provide for Limiting also: say only web pages, only addresses, only images etc. Searching the net is an art in itself. Librarian should be well equipped to handle it and thus become an intermediary between the end user and the NET.

10.9 LET US SUM UP

The unit has discussed the features of ONLINE information systems and how they could be accessed from remote locations. Also, discussed are the significance and utility of the high density storage devices, the CD-ROM's, for information storage and retrieval. Briefly highlighted the features of multi media products. Discussed in detail various types of search facilities available for searching computer based information storage and retrieval systems. The types of user interfaces being offered for these systems are also briefly discussed. The role of librarian as an intermediary has been explained.

10.10 REFERENCES AND RECOMMENDED BOOKS

AMSTRONG, C.J. *Key guide to information sources in online and CD-ROM database searching*. London: Mansell, 1997.

FENICHEL, Carol H and Hogan, Thomas H. *Online Searhing: a Primer*. New Jersey: Learned Information Inc., 1981.

HENRY, W M. *Online Searching : an introduction*. London: Butterworth, 1982.

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KALAM, Sahir. "CD-ROM's on a Silver Platter". *PC World*, Feb 1996; p.36-46.

MCBRIDE, P. K. *Searching the Internet made simple*. London: Oxford, 1997.

VYASAMOORTHY, P. "Database Industry in India: A Current Scenario". *DESIDOC Bulletin*. Vol 15(4) July 1995; pp.11-22.

10.11 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) Write an essay on Online and CD-ROM databases. Describe the merits and demerits of each.

2) Explain the role of command languages in Conducting Online or CDROM searches.

3) Describe various features of searching an online database with special reference to Boolean Operators and their use. Illustrate your answer with examples.

II. SHORT NOTES

a) User Interfaces provided in Search Software

b) Different types of Databases

c) Indian Database Industry

d) Commonly provided Search Features/facilities

e) Searching the Internet

f) Librarian as an Intermediary

UNIT - 11 : COMPUTER NETWORKS

Structure

11.0 Aims and Objectives

11.1 Introduction

11.2 Computer Networks - Basic Concepts

- 11.2.1 Nodes
- 11.2.2 Transmission Speeds
- 11.2.3 Network Configuration/Topology
- 11.2.4 Transmission Media
- 11.2.5 Computing Models

11.3 Types of Networks

- 11.3.1 LAN
- 11.3.2 MAN
- 11.3.3 WAN

11.4 Telecommunication Networks

- 11.4.1 Packet Switching Networks
- 11.4.2 Integrated Services Digital Network (ISDN)

11.5 INTERNET - Network of Networks

- 11.5.1 What is Internet ?
- 11.5.2 Internet Jargon
- 11.5.3 Advantages of Internet
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11.6 Let Us Sum Up

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11.8 Model Examination Questions

11.0 AIMS AND OBJECTIVES

The aim of the unit is to introduce you to the computer networks and their types. It also aims to present some details of Internet.

After studying this unit, you will be able to:

- describe basic concepts of a computer network
- explain different types of network
- acquaint yourself with telephonic and ISDN networks
- appreciate the value of Internet for library work.
- possess a basic understanding about Internet

11.1 INTRODUCTION

When a number of computers and computing devices (like printers, plotters, routers, pads and servers) are interconnected with an objective of sharing resources, the result is a computer network. Computer networks are set up for the following reasons:

1) to share resources like printer, plotter, hard disk and the like
2) to share software
3) to benefit from work group or work flow environments
4) to enable distributed computing across a number of machines sharing the computing burden
5) to access large computer systems for remote administration

The networks could be telecommunication networks, using a telephone system, or a data network or both. The networks could be within an area of working, within an organisation, between group of organisations. Depending on the distance between the nodes a network could be termed as a Local Area Network (LAN) or Metropolitan Area Network (MAN) or Wide Area Networks (WAN). There are also other type of networks called 'Value Added Networks', which while using the transmission channels of a wide area network and private switching facilities, offer specialized services.

A *Computer Network* can be defined as an 'interconnected collection of autonomous computers'. A Network can be defined as a set of things (called nodes) connected to each other by links or channels. The channels are intended for transferring data in digital form at particular transmission speeds.

Networking is done for exchange/transfer of data or information. It facilitates the sharing of information resources which are widely distributed. The resources include: a) databases, b)software, c) computing resources, and d) human resources.

11.2 COMPUTER NETWORKS - BASIC CONCEPTS

Each network has nodes and centralised or distributed processing capabilities. The signals are transmitted across the channels of the network at the speeds the channels can allow. The speeds and quality of transmission are dependent on the network configuration and the transmission media. All these issues are briefly explained in the following paragraphs.

11.2.1 Nodes in a Network

Nodes in a computer network could be of three kinds. *Terminal nodes*are those where the user sits before the system and operates. *Processor nodes* are those which facilitate processing of information and also can be termed as Hosts. *Switching nodes* are intermediate nodes which connect channels. eg. Telephone exchange.

11.2.2 Transmission Speeds

The transmission speeds are the speeds at which the signals can be carried by the network with zero or low error rate. The transmission speeds are expressed as baud rate which is the unit of measurement. The baud rate is measured as number of bits per second (bps) or characters per second (cps). This also determines the type of application which can be handled by the network.

11.2.3 Network Topologies / Configurations

Connecting one computer with another computer is simply a straight forward task. When there several computers are to be linked we have to choose an appropriate one from the different methods. Each method has its advantages and disadvantages.

Networking topologies are basically grouped into i) Point-to-Point type and ii) Point-to-Multi point or Broadcast type.

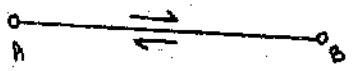

Figure 1: Point to point Network

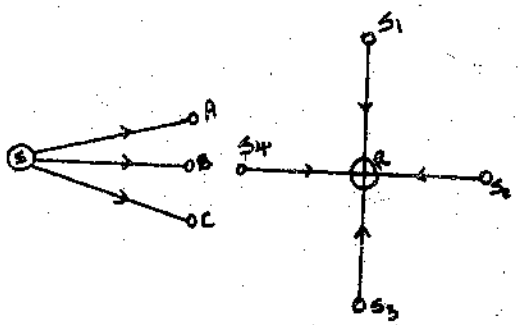

Figure 2: Point to multi-point

i) Point-to-Point Topology:

This type of networking is a fixed one. In this we find star, hierarchical and loop arrangements. Each computer in this topology can communicate with its neighbours, but depend on those neighbours to relay data or commands to other computers on the network.

The Star topology is an extreme example of point-to-point configuration because every node on the network must communicate with the central computer. When this single controller is inoperative the network is down for all local computers. In the hierarchical or loop arrangement all computers are connected to all other computers in a fully connected network.

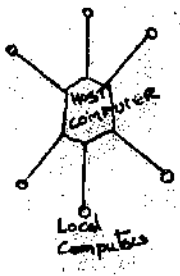

Figure 3: Star Topology

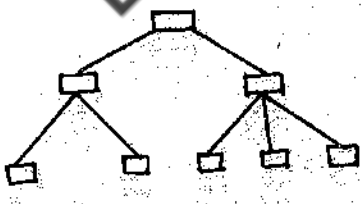

Figure 4: Hierarchical Topology

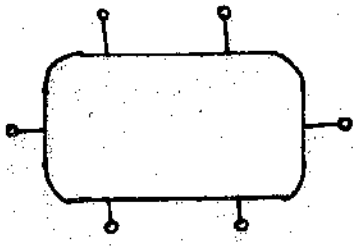

Figure 5: Loop Topology

i) ***Broadcast Topology***

This consists of Bus, Ring and Satellite configurations. The fundamental concept behind this topology is that message is placed on the bus or in the ring, or is broadcast from a satellite. The message contains the name of the intended receiving computer node. Though all computers receive the message constantly, the specific computer to which the message addressed captures the message and stores it. Only one node can broadcast a message at a time. There are two very popular broadcast topologies in use today: the bus-based Ethernet and the ring-based Token Ring Network.

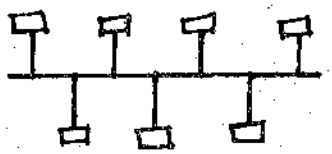

Figure 6: Bus Topology

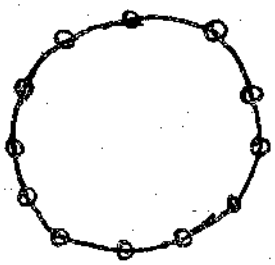

Figure 7: Ring Topology

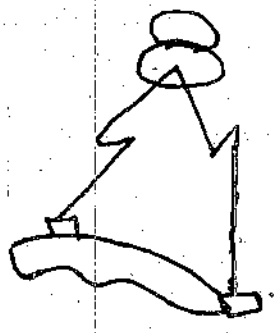

Figure 8: Satellite Topology

11.2.4 Transmission Media

There has to be a medium to connect two nodes. The medium needs to be strong and robust in terms of physical maintenance. The length and the quality will determine the cost. The transmissions speeds required for ensuring continuity and completeness of different types of messages, textual, graphic, video, audio are different. The transmission medium should offer the necessary bandwidth for transmitting the signals.

In other words, each type of message requires a particular frequency and the connecting channels should provide the bandwidth to transmit the signals and messages.

The factors which affect the performance of the transmission media can be summarised as follows.

- cost
- ease of installation
- capacity (bandwidth)
- attenuation (signal distortion)
- immunity from Electromagnetic interference (EMI)

In a Local Area Network the nodes are generally connected by a cable. The time tested medium which has proven robust and also a low cost option is the twisted pair or coaxial cable which is primarily a copper conductor. Another very powerful medium is the optical fibre cable which involves optical techniques for transmitting messages. The medium is costly but offers a high range of options for transmitting different types of messages at high speeds.

For short distances copper cables are adequate with data transfer rates of 1 and 10 mbps. Optical fibres have bandwidth of 100 - 400 mhz and offer sufficient capacity for several high speed data channels.

To carry signal over long distances over copper cables, repeaters/boosters have to be used at specific distances to amplify the signal. Laying long distance cables with repeat ers would increase the cost of the network and decrease the efficiency over long distances.

11.2.5 Computing Models

Another important component is the computing model to be adopted by the network whether it should be centralised computing or distributed computing.

The Centralised computing model may have one server and several dependent nodes. E.g.: Client Server Model.

The distributed computing model has several servers and depending on the requirements at the nodal level the nodes are connected to the server(s). The model is also called as 'Peer-to-Peer Model'.

i) Client-Server Model

The idea of a server in a network is to facilitate sharing of resources. One of the popular models is Client-server model, where a particular node is known as the server and the nodes which are connected to that server are known as the clients of that server. The Client-server network model illustrates the idea of sharing the peripherals. Some of the servers are:

a) *a print server* - the node performs all the printing of files

b) *a terminal-server* (termed *Terminal Concentrator*) - the terminals in the network are connected directly to the concentrator which in turn is connected to a network. The terminal accesses the control processor through the concentrator which handles all the communication traffic.

c) *a disk server* - which provides a large amount of secondary storage to users of the network.

ii) File Servers Another type of server namely a file server (fs) is the file handling equipment in a network. A file server supports the concept of a file. The standard operations are create, delete, open, close, read and write and the server also enables sharing files.

Users interface is available to the file server via other servers or directly to the file server if desired. The database server acts as a server to the user and also as a client with respect to the file server. Similarly different types of file systems based on different operating systems such as MS-DOS and UNIX could be supported by the file server.

iii) Distributed Systems: A distributed computing system incorporates all the above types of components. For instance, the printer processor and servers are connected together via a network. The users are offered a vast computing environment and are not required to know the underlying details of the hardware. An operating system takes care of everything like naming to interfacing various components. The operating system software is referred to as Distributed Operating System.

11.3 TYPES OF COMPUTER NETWORKS

Computer networks are broadly divided into three types: 1. Local Area Network (LAN), 2. Metropolitan Area Network (MAN), and 3.Wide Area Network (WAN).

11.3.1 LAN (Local Area Networks)

LANs are the outcome of technology in the early 1970s and typically cover speeds up to 16 million bits per second and cover areas of up to 1.5 Kms. Three types of LAN are being discussed. viz., Ethernet, Token Ring, and Arcnet.

i) Ethernet

In *Ethernet*, the most widely used type, communicating machines are connected to a coaxial cable via transmitter-receiver stations. Stations can be connected to the cable any where, and they can be extended by using repeaters. Data is transmitted by stations in

packets, waiting for each to be acknowledged. If there is a collision between packets, each station stops for a period and then tries again.

ii) Token Ring

In *Token Ring* systems, stations on the network await the arrival of short bit sequences called tokens. A station reads a token addressed to it. It transmits by entering data into an empty token. In ring system, empty data packets/tokens circulate like empty containers in a pneumatic tube system. When a station wants to transmit, it detects an empty packet, enters address and data, and empties it after the message has been received and comes round again. All stations examine all packets but accept only those addressed to them. The electronics is inexpensive and twisted pair cable is used.

iii) Arcnet

Arcnet, the third type, are a variation of the token ring system. LANs are used to inter-connect microcomputers, workstations, minicomputers, or mainframes, or to share expensive resources connected to the network such as file servers or large printers.

iv) LANs - Hardware and Software Options

Connecting computer systems within a campus through a network has two basic purposes: sharing the software resources and sharing the data or information resources scattered through out the campus without interfering in maintaining their individual existence. For example, buying multiple legal copies of a word processor software and installing it on each computer is not cost-effective compared to opting for a network version of the software and installing it on one machine and making it available through the network. The latter decision saves not only money but also disk space on all the machines.

Similarly, in a LAN, hardware like printers, can be shared and better utilised by the network users by minimizing the idle time of the printer. Secondly, the databases maintained by individual departments in a campus are made accessible to other departments even though with reduced privileges. For example, the sole authority in developing and maintaining a bibliographic database may be with the library and documentation departments of an organization, yet database services are made available to other departments on the campus with privileges only to search the database.

Novell Netware, DECNET, and Banyan Vines are some of the well known network software / operating systems available at present. In a LAN, the network software and the common application software along with data files are stored on a server (usually 500 MB) and two or more PCs/workstations are connected to it. The PCs/workstations connected to the server get software and data from the server and process it. The output may be redirected to the server or to a printer. Individual user specific software and data files only are kept in the PC thereby reducing the load on the server system. LAN system provided with a gateway (exchange or switching device between two computers working on two different platforms) can allow the user to have access to an external (MAN / WAN) network.

11.3.2 MAN (Metropolitan Area Network)

A MAN is a kind of super LAN fiber optic ring network operating at 150 Mbps or more over an area of about 50 Kms. In setting a MAN, one might use a combination of several types of media: Community Area Television (CATV), twisted pair, optical fibers,

radio links or Line-of-sight Optical Communication links. Because of the broadband capacity of MAN, Voice, Data, and video can all be carried simultaneously.

11.3.3 WAN (Wide Area Networks)

The term is used to describe any network covering a large area, presumably larger than a MAN. All communication networks like NICNET, ERNET in India and TELENET and TYMNET in USA, and the Internet fall to this category. In the case of internet, however, it is not a single network but a network of several networks, as we shall see a little later. These networks make use of telephone lines, underground coaxial cables, microwave and satellite communication facilities.

Some of the highly utilised large geographical area networks are telecommunication networks and several MANs and WANs are utilizing them. Networks of big multinational corporations like MCI, AT&T, Sprint belong to WAN category.

Figure-9 shows the distances covered and transfer rates of LAN, MAN and WAN.

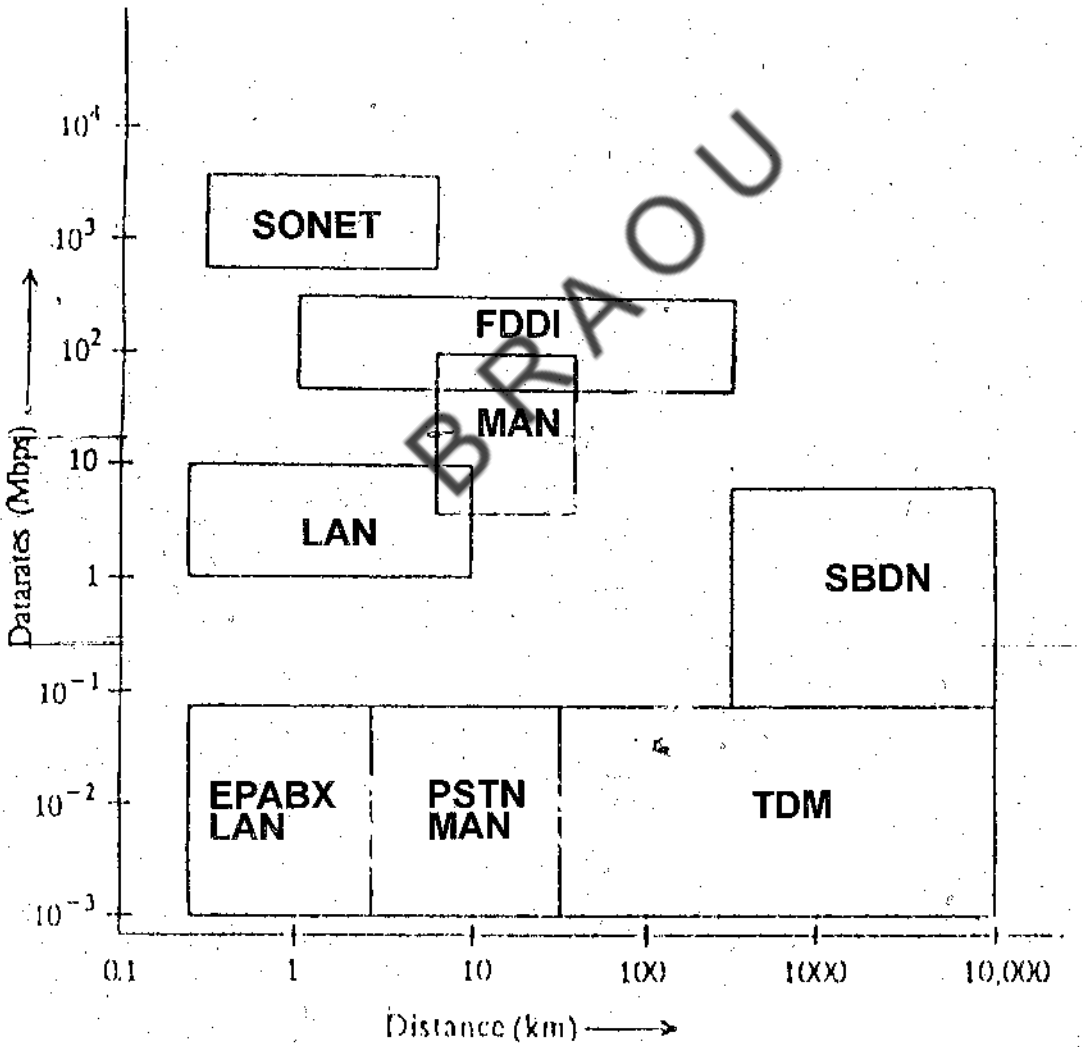

Figure 9: Networks Distances and Speeds

11.4 TELECOMMUNICATION NETWORKS

The best example of a telecommunication network is the Public Switched Telephone Network (PSTN). PSTNs carry analog signals as they are meant to transmit the same. They connect various entities which are geographically apart to communicate with each other. The entities could be telephones, facsimile machines, teleprinters, computer terminals. These networks are the most extensive and are ensuring world wide connectivity.

A public network is available for general public. A dedicated network has nodes connected by a leased line either separately laid or drawn from a public network. The dedicated lines are costlier and naturally offer quicker communication and noise free transmission, and are available all the time for the exclusive use of a single user.

The telecommunication networks could be used for sending data or receiving data but the digital signals of the computer need to be converted to analog signals. This can be done by connecting a modem between the computer and the telecommunication networks.

The Modem converts analog signals into digital signals and digital signals into analog signals. While sending the data the Modem converts the digital signals from the computer to analog signals for transmitting the information on these networks. Similarly the information received as analog signals via the network are converted into digital signals by the modem and transmitted to the computer.

11.4.1 Packet Switching Networks

When data is transferred from one computer system to another, either the whole message can be sent in one go as it happens in Message switching or the message may be broken into small pieces and sent as it happens in Packet switching.

The message is broken up into different packets at the beginning. Each packet has the address of its destination and information regarding the Network user identification and the packets are transmitted via available paths. In fact a packet of size of less than 1 KB has Packet ID, Message ID, Message Size, SourceID, Destination ID, Number of Packets, and of course actual data itself.

Near the destination, they are put back together again in the original order. In other words, portions of different messages may be going together along the different paths with the necessary identification and destination address. The portions are reassembled in the original order near the destination and the complete message is transmitted to the receiver.

The terminals may be packet terminals (PAD's) connected directly to a data network or normal character terminals which are initially connected to a PSTN which is in turn connected to a special node of a network called a Packet Switching Exchange (PSE). The conversion of message to packets takes place at the node.

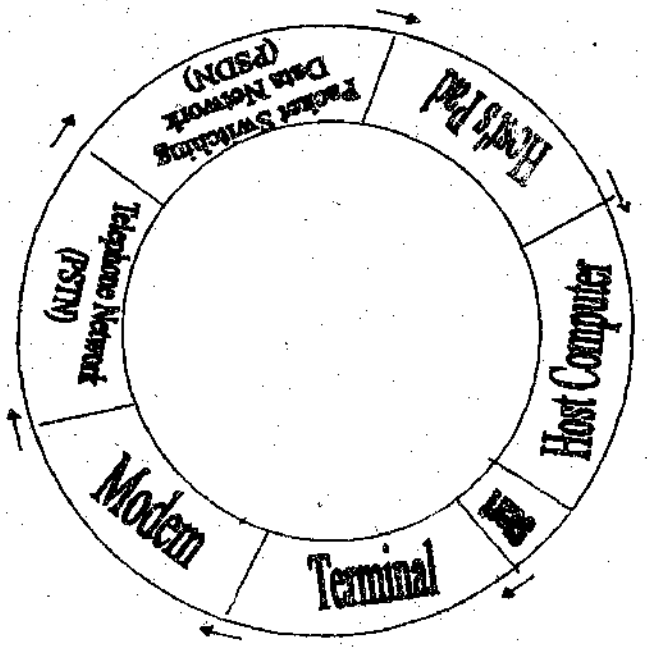

Figure 10: Travel of a Packet

Advantages of Packet switching

The advantage in packet switching is that when a packet is not received properly only that small packet needs to be re-sent. More over, in switching there could be problems of the receiving end overflowing the message storage capacity in the case of large messages. This problem is also avoided. Again, when a large message is being transmitted, if an important urgent small message needs to be sent, in message switching one has wait till the previous long message is sent. This is no problem in Packet switching. Packet switching is faster. It ensures a better method of transfer using different alternate routes.

The idea of these networks was to capitalize on the under-utilization of the telecommunication channels with a mechanism for transmitting data via various paths whichever is relatively free. The packet switched networks operate on this principle. Data communication networks like TYMNET and TELNET in the U.S are good examples of Packet Switching Networks. In India I-NET is a popular X.25 Protocol based Packet switching network service offered by BSNL. Internet also uses a packet switching method with the protocol called TCP/IP.

11.4.2 Integrated Services Digital Network (ISDN)

ISDN is an important development in the field of telecommunications in recent times. The need for an integrated services network was felt by the society as the data to be transferred has been becoming too complex and at the same time the cost of establishing and using independent networks is prohibitory. A sophisticated signaling system is needed to support the transfer of data, voice, image, graphics, video etc.

ISDN is an integrated digital network and supports wide range of services - voice and non-voice; telephony and data transfer; images and video. Digitization starts at the sources and digital switches and paths are established with a small set of interfaces. It is an intelligent system with service features, maintenance and network management functions, all integrated.

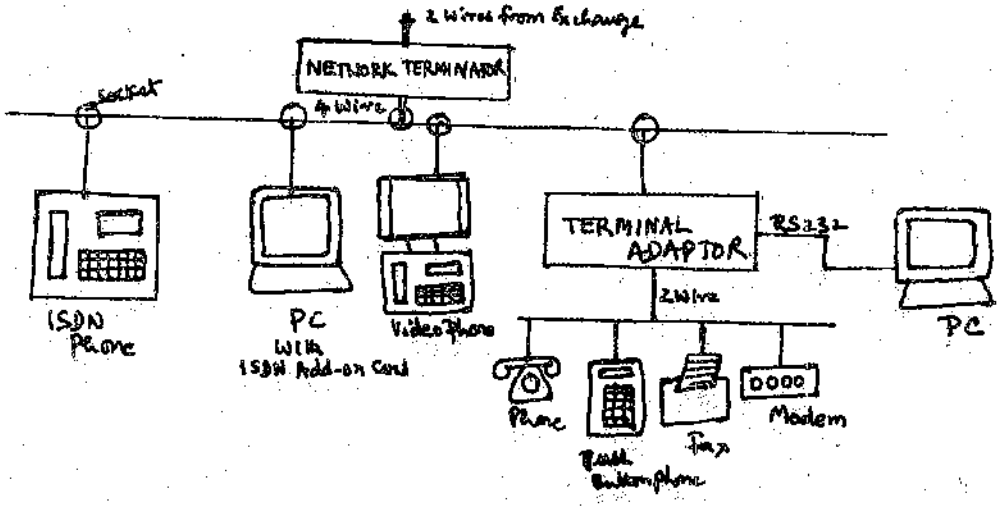

Figure-11: ISDN Facility

ISDN allows two simultaneous calls on the existing pair of telephone lines unlike present system only one call on the line. These two simultaneous calls could be of any type - speech, data, image or video. A wide range of services can be availed for residential as well as business purposes as the subscribers will have full connectivity to both national and international lines. Call set up time is just about 1-2 seconds.

In the ISDN, the telephone line is terminated on a common box, called the network termination. The common box is usually installed in subscriber's premises. Depending on the internal wiring, upto eight terminals can be connected. These can be of several types, for example, ISDN telephone, PC, video phone, video conferencing equipment, etc. Fax machines and modems can also be connected to the internal wiring with suitable adapters. However, the PC to be connected needs an 'Add-on ISDN Card'. PCs can transmit or receive files at a rate of 64 Kbps in a single channel (128 Kbps in two channels)..

ISDN supports the following services:

- e-mail
- teletex
- videotex
- digital facsimile
- electronic fund transfer
- document storage and transfer
- image and graphic exchange
- audio and video conferencing
- automatic alarm services (eg. medical, police, fire)

Among ISDN subscribers, telephone users can avail a number of new facilities:

1. Calling Line Identification Presentation
2. Calling Line Identification Restriction
3. Advice of Charge
4. Call holding
5. Closed User Group
6. Call Forwarding

The speed of transmission is 64 Kbps to 128 Kbps. Video conferencing using ISDN lines is becoming increasingly affordable. For better quality Video Conferencing one needs three 64 Kbps lines.

11.5 INTERNET : NETWORK OF NETWORKS

The basic objective of any network is to ensure sharing of resources and sharing of information quickly and efficiently. The network enables the sender and the receiver of information to communicate with each other and also send and receive information. Some of the basic services which are handled by these networks are electronic mail, file transfers, providing access to non commercial and commercial databases, unorganized information such as opinions, views and news.

The most popular among the networks which in real terms is a network of networks is the INTERNET. Some of the important features of the network are discussed below. In this section, We shall first introduce the topic of Internet, then look at some special words connected with Internet, discuss how to get connected to the Net, some services available on the net, and then what anyone can do with Internet. Finally some points of Interest to librarian are listed.

11.5.1 What is Internet ?

Internet is a network interconnecting several networks in university, business, military and government and public institutions and individuals. The Internet is made up of LAN, MAN and Wan, connecting computers for organizations all over the world. These networks are hooked together with every node from regular dial-up phone lines to high-speed dedicated leased lines, satellites, thereby removing geographic and national barriers.

The Internet is a network of computer networks. It encompasses the entire globe. You can look at as a giant global encyclopaedia. It is the best instance of a cooperative movement. It is a universal service connecting different types of networks. Internet is not restricted in size. Internet is a virtual network system and as well an virtual information store . It is a physical maze because when you are searching you do not know where you are.

Internet is growing very fast in recent years. The Internet has doubled in size every year since 1969. In 1996, 10 million computers joined the Internet. By July 1997, 10 million more joined. In 2001 there were 300 million Internet users. Soon, everyone who has a phone is likely to also have an email account or use Internet in some way.

11.5.2 Internet Jargon

We come across various terms when we use or read about Internet. Some of the major Internet terms are given here for your understanding.

(1) IP Address:

Every machine on the Net has a unique number as its address. It is a series of four three digit numbers in the range 0 to 255, separated by a dot. It looks like:

208.182.199.45

Here the last group of numbers (45 in this case) refers to the host machine and the rest of numbers refer to the network to which it is connected. IP address can also translated as a name understandable by human beings like: www.manage.gov.in

(2) URL: Universal Resource Locator.

It is an address of a specific page of information on the Internet. An example of an URL is given below:

http://www.manage.gov.in/publications/bulletin.html

This tells us that the method of reaching or contacting the Internet site is by using a protocol called http (this is the web protocol. ftp, telnet are other protocols). The actual Internet machine is at: www.manage.gov.in. Within this machine there is a file called bulletin.html in a directory called publications. In short URL tells excatly where to locate a web page.

(3) TCP/IP:

Transmission Control Protocol (TCP) creates and recombines packets, ensures correct ordering at the receiving end. Internet Protocol(IP) : locates desired computer on the network.

(4) World Wide Web:

WWW or World Wide web is a facility on the Internet allowing persons to keep information on a computer such that anyone connected to Internet can reach that computer and access the information, download it and use it. Web Pages contain multimedia information where text, graphics, motion pictures, audio clippings may all. Be clubbed together in the same document. A web page also has hyper links. That is you can go to another page located somewhere else (anywhere - that is it can be on the same machine or another network far away).

A web page is created using a mark-up language called HTML - Hypertext Markup Language. Html for example tells your computer to show some portion of the text in Big fonts or underlined or on the next paragraph. Etc. Among all the services on the net WEB has grown incredibly fast. Hence everyone is interest in it.

(5) Browser:

A web browser is a program which is used to visit web pages. The two most well-known web browsers are *Netscape Navigator* and *Microsoft Internet Explorer*, which are used by the vast majority. Other browsers like mosaic, cello are available as well. Browsers help you locate a page of information on the net; after you have it displayed on your screen, you can copy it; mail it; save it as a file with all links, pictures etc; or print it on your printer. Browsers help us see text, pictures, color, and also see video clips and listen to music clips.

11.5.3 Advantages of Web

What can you do if you get connected to the Internet?

a) Purchase books gifts online

b) Publish your own papers and books

c) Visit web sites
d) Send and Receive Electronic mail
e) Read and post articles in the news groups
f) Down load files to your PC
g) Chat with other users on-line
h) Play games with others on-line
i) Access on-line multimedia including radio and video broadcasts
j) Search the Internet for Information
k) Subscribe to electronic newsletters, e-zines etc.
l) Join contests
m) Contribute articles, and other materials
n) Do on-line shopping
o) Web based learning
p) On-line placement (One can post his resume)
q) Create your own web site
r) Send flowers or gifts to others
s) Find a persons details

11.5.4 Services on the Internet

The basic facilities provided by vendors to Internet subscribers include remote log-in, e-mail and file transfer.

(1) ***Remote Login*** facilitates a user to get connected to another computer on the internet and thereby have access to all the programs and data on the remote machine. What you can do after getting connected to another machine depends upon the permission granted to you. Most University Library catalogues can be reached via Telnet (Remote Login) and searched via catalogue or OPAC programs.

(2) ***Electronic Mail*** helps you exchange personal messages. (In view of the importance of Electronic Mail, Unit 16 deals with this topic fully as a part of Office Automation Tool).

(3) ***File Transfer*** is a facility with which, large files of information can be obtained from other machines. Communication between two Internet nodes is provided by the protocol TCP/IP (Transmission Control Protocol/Internet Protocol). A program called ftp (File Transfer Protocol) is used to get connected for file transfers. Files can be plain text or binary files containing pictures, programs and the like. Many ftp sites (places in the computer network where files are stored for download) are free.

(4) ***World Wide Web***: We have seen some details of WWW earlier.

11.5.5 Internet Connectivity

One can get connected to Internet by subscribing to the services through an Internet Service Provider (=ISP). There are more than 45 private and government organizations acting as ISPs. They cover almost all cities in India. The charges vary for Internet Connection is about Rs 10 per hour.. All of them provide Email service free.

Dial up connection is the simplest. But it is slow. For companies and ofices leased line connection at speeds of 64Kbps are needed. If we frequently download video, music etc then again we need fast connectivity. Nowadays, WEBTV is a method by which the Home TV can act as an Internet terminal and the connection is given by TV Cable companies.

11.5.6 Impact of Internet for Librarians

1) Library and information centers may limit their database development activities to house-hold documents only. Having direct access to specialized databases world wide (e.g. AGRIS, MEDLARS, databases on DIALOG) through Internet may prove to be more economical.

2) Electronic Mail with connectivity to internet can be used for exchanging messages, filling inter library loans, forwarding texts in digital format etc. While performing online searches the search results can be sent directly to end-user's mail box.

3) Internet resources span thousands of libraries and their collections. At the moment OPAC of several libraries including Library of Congress can be searched via internet. Large number of newspapers, journals and full text versions of several books and reference materials are all available on the Net.

4) Several magazines and publications are available only on the net in Electronic form and not in printed form. Librarians could benefit from soft copy publications via internet access.

5) Hundreds of sources for helping the librarian to discharge his functions more efficiently are available on the Internet. Right from classification, cataloging to "Yellow Pages for Libraries" varied types of information are available on the Internet.
(Refer course-03: Information Processing and Retrieval, Unit-15 for more details on internet)

11.6 LET US SUM UP

This unit has discussed some of the basic issues and components related to computer networks. The components discussed include nodes, the transmission media and the data transfer speeds. Issues like network configuration and computing system models have been briefly highlighted. The types of network configurations and types of networks, especially LAN have been discussed in detail. The utility of telecommunication networks and principles of data transfer like packet switching have been briefly described. ISDN has been mentioned briefly. The features of one of the most popular network of networks, the INTERNET has been discussed in some detail.

11.7 RECOMMENDED BOOKS

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DOUGLAS, E Comer. *Computer networks and internets*. 2nd ed. Delhi: Addison–Wesley Longman, 2000

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RAMAN NAIR, R. Internet for library and *Information services*. New Delhi : Ess Ess, 1999.

TANGNEY, Brendan and O'Mahony Donal. *Local area networks and their applications*. New York: Prentice Hall, 1988.

11.8 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) Explain the basic concepts in Computer networks and type of networks in use.
2) Discuss the role of telecommunications in computer networks.
3) Describe Internet, its services and facilities. Discuss the impact of Internet on libraries ?

II. SHORT NOTES

a) Internet Services
b) Telecommunication Networks
c) Local Area Network
d) Facilities in ISDN
e) Internet Jargon
f) Packet switchings

UNIT - 12 : LIBRARY NETWORKS

Structure

12.0 Aims and Objectives

12.1 Introduction

12.2 Library Networks - Need & Requirements

12.2.1 Need for Library Networks

12.2.2 Requirements for Establishing Networks

12.3 International Networks : OCLC

12.3.1 Goals and Objectives

12.3.2 Activities

12.4 Library Networks : Indian Scenario

12.4.1 Library Networks : Indian Scenario

12.4.2 NICNET

12.4.3 ERNET

12.4.4 INFLIBNET

12.4.5 CALIBNET

12.4.6 BONET

12.4.7 HYLIBNET

12.4.8 SIRNET

12.4.9 BTSNET

12.4.10 DELNET

12.4.11 MALIBNET

12.4.12 PUNE-NET

12.5 Let Us Sum Up

12.6 Recommended Books

12.7 Model Examination Questions

12.0 AIMS AND OBJECTIVES

This unit aims to introduce you the library networks. The unit broadly covers the need for library networks and also explains in general the requirements for establishing networks, the features and activities of international library networks and details of the library networking activity in India.

After studying this unit, you should be able to

- distinguish between computer networks and Library/Information Networks
- appreciate the necessity of library networks for resource sharing
- get an idea of the requirements for establishing such networks
- describe the services of OCLC
- discuss the activities of important library networks in India.

12.1 INTRODUCTION

Interconnectivity of computers via computer networks greatly enhances the utility of computer systems by promoting saving of resources and by enabling remote computing, online searches, etc. A look into several networks in India (some of them purely computer networks like INDONET and some others are bibliographic networks) is worthwhile. Advantages of networking Computers have been studied in Unit 11. This unit concentrates on use of such Computer networks for sharing the resources of several libraries.

We shall see briefly differences between Library Network, Bibliographic Networks, Information Networks and Computer Data Networks.

When a group of Libraries get together and form a network (with or without using computers) we have a Library Network. The sharing is in terms of catalogues, resources, people, experience etc. Benefits are extended to all member libraries on mutually agreed terms and conditions. Examples are DELNET, BONET, MALIBNET etc.

Library Networks may be local regional or national depending upon the scope and geographical coverage. BONET is local as it covers libraries in Bombay. INFLIBNET is national as t covers entire India. DELNET is mostly local but extends its membership to external libraries as well and is in the process of becoming national. We do not have regional library network as such in India.

Bibliographic Networks and Information Networks are other terms closely related to Library Network. In the case of Library Network, only member libraries share resources. Mostly they share catalogues of their collections. Bibliographic Networks on the other hand are created on specific subject area. The emphasis is not on any member library but on special topics. ATOMINDEX of INIS is an example here.

Information Networks contain and distribute information not only on books and journal articles but on all other types of materials as well. Data bases of Information networks contain not only books but also numeric and statistical data per se; graphical information, full text items may also be found. Databases created by National Information Center contain information needed by planners and developmental agencies. When they are used on NICNET, they may be called Information Network.

Computer Data Networks, on the other hand, aim at providing connectivity for carrying data of any type not just bibliographic. Here the emphasis is as a data distribution medium not as much for what (content) is being maintained or carried. Computer data networks have already been discussed. Andhra Pradesh State Wide Area Network in AP (=APSWAN) and Satyam-Net of Satyam Computers are examples of Computer Data Networks.

12.2 LIBRARY NETWORKS - NEED & REQUIREMENTS

We a number of computerised Library Networks in different countries for the purpose of sharing information resources. This Section discusses the need and various requirements for establishing the library networks.

12.2.1 Need for Library Networks

Escalating prices of periodicals and other published information, increased publication activity and reducing annual budgets in libraries have made it necessary for librarians to cooperate with each other more extensively than before. Information is expensive as all the activities right from acquisition to cataloguing, indexing, storing and retrieval are all costly. Moreover users of libraries have started demanding better services and look for value addition in services and products offered by libraries.

Therefore, costly resources need to be shared so that users can have access to the combined resources of more than one library in meeting their needs. Tremendous advancements made in the field of Information Technology now offer very many alternatives for networking and resource sharing among the geographically dispersed and remotely located library and information centers. A library network is thus a formalized arrangement between two or more libraries to facilitate the sharing of collections, services, databases, database records software and hardware. Sharing the experience of personnel is not excluded.

12.2.2 Requirements for Establishing Networks

The basic requirements for establishing a library network include:

1) Organizational structure that provides for fiscal and legal responsibility, planning and policy formulation;
2) Identification of nodes along with specialization in collection building and area limitation;
3) Collaborative development of resources among nodes;
4) Identification of levels of services that can be provided by the nodes (e.g. referral, document delivery, data/information etc.)
5) Identification of patron groups along with their responsibilities.
6) Common standards for bibliographic description and communication among nodes
7) Establishment of a communication system is imperative
8) Switching capability that helps to connect with other national and international networks
9) A central database and software to help in locating the needed items within the network
10) Guidelines on the content selection of the network based database
11) Evaluation criteria and procedures to provide feedback from users and operators for better management of the network services
12) Training programs in the usage of network facility

12.3 INTERNATIONAL NETWORKS - OCLC

A fully functional and integrated international library network is the OCLC network. The network and its services are briefly discussed below:

The best example of a wide area Library network which has been the torch bearer for all other networks is the Online Computer Library center network. The network is international in scope and ranks as the best in terms of magnitude, quality and diversity of services and most importantly, pursuing its goals relentlessly. The efforts were sustained and continuous in integrating latest technologies. Initiated by an association in the year 1965, the network was established as Ohio college Library centre's network to forge networking between academic libraries in the state of Ohio.

12.3.1 Goals and Objectives

The primary objective as defined initially "all for the fundamental public purpose of furthering ease of access to and use of the ever expanding body of world wide ... education and knowledge".

Even today the objectives are being pursued with increased vigor and the phenomenal utilization of the network proves beyond doubt the usefulness of such networks. Starting from serving libraries in acquiring and cataloguing books, generating custom printed catalogue cards, providing location information and arranging inter library loans, the OCLC has grown into providing online access to databases, taking a lead in developing tools for better end user access to networks like Internet.

The success and high utilization of the network has been possible because of its efforts to pursue the following goals

- providing tools and products for the libraries which would reduce duplication of efforts, and the costs
- provide tools which would ensure quick access to information and better utilisation of resources and services
- maintaining excellent inter library alliances and relationships which enhanced access and utilization without in anyway affecting their autonomy
- facilitating end-user to access, identify, and ensuring fast and reasonably priced delivery

12.3.2 Activities

Some of the activities are regular and some are adhoc in nature. For instance, besides the activities mentioned earlier, the OCLC undertook specific activities required by member libraries like, retrospective conversion of catalogues to ONLINE catalogues, offering computer based products and services that the libraries cannot afford to singly acquire.

i) Shared Cataloguing

The major efforts of the network has been shared cataloguing which reduced the cataloguing efforts of the individual libraries. The hit rate of finding a catalogue entry for the book already acquired increased from 66% in 1971 to 94% in 1993. The members belonged to only OHIO state during 1967-71 and by 1973 outside members were admitted and by 1977 libraries belonging to 38 states have become members. From 1971 to 1994 the number of participating libraries increased from 54 to nearly 20,000.

ii) Online Union Catalogue

Online union catalogue had about 30 million records in 1994 and is growing at the rate of 2 million records a year. Moreover, the number of inquiries or transactions reflect the utility of the Union catalogue. During the first two decades, the system has grown from responding to 54 simultaneous users to 4000 and with improved hardware and software support it is able to respond to users in a fraction of a second. Everyday user's enter nearly 4 million commands into the system initiating well over 500,000 searches.

By March 2001 the catalogue grew to 44 million records covering 800 million library holdings in 450 languages! OCLC provides access to WORLDCAT - a massive catalogue of library holdings. One has to pay a one time fee of $350 for profiling the library as a user. Software needed to access WORLDCAT is given free.

iii) New Hardware Support

In terms of infrastructure, in 1990 OCLC moved to a new centre, updated its hardware and created better telecommunication systems support. In 1992, the migration of all the earlier systems to new hardware was completed and most importantly without causing much inconvenience to the users of the network. The new hardware ensured higher speeds, lesser floor space. With the improved hardware it could integrate various subsystems like cataloguing module, Union Listing module and ILL module.

iv) Inter Library Loan Services

Several features are being added which monitor Inter Library Loan patterns and simpler administrative procedures for libraries. This was taken care by the ILL fee management system the OCLC Inter Library Loan service which was activated in 1979 grew in stature and in 1993-94 fiscal year around 5400 libraries arranged over 7 million transactions on OCLC Inter-library loan system. The transfer of request forms electronically has further reduced the administrative work in the libraries. Several software programs are being developed to process the large ILL transactions data to get insights into the lending and borrowing patterns of libraries and several other interesting facets.

v) Literature Search Services

Introduced in October 1991 the *FirstSearch* service offered users facilities for ONLINE searching of important databases. The service initially provided access to six bibliographic databases and is able to offer databases covering several disciplines, full-text databases and also directory files. FirstSearch is also making images from 1000 popular academic journals and making them available as a database.

vi) Tools for INTERNET

The OCLC has developed a comprehensive database of INTERNET accessible resources to serve as a tool for INTERNET exploration and delivery. The database is a cooperative effort and describes the source, its scope and utility.

vii) Electronic Publishing

Another project of OCLC is STEPS- Total electronic publishing services. The project is to enable a totally electronic publishing process, from authoring to eventual distribution in print and electronic form. The STEPS system is designed to take a document through the publishing process from author's draft to finished print version or may be directly to a readers computer.

viii) Training

OCLC also offers training to library professionals - both conventional as well as online. For example "Cataloguing Internet Resources using MARC21 and AACR2" is an Online Web based training course available free even to non OCLC Members.

One can obtain current information on OCLC via the web site: http://www.oclc.org/

12.4 LIBRARY NETWORKS - INDIAN SCENE

In this section some networks in India will be discussed. NICNET and ERNET are Information networks. Rest are Library and Information Networks. A brief understanding of both types of networks is useful to librarians.

12.4.1 NICNET

National Informatics Center Network sponsored by NIC, links all state capitals, 450 districts head quarters with the National Center in Delhi. The network uses satellites communications and roof top antennae to transmit and receive data. It will primarily support the information needs of state and central government offices and will enable better monitoring and implementation of developmental plans. It ensures faster and more effective communication between government departments and ministries.

NICNET also serves as a communication channel for other specialized networks like BITSNET, INFLIBNET, etc. NIC has also been designated as the Indian

Medlars center (IMC). It also provides links to international networks, using which IMC is directly linked to the NLM (National Medical Library) in USA, the creator of MEDLARS (Medical Literature Analysis and Retrieval Systems).

Other databases available on-line in related areas through a NICNET include :
Aidsline (bibliographic citations of literature on Aids published since 1980);
Cancerlit (cancer-related literature);
Histline (on history of medicine and related sciences),
OSHROM (on occupational safety and health),
Popline (population related literature),
Psylit (on Psychology) and Science Citation Index.

The biomedical databases on CD-ROMs held at the IMC library are also available to the network subscribers from remote locations through dial-up facilities. NIC is planning to extend services to the remote areas of the country with VSATs (very small aperture terminals) In the near future, neighboring countries like Maldives along with SAARC countries will be provided connectivity to these services.

12.4.2 ERNET

The Education and Research Network, initiated by the Department of Electronics is a network of academic research community of the country. ERNET operates at 3 layers: established LANs at 8 leading institutes in the country - 5 IITs, IISc (Banglore), NCST (Bombay) and Department of Electronics (New Delhi); linking with other MAN (Metropolitan Area Networks); and interconnecting them through a satellite based WAN (Wide Area Network) for access to networks abroad. The major aim of the project was to build capability to facilitate informal and frequent interactions, sharing of computing resources, and more cooperation in research activities. Over 300 institutions in the country representing a cross-section of universities, government societies, R & D organizations, research laboratories are already using it extensively serving over 20000 users through out the country.

The services provided by ERNET include: Electronic mail; Remote log-in; Database access; File transfer; Mailing lists, news groups and bulletin boards; and information retrieval tools (Gopher, WAIS, WWW). It is one of the organizations that provides access to computing resources and users across 120 countries through global Internet.

Current information on ERNET can be had from: http://www.ncst.ernet.in/

12.4.3 INFLIBNET

Inflibnet was started as a project of Inter-University Center for Astronomy and Astrophysics (IUCAA) of Pune in Ahmadabad in 1991. It facilitates Library Networking of academic institutions, R&D establishments and organizations of national importance. Inflibnet is strictly not a Library Network. Besides networking of libraries, all aspects of using computers and information technology in libraries, creation of bibliographic databases, online public access catalogues, training of Librarians in the use of computers software, internet etc are of great interest to Inflibnet.

Inflibnet has given grants to 142 (as of May 2001) university libraries to acquire computer systems, to secure online access to databases, purchase of software, creation of catalogues etc. It also provides SOUL, a library cataloguing software suitable for academic libraries at nominal cost. It has developed a centralized catalogue of 28000 serials, 2.5 lakh books available in some 70 libraries.

For establishing connectivity, one can reach Inflibnet via a) PSTN lines b)I-Net or through NICNET or ERNET. I-Net is an X.25 protocol based data net work provided by BSNL. NICNET is available only to governmental organizations. ERNET is restricted to educational institutions only.

12.4.4 CALIBNET

The Calcutta Library Network, sponsored by NISSAT (National Information System for Science and Technology) was launched in December 1993. The locally developed software Maitrayee, with modular approach, encompassing total automation of housekeeping and library management functions, user services and networking was implemented. The network has adopted UNIMARC format which enhances the scope for eventual exchange of information about 20 km apart are interconnected through dedicated telecommunication lines. The network is supposed to connect around 60 libraries in Calcutta. A low cost E-mail network approach has been introduced for those libraries which face constraints to funds to acquire hardware and software systems for in-house automation. Each institution will hold processed information on local computer, connected with every other node in the network through I-NET's packet switched network.

The Network Service Center acts as host and provides global services. It creates and maintains union catalogues, central authority cards, union list of serials, and partials databases from external sources. It also provides centralized services such as on-line search e.g. of international databases, by DIALOG services of Lockheed; search of CD-ROM based databases, current awareness services such as SDI. It also extends consultancy services to other nodal libraries in automating the in-house procedures. It is also made responsible to continue the research work in augmenting the facilities provided by the CALIBNET. The network facilities hooked on to the network, transfer files and documents across libraries and exchange messages and replies to queries through E-mail services.

12.4.5 BONET

The Bombay Library Network started in 1992 focuses on interlibrary activities, rather than computerizing individual libraries. Participating libraries will computerize their own operations and are likely to share their resources with each other. BONET offers consultancy services to participating libraries where necessary. Linking to nodes in the network is provided by dial-up services and access to libraries outside Bombay and abroad through ERNET. Presently, BONET is accessible via Internet too.

BONET is maintained by NCST which has had lot experience in running ERNET. It has online document ordering facility for its members. TIFR, BARC, NCST, University of Bombay, are some prestigious members.

12.4.6 HYLIBNET

Though several discussions seminars and workshops were held on setting up a network of libraries in Hyderabad and surrounding areas, under the name HYLIBNET, nothing has materialized as of November 2001.

12.4.7 SIRNET

The Scientific and Industrial Network, sponsored by INSDOC links all 40 CSIR laboratories and provides E-mail facilities among its user nodes. The SIRNET is also connected to UUNET (Unix Users Network) via ERNET through which access to other international networks like BITNET, CSNET, and JANET is provided.

12.4.8 BTISNET

The Biotechnology Information System Network established by the Department of Biotechnology creates and maintains databases and provides network services in six different

areas of biotechnology involving 10 specialized centers in 7 cities. The BTISNET makes use of NICNET communication infrastructure for connection among its 10 distributed centers and 25 user nodes. On-line access to international databases and EASYNET is also provided using GPSS communication facilities through its PAD (Packet Assembler/ Disassembler).

12.4.9 DELNET (Development Library Network)

Delhi Library Network (Delnet) was started in 1988. National Informatics Center and India International Center are the promoters. Nearly 140 member libraries took benefit as of November 1999. Delnet offers several databases for online searching. Some of the important ones are:

1. Union Catalogue of books in Delhi libraries. 5.65 Lakh books
2. Union List of Journals in Delhi (140 libraries and 17000 records)
3. Database of periodical articles: nearly 1.5 Lakh entries.

DELNET also has several other databases for sound recordings, video recordings, Urdu manuscripts, thesis and dissertations etc. It has compiled a *Who is who* with email addresses. It provides access to commercial online databases like GISTNIC of National Informatics Center, LOC of Library of Congress, NLM of National Library of Medicine, US Patents also.

DELNET also provides Email and access via Intenet Delnet provides Interlibrary loan facilities to member libraries even outside Delhi. In Hyderabad CIEFL is a member of DELNET. DELSEARCH is an email based catalogue querying system which is very useful if their web site All services from DELNET are fee based.

Software from DELNET:

DELDOS is a software for creating MARC records in English. In Indian languages too you can use DELDOs using GIST technology. DELWINDOWS IS a similar one for Windows. DELSIS is a networking software it has following features:

OPAC facility ;Indexing Technique; Search by author, corporate body, editor, joint author, series, keywords etc; Duplicate checking; Menu driven; Online help

For current information one can go to DELNET website ate http://delnet.nic.in/

12.4.10 MALIBNET

Madras Library Network (MALIBNET) was started in 1993 as a registered society with the technical support of INSDOC, Chennai Regional Office.

Among the aims and Objectives, mention should be made of:

- Evolving a network of libraries & Information Centers in India
- Establishing appropriate links to National and International Library Networks.
- Facilitating Resource Sharing & Information dissemination through networks.

In July 2000 MALIBNET had nearly 50 libraries as members in Madras contributing actively towards the creation of various databases on MALIBNET. With the help of Communication links and sophisticated technology resources of members are shared. 17 major "Member Institutions" share the burden of helping smaller libraries. On the Malibnet server there is a CONTENTS database. This has Table of Contents of nearly 500 journals on a regular basis. A freeware is given to the member to search this database. Results are sent by Email.

Contents of Journals, MALIBNET Holdings, computerized database of Serials are made available on floppies. INSDOC's standard databases like National Union Catalogue of Scientific serials, Medicinal and Aromatic Plants Abstracts et ate mounted on Malibnet server. Another Unique feature of Malibnet is the Membership Card. With the help of the card, any person belonging to a member institution can visit the library of any other member, Facility is limited to free consultation. Annual Charges for membership start from 20000 upwards.

12.4.11 PUNE-NET

Pune Library Network is a joint program of the University of Pune Library and the National Chemical Laboratory, Pune. Sixteen libraries are active members. Some of the are: British Library, NCL, Jayakar University Library, Bio Informatics Center, CDAC, NIC etc. In the case od CDAC and Pune University their catalogues are searchable via Internet. Collections of NCL area accessible only by Members.

12.5 LET US SUM UP

The unit discusses the need for library networks and also the requirements for establishing library networks. The objectives, the activities and the range of services offered by one of the largest International library networks, OCLC have been highlighted. Referring to the Indian Scene, the networks which are operational have been briefly described.

12.6 RECOMMENDED BOOKS

KAUL, H. K. *Library Networks: An Indian Experience*. Delhi, Virgo Publications. 1992.

MACIUSZKO, Kathaleen. *OCLC - A decade of Development 1967-77*. Libraries Unlimited, 1984.

SATHYANAF AYANA, B. et al: *Information Technology: Issues and Trends*. (Festschrift in honor of Prof N. Guruswamy Naidu). Delhi, Vedam Ebooks. Vols 2. 1998. (Volume 2: Chapter 7: Library and Information Networks)

WARWICK, R T and Jenson, P. E. *Using OCLC: A how to do it manual for Librarians*. Near Shuman Pub., 1990.

12.7 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1. Write a short essay on OCLC.
2. Describe the Library Networking initiatives in India.
3. Discuss the terms Library Network, Bibliographic Network, Information Network etc.
4. Describe the activities of INFLIBNET and DELNET.

II. SHORT NOTES

a) Requirements for establishing library network

b) INFLIBNET

c) BONET

d) DELNET

BLOCK - IV : OFFICE AUTOMATION AND OTHER TECHNOLOGIES

The work in an office of any organisation involves generation, storage, retrieval, duplication, distribution and publication of information. Many times the same information may be duplicated with minor changes and reused or communicated. These activities can be handled with ease with the use of modern technology. Office automation refers to successful use of computers, telecom and other electronic gadgets for the office work.

This block deals with all aspects of considering the library as an office unit. How computers can be of use in all routine office activities is the subject matter of this block.

Unit 13: Office Automation. This unit gives an introduction to Office Automation explaining how most of the activities obtaining in an office boil down to some kind of communication or the other: written, oral, face-to-face etc. Software needed and used in the tasks is discussed.

Unit 14 deals with written communication. In particular Word Processing and DTP are discussed in detail. WordStar and MS-WORD are given as examples. To give a broad understanding, fundamentals of DTP and its advantages over WP are given.

In Unit15, Multimedia is described. With the onset of Multimedia CDs and Internet web pages containing a lot of multimedia applications, an overview is necessary. Librarian's role in putting MM products to use is discussed.

Last unit of the Block (Unit 16) deals with Electronic Mail. All aspects of Electronic Mail: what is it, ISPs, costs, advantages, mailing lists and web based email, are all covered. An Appendix gives `Mailing Lists of Interest to the Librarians'. Uses of Email in the library and information centres are also discussed.

UNIT - 13 : OFFICE AUTOMATION

Structure

13.0 Aims and Objectives

13.1 Introduction

13.2 Written Communication

- 13.2.1 Document Generation
- 13.2.2 Document Transfer
- 13.2.3 Document Distribution : Internet

13.3 Voice Communication

- 13.3.1 Telephone
- 13.3.2 Teleconferencing
- 13.3.3 Voicemail
- 13.3.4 Interactive Voice Response System

13.4 Personal Communication (Face-to-face)

- 13.4.1 Personal Information Manager
- 13.4.2 Video Conferencing
- 13.4.3 Presentations in meetings.

13.5 Other Activities in offices

13.6 Software for Office Automation

13.7 Let Us Sum Up

13.8 Recommended Books

13.9 Model Examination Questions

13.0 AIMS AND OBJECTIVES

The present unit introduces you the salient aspects of Office automation with special reference to libraries and information centres.

After the completion of the unit you will be able to:

- enumerate various communication systems in an office
- discuss the significance of Document production tools like WP, DTP and Multimedia
- discuss the Document transfer tools like Fax, Telex, E-mail
- tell about voice communication tools using Information Technology.

13.1 INTRODUCTION

Generally in any office there are three categories of people : 1) Secretarial and clerical - they type out letters, file them, retrieve them, make phone calls, buy petty things and carry out mechanical things; they offer indispensable support services. 2) Executives and Management staff : These people plan what is to be done, set goals as to what is to be achieved, supervise and guide other people's work, authorize budgets and monitor expenses etc. 3) Professionals

who are experts in various disciplines like accounting, purchase, taxation etc who carry out tasks assigned to them. All the three types of people carry out their work in unison towards common goals of the organization.

People in an office - as identified above - are concerned with managing business information. By managing we mean doing several activities like: generation, storage, retrieval, duplication, distribution, dissemination, publication, use and re-use of information. In all such activities they employ instruments, gadgets, tools and equipment which are based on Information Technology. By and large, most of the activities in an office are in some way or the other related to various types of communication.

We will see how most office work involves communication of some kind or the other. Oral Communication may be through telephone or face to face. Written messages or reports are generated using Word Processors or DTP, in addition to lowly typewriter. Distribution of the documents so generated may be distributed over ordinary post, or through telex, fax, email or other methods. People conduct meetings and discuss issues generating agenda, minutes of the meeting, action plans and so forth. Such people need help in managing resources like time, space, equipment etc. Commercial, financial and personnel activities add up to the variety of work in an office. In all these activities one can see that Information Technology (IT) comes to your help. For the purpose of discussion of office automation, the activities in an office may be classified broadly as follows, based on the type of communication as the criteria:

Written Communication

Voice Communication

Personal Communication

Other activities of business information management.

The term 'Office Automation' refers to the use of technology involving computers telecommunication and electronics or simply the use of Information Technology - IT.

We shall consider each of these in greater detail and examine how IT offers different solutions to the problems encountered in these activities.

13.2 WRITTEN COMMUNICATION

Most office work is paper work. "Paperless office" is a system that reduces dependence on paper, but depends on successful use of information technology - computers, telecom and others. Documents are produced (generated), stored, transferred and distributed. Each of these has a bearing on the use of computers.

13.2.1 Document Generation

This involves the use of conventional office equipment like typewriters, duplicating machines, photocopiers etc. During the past decade, the easy availability of Personal Computers has introduced the use of Word Processing for preparing documents.

i) Word Processing

Word Processing or WP is the electronic equivalent of typing. It is faster, convenient and versatile. Revisions are easy to carry out. Multiple copies are available quickly. As this is a topic worth learning in detail, we will deal with it in detail in Unit-14.

ii) Desk Top Publishing

Word Processors have many limitations as far as their use in publishing cycle is concerned. Desk Top Publishing (DTP) overcomes many problems of WP and is a great boon to people like copy editors, compositors, proof readers , artist, designers and others. DTP is the topic of Unit-14.

iii) Multimedia Documents

Offices no longer are satisfied with preparing documents containing mere text and graphics, using tools like DTP or WP. Multimedia documents contain in one system all types of items: text, graphics, audio and video clips. Large volumes of info comprising of multimedia formats can be put on to CD-ROM disks. Such documents become very useful because of what are called 'Hyper links'. Hyper links help you traverse up or down a document in a non-linear fashion.

Multimedia has great potential in two distinct ways in the library. Firstly, Multi media is a storage and retrieval media. Large volumes of info can be stored, searched and displayed via CDROM databases. This is of interest to the clients of a library to store documents lent to users.

Secondly, a library can develop multimedia documents for its own use. For example, orientation program of the library, self-instructional manuals in the use of the library are some areas to begin with. UNIT-15 deals with multimedia in detail.

13.2.2 Document Transfer

Prepared Documents are sent to others via Fax, telex email or by ordinary post. Following sections describe these technologies.

i) Fax

FAX or facsimile transmission has become extremely popular in every office. Fast transmission of one page of a document at a time is possible via Fax. Fax is instantaneous - true to original copies of graphics, signatures and other parts of a document in addition to the text are scanned and transmitted in electronic form. The cost of fax transmittal is just equal to a phone call for the duration of the transmission. Both the parties need to have fax machines in order to utilize this facility.

Many sophisticated fax machines have broadcasting facilities: that is the same message can be sent to many persons without additional preparation of the document. Some messages may be sent to many persons on different fax destinations at one stroke. Re-transmission is tried automatically. Whether the fax was sent without error can be known immediately. Frequently used numbers can be kept in the memory and dialing via short codes is possible. Messages can be scheduled to be sent at pre-determined times so as to make use of non-peak hour telephone rates for long distance calls, thereby reducing the cost of faxing.

Nowadays, personal computers are equipped with fax cards and once connected to a telephone it can act as a fax machine. This eliminates the need to have separate fax machines and enhances the use of the PC. All incoming fax messages are stored in computer disks. The problem of the fax machine running out of paper can thus be avoided. Fax paper is costly. Messages from the computer can be printed on ordinary cheaper computer stationery. It is also possible to avail oneself of fax facility as a part of Email subscription. Technology is improving day by day and the distinctions are diminishing between different forms of electronic communication. SuperVoice, a software enabling you to send fax from PC, is described in section under Software in this unit.

ii) Telex Transmission

Messages typed into one telex machine are transferred over telex lines to another telex machine for printing out on paper. Telex Messages have to be keyed in using special typewriter attached to the telex machine. Only upper case letters numerals and a few special symbols are available. Special rolls of telex paper, 80 characters wide, available in single or multiple plies (with carbon interleaved) are used for output. Just like a phone number, each telex machine has a unique Telex ID.

Telex terminals across the world unite subscribers to exchange messages easily. Electronic telex machines are replacing old Electro-mechanical ones as these used to be noisy, error prone and very slow. Telex messages travel on exclusive data circuits at about 750 bps. This is very slow when compared to modem speeds of 2400 bps to 14800bps, used in email. Telex can transfer only text -based information. Telex is becoming obsolete now.

iii) Electronic Mail

Documents or Message transfer can be achieved via. Electronic mail also. Electronic mail is exchanging messages across computers on a network of computers. Email is fast, secure, cheap and is becoming increasingly popular.

Email, especially if connected to internet, helps you reach nearly 200 million persons around the world. Offices may have in-house email systems based on Local Area Networks, in-turn may be connected to external networks. Unit-16 discusses Electronic Mail in greater detail.

13.2.3 Document Distribution: Internet

Documents produced using multimedia authoring tools using hyper text and hyper links are recorded on a CD-ROM or computers hard disk. Such computer documents are readable, generally at the place of generation unless multiple copies are distributed.

Internet is a network of networks spanning the world. Internet provides an excellent way of distributing multimedia-based documents. Multimedia documents have to be coded in html (hyper text markup language). Using Wordstar one can boldface a word by entering Ctrl-PB before and again after the word. Similarly HTML (Hyper Text Markup Language) has groups of marking facility to indicate headers, size of letters. Thereafter it can be stored at a World Wide Web (WWW) site on the Internet. (WWW is a facility on Internet). Such documents can be accessed around the world by anyone having access to the Internet. Some details of Internet are provided in Unit 16.

13.3 VOICE COMMUNICATION

Voice communication in an office takes place either face to face or over telephone. Present day telephones have sophisticated electronic facilities like tele-conferencing and voice mail. As telephone exchanges have gone electronic and Intelligent Networks have stepped in, many new facilities are available even telephones. These facilities aim at reducing travel, increasing productivity and are easy to use. We will see these in some detail now.

13.3.1 Telephone

The telephone is no more just a piece of simple instrument of communication. It has become versatile and indispensable. The instruments come in all varieties and forms. We have the push button telephone, rotary pulse telephone, those with re-dial facility, those with a button to switch from pulse to tone (DTMF) mode, and others with enough memory to store frequently used numbers and so on.

A number of facilities are available to the subscriber as most exchanges have gone digital. Important among these are: Call Transfer facility, Call Waiting facility and CLIP (calling Number Identification and Presentation), STD, ISD, Abbreviated dialing, automatic reminders etc. Judicious use of these facilities can increase our productivity. For instance, if a librarian is hosting a seminar and would like to answer calls coming to his office number after office hours, he can conveniently transfer such calls after office hours to his residential phone. CLIP helps identifying the calling person's identity using a special attachment. This will help screen pranksters and personal calls during office time.

Intelligent Network (IN) of BSNL offers new services, some of which will be of interest to Library Community. Some of these are: Free Phone Service, Premium Rate Service (PRM), Televoting service etc.

1. ***Free Phone*** : In Free phone service the calling party does not pay for calling certain numbers where the called party agrees to bear all call charges to that number. Libraries can offer free advice, counseling, answer inquiries etc on such free phone lines to encourage members. BSNL allots to the FP subscriber a special number like 160033yyyy (last four digits are unique to the subscriber). When the user dials this special number, the call is transferred automatically to another regular phone number of the subscriber from which he can answer the call.

2. ***Premium Rate Service*** **(PRM):** A library may decide to offer consultancy or reference service for a fee over the telephone. How does one ensure that the user pays for the service? PRM is the answer. Calls made to a PRM number are charged at higher rates (similar to STD rates); BSNL collects the charges from the caller, and shares the profits with PRM subscriber (information/service provider). A number like 09033xxxx is allotted to PRM subscriber, where xxxx is unique to each subscriber. It works on a similar principle to the Free Phone service.

3. ***Tele-Voting*** : A library may conduct a opinion poll of its service among customers using only the phone. It can subscribe to tele-voting service. A number with a special access code for a fixed short period, say one month, is allotted to the tele-voting subscriber. The last two digits called the choice digits indicate the preference of the calling (voting) user. BSNL gives a count of various counters at the end of voting period. For instance you can ask:

   Are you satisfied with the Book Collection? Add 00 as last 2 digits if the answer is 'NO'. 01 if the answer is YES and 02 if the answer is "can't say".

   If the opinion poll is for a week, at the end of the week, BSNL would tell you how many users dialed to you with each of the three choice digits.

Cell Phones

Introduction of cellular phones has further revolutionized voice communication. They work using wireless and terrestrial networks. A Mobile service Provider (MSP) gives cell phone connection. In addition to normal phone charges one has to pay for using the "air-time" depending upon the duration, whether it is in-coming or out-going call, distance etc. The handset comes with a number of facilities. You can keep the phone off; you can have "vibratory alert" of in-coming calls, thus avoiding disturbance to others when you are in a public place; you can be reminded of appointments by beeps of different kinds; You can store different phone numbers for quick reference.

If the MSP offers SMS (Short Message Service) the cell phone can be used to send short messages to other subscribers, very much like pagers. If the MSP allows WAP enabled (Wireless Application Protocol) services, you can use the cell phone to send email, surf Internet, receive several information services on your phone including stock quotes, cricket scores etc.

Some well known MSPs are : Tata, Aircell, RPG, Bharathi, MTNL etc. A cell phone user is always reachable. He can also make STD calls at local call rates within the service providers network domain. A library can offer services via cell phone to the customer on many items like:

- Arrival of reserved books
- Book review session announcement
- Reminder that the library will be closed
- Return books for Stock Verification
- Reminder for return of books

13.3.2 Teleconferencing

Teleconferencing involves several persons carrying on telephonic conversations with each other simultaneously for a common purpose. All of them remain connected from wherever they are. Whatever any one person says is heard by all involved in the teleconference. Responses are transmitted instantaneously and simultaneously to all. Main advantage of teleconference is that persons need not travel to a common central place for discussions. They can remain wherever they are, and carry on official work, irrespective of time zone problems. For example if a group of persons in a company want to talk to a counterpart (say their marketing) personnel in their US office, a conference call can be set up around 8.00 p.m. here!

Teleconferencing facility is offered using some special software at the telephone exchange level. Initially, the operator has to set up the conference call - that is, call each of the parties and ascertain his availability and then provide the connectivity to several phone lines. It is possible for a group of persons in one location to talk to groups of persons in other locations, using speaker phones. Here the incoming voice message is amplified through speakers so that all in the room can hear the conversation.

13.3.3 Voice Mail

Voice Mail is an additional facility provided in major Electronic Telephone Exchanges of private companies and organizations. When you ring up a person and if he is not around to pick up the phone, the VMS (Voice Mail System) picks up your call and allows you to leave a message for the friend. Your friend, as soon as he uses the phone again, gets to know (through a flashing light on his phone or through a different tone on the receiver) that someone has left a message. He simply 'dials' into his voice mail box and listens to the message left by you. VMS is much more sophisticated than simple telephone answering device.

There are several advantages of VMS. Firstly, you do not waste a number of calls trying to reach your friend or he trying you in return. Secondly, the VMS automatically alerts their recipient about pending messages to be read. Thirdly, there is a provision to record a

message just once and broadcast it to a number of voice mail boxes. For example, if you are scheduling a meeting, you can leave a message for all concerned over VMS.

Voice Mail is becoming very popular. Special Electronic Exchanges fitted with VMS (a software) and what are called Dual Tone Multi Frequency (DTMF) telephones are required to efficiently use the system. This will be especially useful on long distance (STD) calls if your purpose is just to leave a message. Since messages are recorded in the computer, the recipient cannot deny receipt of the message.

Voice Mail is offered as an optional service by BSNL in Mumbai and Delhi. If one subscribes to Voice Mail, he is allotted one Voice Mail Box. This enables the subscriber to receive messages from others recorded into a computer even though he may not have a phone of his own. Service persons like Plumbers, electricians etc can collect orders for their services via Voice Mail, confidentially, without disturbing anyone.

13.3.4 Interactive Voice Response System (IVRS)

When a telephone number is changed and you want to know the correct and current number, you can ring up (in Hyderabad) 1991. You are prompted to enter the old number and then the system tells you the new number. This is a simple example of Interactive Voice Response service. For quite some time, Airlines and Railway reservation status inquiry has been put on Interactive Voice Response service. Libraries can offer IVRS for answering queries like: How many books are pending return? When they are due, status of reserved items, holiday confirmation etc. *Tata Infotech* has an IVRS that can be customised to work with the circulation modules of an automated library.

13.4 PERSONAL COMMUNICATION (FACE TO FACE)

Quite a lot of face to face personal communication takes place in an office. Organized meetings , seminars, workshops discussions presentation are some methods of group communication. Organization of such events calls for, in a large company, sharing of resources like space (seminar rooms), communication equipment like Overhead Projector, Mike, Computer Terminals and other projection equipment; and ascertaining that the participants for the meeting are free at the time of meeting.

13.4.1 Personal Information Manager

Nowadays software tools like Personal Information Managers (PIM) are available. They help you schedule meeting, share resources and get confirmation of participating persons concerned etc. Such tools normally work in union with local email system. Such tools also contain various facilities to help the individual plan his time by noting down daily appointments, reminding oneself about appointments etc. Computers perform what personal secretaries are trained to do, using Personal Information Managers. (See also MS Outlook Express explained elsewhere in this unit).

13.4.2 Video Conferencing

Like teleconferencing, Video conferencing helps a number of people in different locations to discuss with each other without ever leaving their offices. Video conferencing substitutes face to face, same place, meeting by showing images of persons on the other side on a TV screen.. It is possible to project the Video Camera to objects like a machine in operation for demonstration, a white board with points for discussions as a remembrances etc.

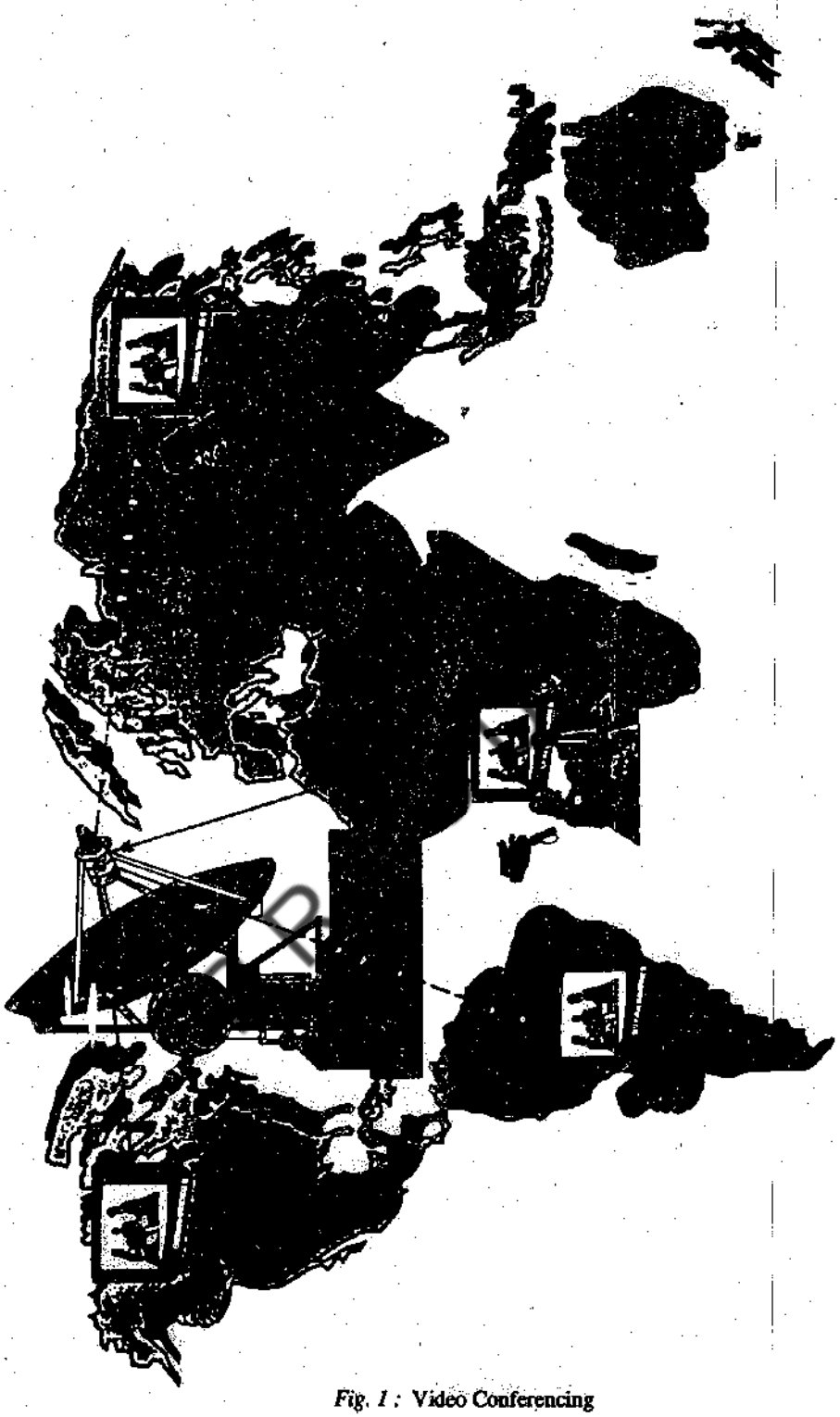

Fig. 1 : **Video Conferencing**

Videsh Sanchar Nigam Limited (VSNL), Bombay offers this facility to large companies having clients/offices in a number of locations abroad. Video conferencing requires costly installation of equipment, computer camera etc. Besides high-speed data communication lines. For instance, Satyam Computer Services Ltd., Hyderabad have their Video Conferencing set up in their Software Technology Centre. Video conferencing cuts down travel costs considerably, and enables fast decision-making. The Chief Minister of Andhra Pradesh is well known for organizing video conferences with district collectors.

13.4.3 Presentations in a Meeting

"One-to-many" type of "face-to-face" communication is found in lectures, seminars, training, discussions and presentations. In such situations, equipment like Over Head Projectors, Slide Projectors, Computer Terminals with LCD projectors, Electronic White Board and epidiascope are used.

Electronic White Boards are useful in a meeting to keep a record of what has been discussed. The speaker writes on a special screen similar to the Black Board. Before 'wiping' it out for writing further items, the information shown on the screen can be printed onto a paper printer. Thus all scribbling, notes, formulas, sketches, rough calculations, -everything on the board - is printed out exactly as they are. This frees the users from taking notes so that they can concentrate on the discussion. A verbatim report of all that happened is also available as hard copy. Papering minutes of the meeting for later action becomes easy. The information on the White Board can be faxed to another location, captured on a Video Conference presentation etc.

In the case of presentations using the computer, Microsoft has a software called MS Presentation (which a part of Ms Office 97). Using this software, it is possible to prepare Slide presentations with color, different backgrounds, and animations, including hyper links. Including pictures, graphs, charts, tables etc is possible. It is also possible to include sound clips making fully functional multi media presentation. For instance, when you have completed your presentation and would like to end it with a "Thank You" slide, you can play a sound recording signifying clapping of hands!

13.5 OTHER ACTIVITIES IN OFFICES

Apart from the primary activity involving various forms of communication as described above, any office may also have certain common activities like the following:

- management of human resources
- purchasing materials for office use
- selling goods/services (not relating to main business)
- financial and accounts maintenance
- communication with outsiders and customers.

For instance, in a large library, activities relating to staff can be automated. Employee attendance control, Employee payroll maintenance are some examples. A number of well designed ready made software are available. Employee attendance control systems normally provide an automatic attendance recording system linked to a computer. Each person is given an Identity Card which is readable in a bar code reading system or magnetic system.

Recording attendance mechanically thus has a lot of advantages. Late coming and early leaving can be recorded with proof. Department wise reports of attendance, by exception, (those who are absent) can be generated. Linked to payroll system, calculations of number of days attended, leave taken, extra hours put in, penalty for late arrival etc can be computed easily. Recording of attendance can be quick and tamper-proof. Data can be archived for any length of time.

Pay Roll Processing systems are most common in any large office. Employees salaries every month are calculated automatically depending upon factors like days of attendance, grade, scale, allowances and many other complicated details. Statutory deductions like ESI, PF, Income Tax, Profession Tax, other organization - employee related deductions like canteen, loan recovery, festival advance recovery etc. can all be done automatically.

Cumulating of data for annual jobs, backup for security, answering queries regarding employees who left the organization are all possible. Nowadays, it is not even necessary to provide in house facilities for payroll processing. The job can be hired out for a nominal fee.

Financial accounting packages are available for purchase off the shelf. Most of them take care of multiple sales and purchase books, bank and cash books. Several views like cash book, bank book, purchase book, sales book, ledger, bills receivables, trial balance, journal, profit and loss account, balance sheet, bills history are available. Even a novice to accounts can generate several reports easily. Tally, Wings, EX-2000, etc. are some well-known accounting software packages.

The above has been mentioned only to remind you that any office is not just a communication center. But the miscellaneous requirements are not peculiar to any single office but are common to all. Use of computers will be helpful in these areas also.

13.6 SOFTWARE FOR OFFICE AUTOMATION

Office Management includes many activities like written communication resulting in document generation, storage and retrieval, filing, message transfer, copying and duplication, normal mailing, electronic mail, fax, telex, and a host of other related ones. No single software package can take of all activities. Separate software packages dealing with specific items like word processing, desk top publishing, spread sheet programming, time management, document digitization, storage and retrieval, filing programs, address management systems, personal information systems, front end electronic mail programs are all available. However, there is a trend towards integrating several functions into one package and such packages are also made available on different platforms like DOS, Unix, OS2 and others.

Let us now discuss a few software items for office automation :

MS Presentation has already been discussed in brief under Face-to-Face Communication: Presentation in Meetings. Units 14 to 16 discuss Word Processing, DTP, Electronic Mail, Multi media authoring tools in some detail. Earlier section gave details of Software packages for Accounting, Payroll, Attendance Recording etc.

Spread Sheet software like ***Lotus 123*** or ***MS Excel*** can be used in accounts, finance and budget related activities. Pay roll, purchases, bank statements etc can be put in spread sheets. A good data base management system like Fox Pro, dBASE or MS Access will be very useful for maintaining addresses of contacts, suppliers, membership data, publishers etc. An Electronic Note Pad is a software that duplicates the card Index seen in many offices. Member records, suppliers list etc can be handled by NotePad also.

Microsoft has a software called ***Outlook Express***. It is basically used to manage Email. As a part of it, there is a scheduler program. Using the scheduler, one can:

- organize meetings
- allocate or reserve resources like room, projectors, coffee machines
- ascertain availability of participants for the meeting
- alert participants before the start of the meetings etc.

Outlook has an Email "Address Directory" coupled with a very powerful 'contacts' database. Any software like Outlook can be used only in a networked environment. Libraries having LAN can benefit by Outlook Express.

SuperVoice

SuperVoice is a software that helps you to convert your PC - modem - phone combination into a powerful fax machine, answering machine, file downloading device etc. It also has a dialer program that recognizes different types of telephone rings (long, short, sharp rings) and take appropriate action. With Supervoice you can keep a log of all calls made.

Dragon Speech Recognition Software

Using this software you can dictate using a microphone whatever you want to enter into the computer: the words appear directly on the screen! The accuracy obtainable is about 95%. Dragon Speech can be used with other utilities like MsWord, Eudora, WordPerfect and others. Editing text already entered can be done via Voice commands in natural Language. No special set of limited commands needs to be learnt. An in-built Vocabulary builder learns new words of the user - the information context, spelling and pronunciation. Each user can customize his own dictionaries. With the help of Dragon Naturally Mobile, it is possible to dictate messages into a hand held recorder for later transcription into the computer.

The Web site of ITRAMA.com has published an exhaustive directory of some 4700 IT related products and services including Software produced or supplied in India. It is in CDROM format available free of cost. A copy was distributed with OCT 2000 issue of Computers@Home magazine. Another source for finding software is to look into directories published by NASSCOM, Delhi. A sample list of software for Office Automation is given in Table-1 at the end of this Unit.

13.7 LET US SUM UP

Offices have one main purpose, that is communication. In this connection, the telephone, Email, Voice Mail, WP, DTP, Fax, Telex, Video Conferencing, Teleconferencing, Multimedia, Multimedia document authoring and distribution of multimedia documents via internet or intranet are some of the tools/facilities discussed. Some non-communication functions relating to managing business information have been discussed along with solutions offered by Information Technology. Information Technology has a major role to play in any office in the future.

13.8 RECOMMENDED BOOKS

BALAGURUSWAMY , G. *Office Automation*. TMH

MAYER, J J. *Time Management for Dummies*. Delhi: BPB, 1996.

BASANDRA, SK. *Computers Today*. Delhi, Galgotia. 1997. Chapter 14.2

13.9 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) Write an essay describing how IT plays a major role in the field of written communication.
2) Write a note on Voice Communication and the role of IT
3) Discuss the salient features of present day telephone, fax and telex communication, with special reference to libraries.

II. SHORT NOTES

a) Fax
b) Telex
c) Internet
d) Teleconferencing
e) Video Conferencing
f) Personal Information Manager
g) IVRS
h) Electronic White Board
i) Intelligent Network services of BSNL.

Table 1: Some Software Packages for Office Automation.

	Name	Description	Vendor
1	Arthalekha Accounting Package	English and one more Indian Language of Choice- Inventory Control Included	Modula Infortech
2	Wings 2000	Financial Accounting; accounts receivable; accounts payable, invoice printing etc	Wings Infonet
3	Tally Gold Multi User	Easy to use accounting Package for India business.	Rishab Marketing
4	HR Co-ordinator	HR management solution with support for personnel detail, including photo, internet password.	Genuine Software
5	Payroll	Payroll and HR Accounting Information. IT, ESI, PF; ERP application	Hypersoft Technologies
6	Paypack	Payroll and HR accounting software. PF, ESI etc are covered.	Accountronics
7	MS-Access 2000	Database	Microsoft
8	Foxpro 6.0	Database	Microsoft
9	MS SQL Server	RDBMS	Microsoft
10	Merlin	Software for Trading used in Sales, purchase, marketing, Inventory control	Pentasoft Technologies
11	Acrobat Capture 3 for NT Personal Edition	Document Management.	Adobe
12	Document Mgmt Extensions	Document Mgmt: to organize unstructured information centrally using Exchange Server	Bunka Orient India

	Name	Description	Vendor
13	Effect Office 2000	Instant Storage and Retrieval of any document – easy retrieval; full text search; compatible with Fine Reader.	Warharot Infosys.
14	Office 2000 English International MS	Office Suite - Excel, Word, Access, Outlook and Presentation.	Microsoft
15	Project 4 for Windows	Project Planning and Scheduling	Microsoft
16	Dragon Naturally Speaking	Speech Recognition Software	HCL
17	Leaflet Office 2000	Complete Indian Language Software for Office; Email, Spell Check etc covered	CDAC
18	NTRANS	Translation Software for Indian Languages	CDAC
19	SULIPI 9 V2	Indian Languages WP	Rashi
20	Fine Reader Standard 4	OCR Software	Chataria Infotech

UNIT - 14 : WORD PROCESSING (WP) AND DESK TOP PUBLISHING (DTP)

Structure

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- 14.2.2 Common Features of Wordstar
- 14.2.3 Advanced Features of WP
- 14.2.4 Advantages and Limitations of WP
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- 14.3.4 DTP Software
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- 14.3.6 Limitations of DTP

14.4 Let Us Sum Up

14.5 Recommended Books

14.6 Model Examination Questions

14.0 AIMS AND OBJECTIVES

The aim of the unit is to introduce you to Word Processing and its application in library and information centres. It also briefly introduces the Desk Top Publishing (DTP).

After reading this unit, you will be able to

- say what is Word Processor and Word Processing
- list features of a standard WP Package like Word Star
- explain advanced features in other packages
- discuss how WP is inadequate in performing various publishing tasks
- describe what is DTP, its components, important features and its limitations.

14.1 INTRODUCTION

"WORD PROCESSING" has become popular even in our country for more than a decade now. For instance, there was an illustrated article on Word Processing in TINKLE,

one of the popular children's magazines, as far back as 1987! In this unit, we shall discuss the generalities of Word Processing, its applications to libraries, advantages and limitations and certain advanced features of sophisticated systems. WP will denote Word Processor or Word Processing depending upon the context.

14.2 WORD PROCESSING (WP)

Word Processing is the Electronic Equivalent of Type writing. A Word Processor has five basic hardware parts:- the video display terminal, the CPU (the Central Processing Unit), the Floppy Drive or hard disc drive, the keyboard and the printer. When we type at the Key Board of a Word Processor, the text is not printed directly on paper; but it gets displayed on a Video Screen. As the text is held in electronic form, changing the text once typed in - like addition, deletion, correction etc. becomes very easy. You can store on floppies what you have typed .It is also possible to render certain words in BOLD Face, underline them for emphasis, move complete paragraphs from one point to another etc. All these can be accomplished by just a few keystrokes at the keyboard.

14.2.1 Different Types of Word Processors

The term Word Processor usually refers to a stand alone machine exclusively devoted to word processing only. This has a key board with many additional special keys to facilitate maximum use of the capabilities of word processor. The printer attached to it is capable of generating different sets of fonts to take care of sophisticated printing needs of a publisher. A stand alone Word Processor may be needed where the requirements are heavy, say in a publishing house.

Most Microcomputers come with some sort of Word Processing Software. WORDSTAR is one such WP package. Besides using the computer for WP, it can also be used for other types of applications like spread sheets, Data Base management, regular Data Processing jobs employing Programs written in well known languages like COBOL, BASIC etc. Thus, Word Processing is one of the several applications for which the computer is used.

In another situation, you may have a large Mainframe Computer or a Central Minicomputer with a number of Terminals. The Central Computer has WP software, and the Terminal is just used to access the Central facility on a time sharing basis

Having seen what is Word Processor or Word Processing briefly, let us look into several of the most common features of WP now. Later on we shall discuss special features available on different WP Packages, other than WORDSTAR. [For the sake of simplicity of a definition, `Common features' are those available in WORDSTAR. `Special Features' are those not available in `WORDSTAR'].

14.2.2 Common Features of WP

WP helps us keep textual material (as against numerical data) like letters, contracts, manuals, correspondence, reports etc. in electronic form. The advantages of keeping our letters in Electronic form are many.

WORDSTAR is a very popular WP package available on Personal Computers. It is a menu driven package where the menus appear in a rectangular portion on the top of the screen. The menu items are chosen through a combination of several keys including the

Control Key , Alt Key. Many commands can be issued using Function Keys as a shortcut. Menus of Wordstar are illustrated in Fig-1 below.

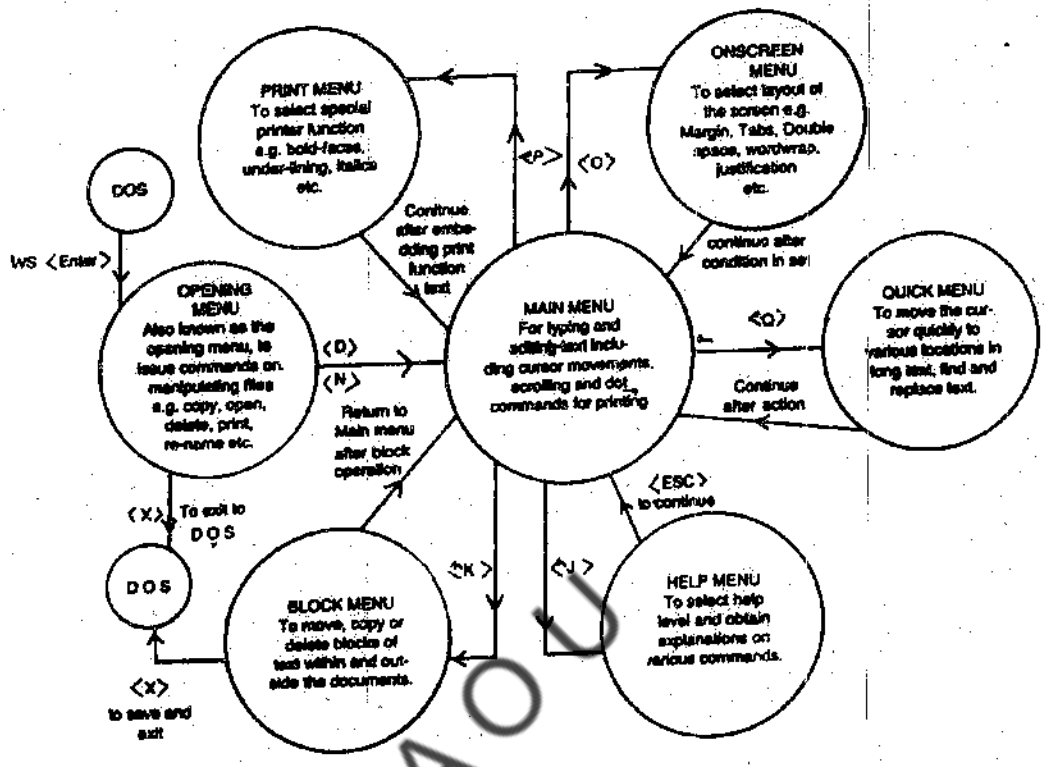

Fig-1 : Menus of wordstar

Even a basic understanding of Wordstar or any other package can best be done only through practic on the computer.

i) Normal Editing

WP helps you correct already entered text by: Deleting characters, words, lines, sentences, paragraphs etc. Inserting whatever we need, how much ever needed and wherever required; when the Text is long, we can scroll the displayed portion up and down, or horizontally from left to right etc.

ii) File Oriented Commands

As most of the WP packages are file oriented, they help us create files with names given by the user; Make copies of files; Rename existing ones by other names; Erase or remove files forever, when we no longer need them.

iii) Find and Replace

If the word 'COLOR' should be replaced by 'COLOR' wherever it occurs in a file this can be achieved easily through "Find and Replace" command. It is possible to mark portions of text with place markers (like book marks which we use in a printed book to tell us where we left) in the file to help us come back to desired places.

iv) Block Operations

WP are normally good in handling blocks of text data. You can mark the beginning and end of a piece of text as a block. Thereafter you move it - i.e. Shift to another location in the file or it can be written out as a separate file. A block can be copied, that is, you can

leave the original in its place and have a copy in another place in the text. It is also possible to take an external file and completely 'read' them into the file you are editing, i.e., merging one file into another is possible.

v) Formatting

A variety of facilities are available to format the text, when it appears on the screen. Some of these are: The page can be defined in terms of the required left margin, right margin, or page length (lines of Text). Paragraph heading and sectional heading can be "centered' easily. When we are typing in long paragraphs, we can set the Word Wrap facility on. This means that we do not have to end each line with carriage return as we do in manual typing. The words wrap around and go to next line automatically when they cross the right boundary. With right justification, we can ask WP to align the para to right margin (as in printed text) to give a pleasing appearance. [Extra space in a line is justified by expanding spaces suitably]. The Formatting features allow you to hyphenate words as and when needed.

vi) Print Options

When the material is sent to the printer we may require it to possess special characteristics. WP provides for many of these. Figure-2: Illustrates some print options:

1	UNDERSCORE	UNDERSCORE
2	DOUBLE STRIKE	**DOUBLE STRIKE**
3	BOLDFACING	**BOLD FACING**
4	OVERPRINT	N + Z
5	SUBSCRIPT	SUB$_{SCRIPT}$
6	SUPERSCRIPT	SUPER^{SCRIPT}
7	STRIKE OUT	~~STRIKE OUT~~

Fig-2: Print options in Wordstar. Under item-4, the character was obtained by overprinting Z over N.

Besides the above, there is provision for NON-BREAK SPACE; Changing the pitch (space between characters); stopping the printing for, say, changing the print wheel; to shift the ribbon to get different colors etc.

Printing out a file can be done directly onto a disc or onto paper. Any desired portion of a file can be printed. Page size can be varied at will. Different print style fonts etc can be changed. Thus quite a lot of flexibility is available during printing operation.

vii) Help Level Adjustment

Word Star is a menu driven program, for most part, several menus are presented and commands are chosen from the Menus. Once the user gets familiar with various menus and becomes an expert in handling the system, menus are no longer needed, not at least that frequently. It is possible to turn off the menu screens so that Word Processing is faster. It is also possible to get on-line help for most of the commands

viii) Backing Up

Word Star automatically prepares a back up file for safety. There after at any point of time, we can have 2 files, the current one and the backed up version. Back up files reflect the changes made in an earlier session.

ix) Spelling Checking

Once we have a created text file, we can check the spelling of all the words against a suitable dictionary. This kind of Proof reading is fast and accurate. We can correct the mis-spelt words; New words can be added to 'Dictionary'.

x) Merging Files

Merging files is also possible in WORDSTAR using the special Mail Merge option. We can have a separate list of addresses of persons in a file. Another Text file may contain the 'letter' to be sent. Mail Merge will print out one letter for each person by picking out the name and address from the "Data File". The recipient feels as though he has received a letter exclusively typed out for him. It is also possible to leave portions of letter such as date, Invoice No. etc. to be "typed in" while the letter is about to be printed out.

xi) Importing / Exporting

It is also possible to prepare 'data files' using WP. These data files in turn can be converted and used by programs like dBASE III, Super Calc, or Basic Programs etc. This is called Importing or Exporting of Data files. The idea is that once a set of data has already been typed in, further repetitive keying in should be avoided.

xii) Print While Edit

Wordstar allows you to "edit" a file while some other file is being printed out. While this is possible, as the printing takes higher priority, editing becomes somewhat slow.

14.2.3 Special Features of WP Packages

Let us now look into some of the features not available in Wordstar but which form of part of WP facilities provided in other packages.

i) Automatic Reformatting

Some WP packages (eg. PFS Write) provide for automatic reformatting. In Wordstar reformatting has to be done again and again after changes.

ii) Automatic Saving

Packages like WORDLORD provide for automatic saving of files. That is as and when you are editing or inputting into a file, it is automatically saved at fixed intervals of time. The user can set the period for saving even at 5 minutes.

iii) Printing from Memory

Some programs permit you to print from Memory. This means, you don't need to create a file in order to print out a temporary text. Printing is faster too.

iv) Foot Note Capability

Persons preparing articles for learned journals, dissertations etc. have to use "Foot Note" capability. Matter appearing as Foot Note should be kept on the same page in which it is referred to. This is possible in, for example, 'Omniwriter".

v) Spelling Check while Entering Text

Lexicheck is a good spelling checking program available in WP Word Juggler [Apple Iic / IIc computers]. The beauty of this spell checker is that it allows you to check the spelling of a word as soon as you have entered it!

vi) The UN-DO option

Some WPs (for example HOMEWORD available on variety of computers including IBM PC, Commodore or Apple II family) have an UN-DO command. This command brings back deleted lines or Texts back into view

vii) Capitalizing

Perfect Writer (available on CP/M machines) allows capitalizing of words, besides foot note and indexing facility.

viii) Conditional Merging

A paragraph could be included in the text for printing out if the value of a variable meets a certain condition. For example, if the amount due from a customer is beyond a specified sum a paragraph threatening to take a severe action could be included in a "Dues-collections-Reminder letter".

ix) Special Fonts/Characters

Extended Greek, Math, and Statistical symbols, foreign languages character sets are supported by WORD PERFECT (available on IBM PCs). This is very useful and necessary for scientific writers.

x) Security of Files

Some WPs allow the use of passwords along with file names and protect user's files from being misused. Viewing, reading, printing, editing, copying etc. - any or all of these aspects may be restricted. Microsoft Word offers security to files.

xi) Multicolumn Printing

Some Word Processors allow printing of text in 2 columns, as it generally appears in Journal Articles, conferences Proceedings etc. Single Space printing achieves economy of paper used, and double column printing enhances readability. If the printer is capable of shifting paper backwards via program control, then printing is done column by column. Otherwise both columns, consisting of one line is printed at a time from top to bottom.

xii) Indian Language WPs

"Lipi" is a dedicated Word Processor developed by CMC Ltd for Indian languages. Assamese, Bengali, Gujarat, Hindi, Kannada, Marathi, Tamil and Telugu are the languages available as options in addition to English. Mass mailing, screen editing page formatting, numbering, bold typing, filing etc. are the facilities in Lipi.

"Shabdmala" - Tata constancy Services have brought out Shabdmala. This Word Processor is capable of intermixing Standard English text with any other language text with Devanagari script. Screen management, error correction while forming Devanagari letters, regular editing, file maintenance etc are provided.

There is another multilingual software package called `Bharati' developed by CIIL for Indian languages.

xiii) Microsoft WORD for Windows

Microsoft Word for Windows is a GUI (Graphical User Interface) based Word Processor. This package offers many advanced features. Some of these are given below:

- Pictures can be included
- Tables can be included
- Printing can be pre-viewed
- Complete spreadsheets from Excel can be included
- Graphs can be included
- The page can be seen enlarged or reduced

14.2.4 Advantages and Limitations of using WP

There are several advantages as well as limitations of using Word Processing software. Some of the major advantages and limitations are listed here.

i) Advantages of Using WP

1) Multiple copies of any letter can be printed out - each looking as true as original. No extra typing is needed.

2) Documents varying from each other in some small measures like name, address etc. can be 'mail-merged in large volume production and printing. This saves time needed for repetitive typing.

3) Proof reading, Checking Spelling, Correcting text throughout etc. are all time saving and manual work is very tire some.

4) Printing is faster than typing, as Printing speeds are of the order of 180 to 660 words per minute.

5) Storing document in Floppy Disks saves space. Transferring documents from one location to another via computers linked through telephone lines, makes delivery of letters documents etc. very quick and error free.

ii) Limitations of Using WP

While Word Processing improves productivity, quality of output, and removes drudgery of clerical typing work, thus freeing the typist to do better work in other areas, and add the intangible benefits, there are no real savings in terms of expenditure. WP as compared with Typing is costly. Initial Equipment, accessories, Ribbons, Floppies, Printheads, Daisywheels, Paper etc. are all costly. Some Training is also needed to get most out WP.

14.2.5 Library Applications of WP

In as much as the Library is also an office turning out paper work, all types of correspondence, letters, Forms, Tables etc. can be prepared using WP. Preparation of Manuals for the Newcomers, brochures explaining the rules regulations facilities etc., reports on studies undertaken, project and budget proposals to authorities etc. can be done on WP.

Routine uses would be - preparation of List of Additions, Bibliographies, Documentation Lists, Abstracting Bulletins etc. In the case of Bibliographies, keeping them updated becomes very easy as, nothing needs to be retyped. Only additions and alterations or corrections need be done.

Several Form letters used in the library can be conveniently done on WP. Reminders for return of books, non supply of periodicals, books etc. are some examples.

Abstracting Bulletins

All of us know how abstracting periodicals are prepared. Abstracts are written or typed out on abstract cards by abstractors. These are cumulated once a month or so and sorted out into some useful order of subject/topic or other criteria. Then they are given Serial number, continued from earlier issue. At this stage the entries are "frozen" and then photocopies taken for multiple copies. Because of the need to 'Freeze Entries', one has to wait till all abstracts for the period are received from the abstractors. With WP one can go ahead and enter whatever abstracts are received then and there. Changes, rearrangements,

insertion of abstract number etc. can be made easily later on in one sitting. This will speed up production of Abstracting Bulletin.

Some Libraries prepare catalogue cards for all its branches or departmental libraries. Such centralized cataloging involves production of multiples of catalogue cards to be printed out. WP comes in handy in such situations also.

As an aid to the author in preparing lectures, manuscripts for publications, drafts for circulation for approval of authorities within an institution, WP is indispensable.

Given below is a list of typical applications in the library

- Reprint request letters
- Request letters for catalogs of equipment's or products.
- Request for quotation for materials.
- Purchase orders
- Interlibrary loans : Request/ reminders/ renewal etc.
- Reminders for any follow up action
- Minutes of meetings
- File of frequently used quotations, statistics etc.
- Lists of addresses of booksellers, clients, borrowers, staff, local libraries etc.
- Frequently needed and updatable information like railway/ bus/ flight timings
- Internal memos
- Bibliographies, Abstracting bulletins
- Book Recommendations by users of the library
- Addresses of suppliers of library material.

14.3 DESK TOP PUBLISHING (DTP)

Work in any office involves communication and correspondence, discussions across the table. Communication can be through telephone fax telex or e-mail but mostly it takes place through written documents generated for internal and external use. Discussions, meetings and presentations also end up in agenda, minutes, reports. Information Technology offers many solutions to facilitate management of written communication in an office. Use of computers for word processing is one such area. This unit explains how Word Processing is inadequate and explains the advantages of DTP over WP in some of specific publishing tasks.

14.3.1 Conventional Publishing Process

The steps involved in traditional publishing can be studied by looking at the responsibilities of various persons doing the job. We have the author, editor, copy editor, artist and designer, proof reader, paste up artist and finally the printer engaged in various stages of publishing activity.

Author conceives the idea contained in the publication. He describes the thought contents in natural language by committing them to paper by typing or writing out in long hand or perhaps into a computer using a Word Processor. Author also suggests pictures and illustrations - what they are and where they fit in.

Editor decides whether the document is fit for publication by checking the document for clarity, language, style and other aspects. If necessary the author re-works on the document based on the suggestions from the editor.

Copy Editor looks into grammatical and spelling errors and consistency in the whole document thus ensuring that qualitative points have been taken care of.

Art Designer undertakes the responsibility of seeing that the publication communicates with the target audience. He tells what fonts to be used, decides page layout, physical size etc; the artist on the other hand creates the final art work based on author's rough cuts or verbal descriptions.

The *Compositor* is in charge of type setting. This can be manual as in the case of Letter Press Printing or automatic using Linotype machine. Phototype setting eliminates the need to use molten metal types by producing photographed text directly by photographic methods.

Proof Reader compares the author's manuscript and the first proof (gally proof) and corrects all errors - spelling mistakes, page numbering, omission of lines etc. Corrections are carried out by compositor. This cycle is repeated till an error free text is obtained.

Paste up Artist pastes the galleys containing text and art work having pictures on a board which forms the whole page. The boards, called mechanicals, are then passed on to the printer.

Printer makes films out of mechanicals, transfers an impression of the film to the printing plates and finally to multiple copies. Generally Off-set Printing method is used to get thousands of copies from a single plate.

14.3.2 WP to DTP - An Advancement

Having seen the various stages of publishing in the traditional way, let us see how a text processor or word processing as it most often called (by mistake) is not fully equipped to help us.

Word Processing is the marriage between the typewriter and electronics. Word Processing offers many advantages over manual typing, as already seen. However the requirements of office correspondence have become more sophisticated, complex and demanding instead of merely being a means to achieve communication through written media. Correspondence and company reports, manuals, circulars, memoranda product/service catalogues, proposals are no more plain text involving just one type of type face plus and a few tables or charts. There is a need to introduce variety, provide a pleasing overall impression by a mixture of pictures, letters of different sizes and shapes.

A publication, as against mere office correspondence, is intended to be widely circulated. Visual impact and communicating to the reader is important. Cover design, paper quality, page layout, quality of illustrations etc. all play a role in enhancing the aesthetic aspect. This is intangible but necessary. DTP overcomes the limitations of WP by providing a lot more support in many publishing activities

An author's job of preparing the manuscript can be easily done by WP. His intellectual activity relating to thought/ideas and the subject matter of the publication cannot be done by machines. The Editor cannot also be helped much by WP. Copy Editor, however, has to remove spelling errors and grammatical errors. Many WP packages contain automatic spelling checking and grammar checking components making the copy editor's job easier and faster.

The job of artists and art designers has a lot to do with graphics, pictures or illustrations. WP is not fully equipped to handle graphics. Only text, perhaps different fonts,

good page layout taking care of margins, page numbers, headers, footers, spacing is possible. Regular publishing includes lot of graphics, different fonts, colour combinations, pleasing page layout etc. WP has limited choice in the case of selection of type faces.

Compositors and proof readers benefit greatly from Word Processing. The text can be corrected very easily. No re-composition is needed. Page and paragraph formatting is of immense help. However insertion of graphics is not a common feature of Word Processing. Normally Dot Matrix Printers or Daisy wheel printers are used for printing and their output is of poor quality. Although many WP packages can use Laser Printers, such packages do not make use of all the facilities of Laser Printers.

By considering the various stages in publishing, we have seen that WP is woefully inadequate to meet the publishing needs. Desk Top Publishing is decidedly an advancement. Many publishing tasks can be simplified by DTP, as we shall see a little later.

14.3.3 Components of DTP System

Computers, scanners and Laser Printers form the most important components of DTP. Let us see these in more detail:

i) Computers

DTP was first developed to work on Apple Macintosh Machines. Later on when IBM PC range of computers proliferated the market, DTP packages became available for IBM systems as well.

DTP applications are memory intensive and require fairly large amount of disk space also. As technology is changing fast, more and more sophisticated systems are available at less and less prices. Any recommendation on a suitable configuration is likely to be outdated very soon. In 2000, the requirements for a DTP system were:

Pentium 2; 700 Mhz; 128 MB Ram; 17 GB Hard disk; Video card with 32 MB VRAM; 101 Key Board; Creative Sound Blaster Card; 17 inch high resolution color Monitor.

ii) Monitors

Needless to say, DTP requires high-resolution screen. CGA offers a resolution of 320 x 200 pixels while EGA monitors yield 640 x 400 pixels. VGA colour monitor resolutions are of higher order. However, actual printing quality is not governed by screen resolution. Even though you may see a picture with poor resolution, good laser printer can give clear prints on paper. Good resolution is needed to make corrections of graphs etc. on the screen using mouse or key board.

iii) Scanners

A digitiser converts an image or drawing into digitised information so that it can be stored, processed, displayed on the screen, printed on paper or transferred as a computer file from one computer to another or via floppy or email. Editing the images on the screen may change colour, content, shape or form of the pictures. Such scanned pictures can later be inserted into text in appropriate places.

Scanners almost look like photocopiers. Just place the diagram to be copied on a flat bed of the scanner. A thin stream of light scans the document and produces the scanned image as a file in your computer. Scanners come in different sizes, resolutions, speeds and colour capabilities. A scanner also comes with an OCR (=Optical Character Recognition) software which converts text part of the picture into ADCII format. This conversion makes text part searchable, indexable etc.

iv) Laser Printers

A laser printer works in a similar way as that of a photocopier. It uses a photo conducting drum and a copier-style paper handling mechanism. Toner is applied and fused onto the paper resulting in printed output. Its output quality is unmatched with any other computer printers. Besides, laser printers produce one page at a time in contrast to dot matrix printers or daisy wheel printers that produce one character at a time or line printers that produce one line at a time. Laser printers produce no noise during their use.

This feature of laser printers makes them the fastest among printers. The current laser printer (1996) can work at a speed of 16 ppm (pages per minute) in black and white and a resolution of 600 dpi (dots per inch). Although 600 dpi gives best results in printing text, in falls much short of the desired resolution for printing photographs which require almost 4800 dpi.

Following are some of the parameters that should be considered while choosing a laser printer:

Engine: The laser engine is the heart of printer and determines the print quality and the life of the printer

Speed: The speed of a laser printer is determined by the number of pages it can print per minute (ppm). Most of the laser printers have a speed rating of 6 to 10 pages per minute.

Drum and Toner: The photo conducting drum and toner are important components which determine print quality. These are consumables and have to be replaced at intervals. If the drum and toner come in single unit there is the advantage of easier maintenance.

Resolution: Resolution of a printer refers to the clarity of print on paper it gives. Normally the laser printers offer 300 or 600 dpi (dots per inch) resolution. This is adequate for most text printing jobs except when lot of graphics are incorporated into the text.

Paper Handling: Ideally a laser printer should be capable of handling paper of different sizes like A4, letter and document sizes etc. The tray capacities vary between 50 to 200 sheets.

Font Support: Laser Printers have a built in set of fonts. These range from 2 to 32 depending on the make of the printer. Fonts may be either 'portrait' or 'landscape'.

Memory: Generally a page is composed in the printer's memory before printing. Usually printers come with 512 KB memory. But for a page with graphic images at least 1MB memory is required.

Software Compatibility: Laser printers should be able to work with a wide variety of software like DTP, word-processors, CAD and graphic packages.

Interfacing: The interfacing of laser printers with computers should be flexible and offer the user options

Post-Script Facility: The laser printer should be able to print files in postscript format.

Any specification for hardware becomes outdated in a short time as advantages take place in the hardware industry very fast. In 2001, Laser printer that are digital, network based became available. In this machines, one can fire print requests from anywhere on the network; prints can be obtained simultaneously on both sides of the paper. The printer automatically prints, collates the pages and makes sets, all in a jiffy.

14.3.4 DTP Software

DTP Software attempts to overcome several inadequacies of WP in many areas of publishing processes like page composition, text-image integration and in the choice of fonts. Ventura and Page Maker are two popular DTP software.

i) Page Design

Any good DTP software provides help in page design. Page design can be understood by discussing three important aspects - a) Space Management b) Graphics c) Type faces.

ii) Space Management

Involves managing the white space on a page. Where to position a specific picture, what should be its size in relation to the total page, how to choose of bold or large letters, how the various elements in a page are juxtaposed are questions that need to be answered in this connection. Space management is more an art than a science. It comes with years of experience in learning how to get your publication communicate with the audience.

iii) Graphics

Choice of pictures colour, positioning on the page, titling are all important. Graphics relates to any non-text content on a page. Hence tables figures, maps, illustrations etc. fall under this category. Fig. 3 shows an illustration of a typical cover page for a booklet prepared using DTP.

Fig-3: An Illustration of DTP Output

iv) Fonts

A typeface is a designed set of characters in a particular style. Helvetica and Times are typical names of some fonts. Size of typeface is measured in terms of points where one print is equal to 1/72 inch and one pica = 12 points. A font is a collection of all letters, capital and lower case, figures, punctuation, special characters of a particular typeface of a specific point size. Fig-4 gives examples of Alphabets of typefaces: Helvetica and Times.

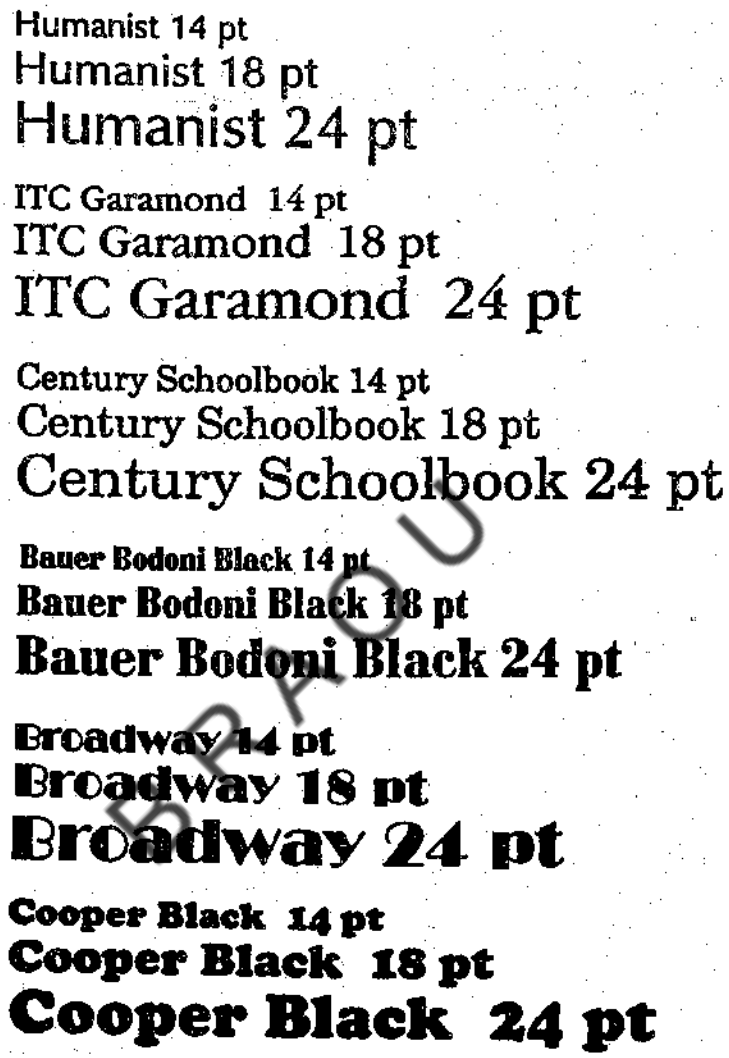

Fig. 4: Alphabets in Various Typefaces

Most DTP Software provides WYSIWYG during the integration of text and graphics. WYSIWYG means "what you see is what you get". All changes can be made in a variety of ways. Pictures can be changed in size, moved from place to place. Fonts can be changed at ease. The colour scheme can be changed and the combined effect can be seen immediately on the screen. An enclosed space in a diagram can be shaded in a variety of ways. DTP Software allows text to be entered using any word processor and graphics to be produced by external software like PC Paint Brush, Power Point, Corel draw and the like. Pictures can be scanned into the system by using a scanner also.

v) Some DTP Software Features

Some more common features of a DTP Software are given below:

1) *Multiple Column Printing*: As in the case of a newspaper one can have same information presented in multiple columns.

   Human eye can, at a time, take up a large chunk of printed matter while reading. This chunk can be enlarged, if the matter is printed in multiple columns, rather than in single column printing. That is to say, faster and easier reading is facilitated by multiple column printed on a page.

2) *Multi-page Brochure/Folder Printing*: When we publish brochures for seminars, products and services, DTP comes in handy. Once the matter to be presented has been entered, it is easy to see it as a single fold (4 page) double fold (6 pages), three folds (8 pages) brochures. DTP software prepares the pages automatically placing the contents in the appropriate pages.

3) *Thumb Nails*: These are essentially compressed images: One can see, say, 16 pages in miniature form at a time

   Availability of thumb nails feature helps in checking for consistency at a glance among a large number of pages.

4) *Cut and Paste Portions of Pictures or Text Matter*: Matter, be it text or pictures can be subjected to cut and paste. Portions can be "selected" and then the selected portion can be deleted or dragged and added to any other place in the document.

5) *View Pictures in rotated fashion, enlarged, reduced or in different colour schemes*: Pictures can be seen vertically or horizontally or flipped through 180 degrees. Colour background and foreground can be changed. Enlarging and viewing of pictures is sometimes necessary to observe minute details.

14.3.5 The DTP Process

Producing a document using DTP software consists of a number of steps. They are enumerated below:

1. Consider what needs to be done, by whom when and why.
2. Design the Lay out. That is work out how the document should look. Where the pictures should go and so on.
3. Set up the margins, left frames and other frames if any.
4. Import the text from some other file or type it in directly.
5. Import the pictures and place them in appropriate places.
6. Change the text fonts, color and re-format the whole document if necessary.

Here consider multi column text, if need be.

1. Save the document, style sheet or template.
2. Print the document.

14.3.6 Limitations of DTP

Although DTP is far advanced and sophisticated in aiding publishing functions, it is not as good as regular traditional publishing. DTP is suited to small volume jobs. Laser Printers are costly and photo reproductions of laser prints are of poor quality. Laser prints give 300-600 DPI resolution whereas regular printing can yield upto 4800 DPI. The quality of

graphics produced using Laser Printer is far less than the ones obtained in formal printing. Choice of typefaces is limited.

DTP can be used to produce mechanicals. The plates can be made using phototypesetting machines and the actual printing can done using Offset Printers. Using DTP as a complementary system in this way to routine printing will yield better results.

14.4 LET US SUM UP

Word Processing has come to be accepted as a routine facility in most offices. Word Processors differ from each other in the facilities and features they offer. Block manipulation, formatting, mail-merge, printing, spell check are some of the important features. Advanced features take care of graphics mixed with text. Desk Top Publishing is designed to do this.

Word Processors are better than mechanical typing but have lot of inadequacies to meet demands of all aspects of the publishing system. DTP is a better development going half way but still cannot replace regular printing. DTP is of great use in page composition, deciding on the page layout, combining graphics and text, and in providing greater choice of typefaces, colours, clarity. The output of DTP is better than WP as Laser Printer is used. As many WP are incorporating DTP functions/facilities, differences tend to merge. The Library can benefit by DTP in most of its printing/publishing activities, as the volume of work is relatively low.

14.5 RECOMMENDED BOOKS

BEAUMONT, J. "Desktop Publishing: What does it mean to libraries ?" *CLJ*, June 1988, Pp. 141-144

FREEDMAN, Ted. *This is DTP : A Young Person's guide*. New Delhi: Affiliated East West. 1995.

GLATZER, Hal. *Introduction to Word Processing*. Berkely, USA: Sybex, 1981.

GOOKIN, Dan. *Word for Windows 95 for dummies*. Delhi: BPB, 1996.

MANASFIELD, Ron.: *Mastering WORD 97*. Ed 4. Delhi: BPB, 1997.

Pagemaker 5 for Windows for dummies. Delhi: BPB, 1995.

TUCK, B. "Desktop Publishing: What is it and what it can do for you ?" *ASLIB Proceedings*, 41(1), Jan 1989, pp.29-37.

WORDSTAR for DUMMIES. New Delhi: BPB, 1955.

Computers@Home, a popular monthly magazine is a good source for information for topics of this unit.

14.6 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1. Write an Essay on the advantages of Word Processing taking Wordstar as a typical example of WP software Package.
2. Describe the salient features of Microsoft WORD as a WP Package.

3. Discuss the various stages of traditional publishing process and explaing how DTP can meet some of the tasks better when compared to WP?
4. Write a note on the inadequacy of WP in publishing functions?
5. Write an essay describing typical facilities and features of a DTP software.
6. Write a note on the various physical components of a DTP system.

II. SHORT NOTES

1. Mail Merge
2. Formatting
3. Print options
4. Library uses of WP
5. Word Processing and Word Processor
6. Steps in DTP Process

UNIT - 15 : MULTIMEDIA

Structure

15.0 Aims and Objectives

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15.2 History of Multimedia

15.3 Multimedia System Requirements

- 15.3.1 Factors in the Production of Multimedia Products
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15.6 Let Us Sum Up

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15.9 Model Examination Questions

15.0 AIMS AND OBJECTIVES

Multimedia is a presentation stored on a single medium and contains text, data, audio, graphics, still photos, animation, etc. This unit introduces the basic features of multimedia and their role in the libraries.

After reading the lesson you will be able to

- Explain the terms, hypertext, multimedia and hypermedia
- Trace the history of Multimedia Technology
- Specify minimum hardware needed for multimedia operations
- Look into various file formats associated with Multimedia and the relevant software
- List many multimedia applications including those in library and information Science.
- Discuss how the librarian's work is affected by the availability of this new media.

15.1 INTRODUCTION

All the traditional text, whether printed or in computer files, is sequential. Hypertext is non-sequential. There is no single order that determines the sequence in which the text is to be read. The reason people are getting excited about hypertext even though the concept dates back to 1945 is that it can now be implemented with commercially used technology.

Hypertext consists of inter-linked pieces of text. Each piece of information is known as node. Whatever may be size of these nodes, each of them may have a pointer to another unit and these pointers are called links. A hypertext link connects two nodes in the sense that it points from one node (called anchor node) to another (called the destination node).

Originally coined as a conjunction of hypertext and multimedia, hypermedia is less commonly used at present than the popular term multimedia. Multimedia thus includes hypertext now.

The traditional definition of the term Hypertext implies that it is a system of dealing with plain text. But current systems also include the possibility of working with graphics and various media. Some people prefer using the term hypermedia. Hypermedia is a natural technology for supporting multimedia interfaces since it is based on the inter-linking of nodes that may contain different media such as text, graphics, video and sound.

The new coinage multimedia describes systems, which put all the audio, visual and data processing into one box and the whole presentation onto one medium. A handy definition of multimedia is that a presentation stored on a single medium and contains at least three of these such as text, data, audio, computer graphics, still photos, animation, movie footage. Since many of the current systems also include the possibility of working with graphics and various other media, some people prefer the term hypermedia to stress the multimedia aspects for their system.

It is difficult to find a definition of multimedia that is acceptable at every level. At its simplest, it is computing with sound and motion; it depends on optical storage technology, like CD-ROM, to handle large volumes of digital data: text, audio, graphics and images. The European Multimedia Center considers it "a set of enabling and covering technologies" which include, in the PC world:

- Graphical object-linking database navigational aids (hypermedia and windows environments) and authoring tools
- CD-ROM for mass digital data and image storage
- Digital video compression for rapid and seamless motion video
- Audio mixing tools - A processing engine capable of driving power-hungry applications (Personal Computer)

15.2 HISTORY

In 1945, Vannevar Bush described a machine, which he referred to as a Memex that could be used to browse and make notes in voluminous online text and graphic system. The Memex contained a large Library of documents in addition to personal items such as notes, photographs and sketches.

In 1963, Engelbart introduced NLS (ON Line System) which is any early hypertext system consisting of files that were organized into a segment of 3000 words or less that could be linked both hierarchically and non-hierarchically.

In 1965, Ted Nelson coined the word Hypertext and developed a system more expensive in some sense than that of Engelbart. It was named as Xanadu project.

Hypertext systems are based on the same general notion of association structure of Graphics, text so on. In the 1980s there has been an explosion of interest in Hypertext. Hypercard was introduced in 1987. It is one of the most widely used hypertext systems. Hypercard was developed by Bill Atkinson.

Notecard is yet another hypertext environment developed in the Intelligent system Lab in 1987. Notecard has good browsing tools, including a hierarchical system for organizing complex Notecard networks.

Gude was the first hypertext system available for Macintosh. It was originally conceived as a tool for building electronic documents. It provides a very flexible way of building electronic documents with a variety of cross-referencing and annotation.

Intermedia is a hypermedia system developed at Brown University for university research and teaching. Intermedia system is built on the BSD UNIX4.2 operating system and runs on Sun workstations.

With the advent of Graphical User Interface (GUI), windows environment like X-Windows, MS-Windows are provided on many platforms. In the world of IBM-PC, it is MS-Windows 3.1 that has provided many facilities for Multimedia applications. Windows 3.1 was the follow-up to Windows 3.0. Not only did it fix bugs present in the original version of windows, it also added the entire set of conditions needed for the multimedia extent. It means that every version of Windows 3.1 contains support for audio, MIDI, and joystick. Windows Operating System has undergone series of developments from version to version and has become fully supportive of multimedia requirements. Windows 95, Windows 97, Windows 2000 and now we have Windows ME, the Millennium Edition. For details on Windows ME see Unit 2 on Computer Technology.

In 1991, the Multimedia Marketing Council announced the Multimedia Personal Computer (MPC) standard. This standard based on the minimum system requirement for windows, gave manufactures a minimum hardware required by PC system in order to be considered multimedia machine.

For a long time, computers had been dealing with character based information whether it was numeric or textual data. However, to be a data processing machine, computer should be able to deal with other forms of data like visual, audio, smell and taste. Multimedia technology has equipped computers to deal with audio-visual data. The present day multimedia deals with text, graphic, audio and video media. This has opened up another step towards man-machine communication. For example, if we look at the development of Operating Systems, earlier they were only command-driven. Then came the menu-driven approach, followed by Graphical User Interface(GUI) based on icons. It may be followed by voice-based interface. The trend is towards more user-friendliness. Many of the so-called user-friendly software do require lot of training and skill in order to use them. However, it is hoped that multimedia technology provides better user-friendly software.

15.3 MULTIMEDIA SYSTEM REQUIREMENTS

Computer hardware and software, especially the operating systems have undergone series of developments and have become fully supportive of multimedia requirements in the recent times.

15.3.1 Factors in the Production of MM Products

Before we go on to the hardware that is needed for developing multimedia product, let us discuss briefly factors affecting MM product development. Following three are the most important factors:

1) Creative and authoring/production techniques that aid the publisher in designing and producing meaningful valuable multimedia products. As we will see from the profile of people involved in this field (*See* Section 15.4.3), a combination of several creative skills are needed.

2) Standard low-cost platform and components, along with easy to use system and application software. This is needed not only from the standpoint of production but from customer's usage as well.

3) Resolution of many intellectual property issues that impact the development of multimedia products, which can contain elements from many direct works from many different sources. This is one of the reasons why MM products tend to be costly at times.

15.3.2 System Configuration for Multimedia

Multimedia PC (MPC) specification, announced in November 1990 defines the following standard requirement.

i) A286 (10MHZ or faster) or 386/486 CPU

ii) 30 MB or larger hard disk

iii) VGA (4 bit or 8 bit) video display

iv) A digital audio subsystem

v) A CD-ROM drive

vi) Application software compatible with the Application Programming Interface (API) of MS Windows graphical environment version 3.1 with multimedia extension or equivalent API.

Changes and developments in Hardware and Software are happening so fast that any specification or recommendation becomes obsolete very fast. Compare the 1990 MPC recommendation cited above with the following System Configuration suggested as model for MM usage at home by the magazine, *Computers@Home* in August 2000:

C&H recommendation for high-end Multimedia work involving games, graphics and sound and video editing:

Pentium-II 700 MHZ, 128 MB RAM, 17 GB Hard Disk, Video card with 32 MB VRAM, 101 Key Board, Creative Sound Blaster Card, 17 inches Monitor.

While we are on specifying a configuration, it is pertinent to learn about Digital Video Disks (DVDs) with specific relevance to MM:

15.3.3 Digital Video Disk (DVD)

A DVD is a high capacity optical disk for storing large volumes of graphics, audio or video, in short MM files. Depending upon the number of sides used and the packing density, the capacity of DVD can be anywhere from 4.7GB to 17 GB. There are in fact 5 distinct DVD formats:

1. DVD-ROM: Read Only disk for normal use in a PC
2. DVD-Video: For storing Video. Capacity may be upto 17 GB. This is useful for high volume interactive play back of high quality Video - Features like built in navigation, parental locking, copyright protection are available.
3. DVD-Audio: High capacity High quality Audi content.
4. DVR-R: Write Once Read Many Times type of CD. $ GB could be the capacity.
5. DVD-RAM: This is a read and write optical format for general purpose: back up, transfer device from system to system, software installation etc. Capacity upto 2.6 GB

15.3.4 Multimedia Authoring Tools

An authoring system is a set of software tools for creating multimedia applications. Tools are individual computer programs that perform one or more of the tasks needed to create an application. Authoring usually requires special hardware for audio and video support and it also places special demands on the operating system software. Icon Author, Authorware Pro and HSC Interactive are some of the most popular authoring software.

15.3.5 Multimedia File Formats and Software Related to them

We have seen that a Multimedia Product may contain different types of information: text, pictures, color graphics, sound clips, video clips, animation, hyper text etc. All these are stored in various file formats. Let us familiarize ourselves with a few associated with Text, Graphics, sound and Video.

1) Text Files

TXT, ANS, DOC are some file extensions associated with pure text. Pure text files are created with DOS Edit or Windows NotePad programs. Microsoft Word helps produce Word Files that are in reality binary files. They produce RTF that is Rich Text Files, which are intermediary and can be read by most other word processors.

2) Graphic and Picture Files

Computer files such as GIF, TIFF, PCX, IFF, IMG, BMP and EPS are some of the file formats encountered with graphics.

GIF is a proprietary format of CompuServe. It is the most popular one too. It allows compression of data. 2 to 256 distinct colors can be shown. Images are true like photographs.

JPG files, specification of Joint Photographic Experts Group, are greatly compressed and occupy least space, when compared to GIF or BMP.

PCX files are created by MS Paint brush. No compression is done. The purpose is to retrieve files easily. IMG files belong to Digital Equipment Corporation. Here picture of any size can be stored. They are easily accessible. TIFF stands for Tagged Image File Format. This format is supposed to be platform independent that is it will work in all operating Systems. Most faxes

are sent in TIFF format. BMP stands for Bit Map and are created by Paintbrush. They occupy much space and are raw. But they can be read by all picture programs.

Many times files have to be converted from one format into another. Internet browsers like Netscape and IE can read most common file types mentioned above. A utility called GIF Construction Set helps us create a Slide Show out a series of several pictures.

3) Audio Files

Commonly known Audio File Formats are WAV, VOC, MID, AIFF and MP3.

AIFF has been developed for APPLE computer.

MID file is based on Musical Instrument Digital Interface Standard for Audio Control in MM.

WAV files, most commonly used in PCs, runs under Windows easily. It allows both compressed as well as uncompressed data.

VOC files, created by Creative Labs Sound Blaster are used to store digital data. VOC files give clear audio and are also common in PCs.

MP3, another audio format, short for MPEG Layer 3, has become very popular in the recent few years. It is like WAV, but highly compressed: compression ratio: 12:1 (44KHZ, 16 bit, Stereo). You can store 12 hours of music on a single CD.

MP3 music files can be played by MP3 Players. FreeAmp, WinAmp and Jet Audio are some well-known MP3 players. Most MP3 players offer:

a) Volume control
b) Fast Forward and Rewind
c) Move to next/prev track
d) Repeat or shuffle tracks
e) Song time and length display
f) Graphics equalizer

4) Video Files

AVI, MOV, MPEG and QT are some of the formats in this category.

AVI files have both compression and non-compressed data. Devised by Microsoft, they contain nested data chunks. AVI files can be edited using Adobe Premier and a host of free ware programs.

MOV files are standard movie files. Quick Time is movie files for Apple. Mov files can contain both audio and video. Mov files are also machine independent.

MPEG of Motion Picture Experts Group came up with MPEG-1. This is a compressed version resulting in loss of quality. It supports transfer rates upto 1.5 MBPs and are therefore best suited for MM production in CD format - as against MM for web server. Later version MPEG-2 is meant for broadcast Video, with a transfer rate of above 4MBPs.

QuickTime or QT files are rather specific for Apple Computers. QT has a series of software: The browser or the Client is available for PC and MAC. The Professional Edition

allows you to edit and create movies, graphics and 3D panoramas and streaming Videos. QT4 the latest allows previews and supports all kinds of audio and video file formats.

We have so far seen in this section various formats for files having text, audio, video etc. along with software connected with the same.

15.4 LIBRARIAN AND MULTIMEDIA

Let us now see how a librarian can go about selecting MM products to be added to his collection, where to look for MM titles and how he could benefit from the several career opportunities coming up in MM field.

15.4.1 How to Select MM Titles ?

When you buy a MM title for the library, following salient points have to be kept in mind. In common with printed books, we need to look into the author's and publisher's credibility, suitability for a certain level or grade of the user group, price, ease of procurement etc. These issues are not discussed here.

1) Ease of Installation

Some CDs can be installed without any problem just by running the setup program. Some others land us into problems - especially when program files that are copied from CD into hard disk are available on the hard disk in either older version or later versions. Many times system might hang without leaving any clue as what to do. Therefore installation procedure must be simple.

2) Disk Space Utilization

Some programs keep some files on the CD and some files on the Hard Disk: this calls for CD being mounted whenever the application is run. In other cases, most of the files are copied into the Hard Disk. This method allows faster responses but eats up disk space.

3) Program Loading

We need to look into how fast the program data and graphics load. Do they load reasonably quickly?

4) Navigation

As most CDs are produced using Hyperlinks, you should check up if the navigation from one part to another is smooth and intuitive. Hyper Links must lead you to correct files and to current files. Some times system might hang because of bad links. For example, if a link is to an external Internet web site, the machine may not be properly connectable at the time of CD usage: this ma lead to problems.

5) Graphics

Quality of graphics has to be verified. Are the pictures and animations blending? Are the pictures laid out at suitable places, at the correct sizes?

6) Text

Can the text and other portions cut and copied? Many pdf files allow you only to print directly onto paper. Copies can not be made on hard disk for further editing. We need to also examine what the competitors offer so that we get the best value for money.

15.4.2 Sources for Acquiring MM Titles

As librarians you need to acquaint yourselves with sources to select and buy CDROM based Multimedia titles depending upon users' needs. A decade ago an annual publication called the RED BOOK used to be a singularly useful source for locating CDROM titles. The scenario has changed and a large number of publishers bring out useful titles for all age groups, for all purposes like training, self learning, equipping oneself for competitive tests, on all topics from religion and culture to complete dictionaries and encyclopedias, at all price ranges!

A monthly magazine called *Compters@Home* contains several reviews, advertisements and articles on MM titles. Magazines like *DataQuest, PC Quest, Voice & Data, Chip* and others distribute MM CDs along with printed monthly issue in paper form.

Many books carry floppies and CDs as supplement. These are very useful just for the shear vastness of additional information they carry. It is always advisable to prefer books with CD supplements.

BPB Publications, Comdex Computer Publishing Company, CrossWord, Gangarams, Vikmans Multimedia and Waldens are some of the book sellers who have separate sections devoted to MM titles.

National Centre for Publications on CD-ROM (=NCPC) was set up at FITT (Foundation For Innovation and Technology Transfer), IIT Delhi in the year 1996 by NISSAT, DSIR, GOI. This Centre is the National Repostory (Archives) of all the CDs being published in India and on India, except Games, Music, entertainment and software products.Till date (May 2001) NCPC has a collection of over 300 different titles being published in India, covering art, culture, heritage, S&T, Industry, economy etc. A data base of titles available is searchable in their website at : www.indiacdproducts.org/

15.4.3 Multimedia as a Career

Multimedia product development firms have jobs of various kinds. Scanning Assistants, Content Writers, Visualisers, Designers, Programmers, Editors etc

At the lower end there are Scanning and Editing Assistants who help pictures to be scanned, edited and integrated with rest of the text. Visualizers look at the page layout as a whole and suggest and carry out changes to suit it to the audience. Knowledge of Multimedia tools is enough for Scanning assistants and Visualizers.

A graphic designer, on the other hand, is a skilled artist with a qualification in basic design methodology from NID, Ahmadabad and the like. To be a good programmer one needs to be an engineer or an MCA with knowledge of a few programming languages. An Editor is a very senior person of the level of a Project Manager: He is fully conversant with all the work done his subordinates and has enough experience to guide and direct them. Another category of staff in MM is content writers. These are people with Journalism or Mass Communication background, strong in English with a flair for writing and reading and are quick in grasping complex topics. Some librarians might fit in here as well. Librarians, as they are supposed to be good in Abstracting and summarization, can hope to fit in here.

A basic knowledge of MM product development is very useful as most libraries would have be having their own web sites offering MM based contents - training material, documents, presentations, guides etc.

15.5 APPLICATIONS OF MULTIMEDIA

Though there are several applications of multimedia in entertainment, education, business and trade, scientific research and development, however, libraries and information centres are mostly concerned with the retrieval of information.

15.5.1 Library Related Applications

Some library applications are for the retrieval of technical and scientific information. Libraries need to include electronic publication like hypertext, if they want to keep up with the modern technology. In future, the libraries might well be a computer network service rather than a building. For example, Book house is a library system using hypertext techniques to help user to find books without the limitation of traditional information retrieval. The user interface of the Book house is based on a building metaphor somewhat like a real library.

Another example of a library application is to provide public access to archives of history documents. For example, the state library of New south Wales in Sydney, Australia, contains large amount of old convict records from the settlement of the colony 200 years ago and many modern Australians visit the library to discover what crimes their ancestors committed that caused them to be deported. Currently this genealogical search requires people to wade through mound of old documents and follow the links to past generations by hand. Most of this material would be an obvious candidate for hypertext access.

Information Access: It is often said that this is an age of information. We are literally being overwhelmed with an overload of information. This abundance of information makes it difficult to access. Multimedia provides effective ways to organize information and search for specific facts quickly and effectively through navigational tools.

Information Terminals: Information systems are located in the reception areas of many major business houses and they provide an interesting way for visitors to learn about the firm and their products when they are waiting for their prospective business partners.

Cataloguing: Most cataloguing codes enable users to locate a well-defined bibliographic unit easily, but they do not allow them to look for literary units without any problems. A mechanism to collocate various manifestations of a work can be based on bibliographic relationships for establishing links between the units concerned. Investigations show that these relationships between descriptors are analogous to the relationships between descriptors in a thesaurus. Concepts and practice in thesaurus handling can be applied in cataloguing linked bibliographic units. International bibliographic numbers are recommended for the unique identification of the bibliographic units. For the implementation of such a system it is sufficient to define only relationship between two bibliographic units. All other links can be generated by the system itself because of the characteristics of the relationships. A hypertext system is able to offer an appropriate interface.

Reference: Reference works are the area in which libraries are most likely to come across multimedia applications. The simplest form requires only the existing well-known technology of the CD-ROM, with the addition of a speaker. For example, the National Geographic's *Mammals: A Multimedia Encyclopaedia* is a text and image database, which corresponds to the 2-volume Book of mammals. In addition to text, it includes some 700 photographs and 150 maps, 45 full-motion video clips and sounds (the calls of the animals themselves). The user navigates through the encyclopaedia via menus, icons and a hypertext interface.

15.5.2 Other Multimedia Applications

Education: The essence of multimedia is to make computer use more interesting. It does not matter if a child is in grade school or an adult is getting a master's degree. Students are highly motivated to work co-operatively and without teacher supervision to search out and remember content of a wide variety of resources, with visual recall being especially promoted. Multimedia is an excellent tool for computer aided instruction

Edutainment:. This is the new type of software category that mixes the education with entertainment. The idea is to make learning fun while providing some type of entertainment.

Entertainment: Multimedia games are a lot of fun to use. Children and adults equally enjoy playing on the computer.

Business Presentation: In many companies, presenting information to business is a required form of communication. Applications are already available for creating impressive and through Multimedia these applications will become even better and effective.

Interaction: The effect of multimedia increased even further by incorporating user interaction. Here the user is included in the process, since he or she controls the path and the types of information.

Virtual Reality: In virtual reality, such illusion gets yet another twist. The user takes a participative role at the center of the action, not only seeing and hearing his surroundings, but also manipulating them with natural body movement. Simulation is an important application of virtual reality. It is useful in medicine, air travel. Military maneuvers and other situations where a safer and less expensive alternative to "actual reality" is required.

Architecture And Landscape: Multimedia provides another form of presentation: simulation in the area of city and landscape planning. Architectural proposals are visualized by overlying landscape pictures with those of the proposed structures.

Dictionaries And Reference Books: Several dictionaries and large reference works have been converted from a traditional paper form to a hypertext format. But so far we have seen no major project trying to generate a hypertext dictionary from scratch. The electronic catalogue is a fairly big hypertext with its 9742 nodes taking up a total of 413 megabytes. Clearly one of the biggest advantages of hypertext encyclopaedia and dictionaries, compared to a printed work is that they can show moving images and play sound. For example, a version of Webster's dictionary is available on CD-ROM with sound recording of how the 160000 words actually are pronounced.

Trade Shows, Product Catalogs, and Advertising: Many kind of advertising and communication to customers can be improved by hypertext. Hypertext can also be used to provide information about an entire trade show and help people find these exhibitors that would interest them, through implicit links from any text. A student who does not know English very well might still be able to understand material in multimedia because of its ability to link to an explanation of any word. Hypertext also enables a student to view two parallel version of the same text -- an original version and a translation.

15.6 LET US SUM UP

Multimedia Technology is one of the latest areas of computer applications. It offers a powerful combination of text, graphics, Audio and video data that make the presentation livelier. Hypertext is another technology, which allows non-linear presentation of information, so that one chooses his own way of using navigational tools. Although the word `Hypermedia' is less used now a days, it is the combination of Multimedia and Hypertext.

Although the end-user of the Multimedia products do not require any software, the generators of multimedia products do require Authoring tools, and editing tools for graphic, audio and video data.

The applications of Multimedia are many and varied including Computer Aided Teaching. Edutainment, presentations, reference material etc. Multimedia in future may change the look of the PC. In this context, it is desirable that every library possesses multimedia system. Like microfilm reader/printers, multimedia should be provided to the user in order to allow them to use multimedia products like encyclopaedias, dictionaries that are brought out in CD-ROMs. Multimedia Systems can be used for developing multimedia documents, like training manuals, library guides and orientation materials.

15.7 GLOSSARY

Animation: A process for creating artificial video where the computer calculates or assembles the content of each frame as it is displayed.

Application: A computer program written for a specific purpose.

Api: Application Programming Interface: This means whereby an application communicates with the system software. An API is usually specified in terms of one or more computer languages, such as C or Pascal.

Author: One who uses authoring tools to create application programs.

Authoring: The process of creating an application program by the use of authoring tools.

Authoring Language: A high-level programming language intended specifically for authoring. It contains commands or statements that simply many of the steps of authoring.

CD-ROM: A digital data version of the audio CD(Compact Disc).

The CD-ROM can be inexpensively replicated and holds up to 680 megabytes of data. Because it is read-only, the user cannot change the data.

Compression: A digital process that allows data to be stored or transmitted using less than the normal number of bits. For example, video compression refers to techniques that reduce the number of bits required to store or transmit images or motion video.

Computer Based Training (CBT): The use of a computer to deliver programmed one-on-one personal training.

Graphical User Interface (GUI): A computer-user interface that combines a graphical screen capable of displaying graphics and images with a pointing.

Hypertext: A text display system that allows an author to highlight specific text words or phrases to indicate to the user that he can click on that item for additional information.

Icon: In a graphical user interface, a graphic or image that visually represents an object in the environment.

Image Processing: Techniques, which manipulate the pixel values of an image for some particular purpose. Examples are: brightness or contrast correction. Color correction, or changing size(scaling).

MM: (Short for) Multimedia.

Multimedia Personal Computer (MPC): A PC that contains equipment for multimedia, such as audio, video, and CD-ROM hardware.

Operating System: In a personal computer, the core program that provides applications with access to all of the hardware resources of the system. Typical operating systems are DOS and OS/2.

Simulation: The process where a computer program behaves like a different object or system.

Windows: When capitalized as shown, Windows is the graphical user interface created as a DOS extension by Microsoft.

15.8 RECOMMENDED BOOKS

BUNZEL, Mark J and Sandra K Morris. *Multimedia Applications Development*. 2nd ed. New York: Mc-Graw Hill, 1993.

FRATER, Harald and Dirk Paulissen. *Multi Mania*. Michigan: Abacus, 1993.

GOODWIN, Michael. *Making Multimedia Work*. Delhi: Pustak Mahal, 1995.

LUTHER, Arch C. *Authoring Interactive Multimedia*. Boston: AP Professional, 1994.

LUTHER, Arch C. *Designing Interactive Multimedia*. New York: Bantam Books, 1992.

MULTIMEDIA *& CDROM for Dummies*. Delhi: BPB, 1995.

ROSHAN Raina: *Management Development Program on IT Application in LIS*. Lucknow: IIT, 1996. (pp 116-123 on Multimedia).

SATYANARAYANA B and Others: *Multimedia: Its applications in Library and Information Science*. Chennai: TR Publications, 1998.

VAUGHAN, Tay. *Multimedia : making it work*. 4th ed. New Delhi: Tata McGraw-Hill, 1999.

VILLAMIL, John : Mutimedia - An Introduction. Delhi: Prectice Hall of India, 2000.

WODASKI, Ron. *Multimedia Madness*. Indianapolis: Sams Publishing, 1994.

15.9 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1) What is the subtle difference between Hypertext, Multimedia and Hypermedia?
2) What is Multimedia? What are the different File Formats encountered in a Multimedia Product? Discuss briefly mentioning the relevant software connected with such formats.
3) What are the various applications of the Multimedia Technology?

II. SHORT NOTES

a) CD-ROM
b) Multimedia Authoring tools
c) Hardware needed for Multimedia
d) MP3
e) DVD
f) GIF
g) JPG tools

UNIT - 16 : ELECTRONIC MAIL

Structure

16.0 Aims and Objectives

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16.8 Recommended Books

16.9 Model Examination Questions

16.10 Appendix : Mailing Lists of Librarians' Interest

16.0 AIMS AND OBJECTIVES

Electronic Mail or Email has become one of the major applications of Internet. It is a very popular mode of communication to connect people across the globe more economically. This unit introduces the basic features of Electronic Mail and its role in the libraries and information centres.

After reading the lesson you will be able to

- describe the concept of electronic mail
- enumerate the advantages and disadvantages of Email compared to other methods of message transfer like fax, telex, post, etc.
- learn some tips on using the Email
- familiarize yourself with Email etiquette
- get a hang of specific uses of Email in the Library
- use web-based Email effectively
- explain what Mailing Lists are and discuss their uses.

16.1 INTRODUCTION

Electronic Mail, or Email for short, is a method of exchanging personal messages from one person to another using computers connected via a powerful network. Thanks to Internet, Email shas become a very popular mode of communication during the past few years. Email connects people from across the globe in a few seconds at a cheap cost. There are more than 200 million Internet Email Users in the world. Email can be used, in addition to simple message transfer, as powerful way of distributing newsletters, carrying on non-interactive discussions, conducting opinion polls etc. As an integral part of Office Automation Email plays a vital part in exchanging written communication. This unit will discuss the issues outlined in Aims and Objectives in some detail from a Librarian's point of view.

16.2 EMAIL - ADVANTAGES & DISADVANTAGES

Before we discuss the advantages and limitations of email, first let us know what do we need to use email.

16.2.1 What do we need to use Electronic Mail?

In order to use Email one should have a PC, Modem and a telephone line. As the telephone line is capable of handling only analog signals and the signals from the computer are digital in nature, an instrument to convert analog to digital and vice-versa is needed. Modem takes care of this need. In addition you also need an Email connection (just as a telephone connection from BSNL) from an Internet service Provider. An Internet Service Provider (=ISP) gives you a UserID and a password for an annual fee.

The UserID is the Email address similar to Phone number or fax number. Email address usually looks like: Vyasa@manage.gov.in where the first part before the @ sign signifies the user's name and the second part after the @ sign indicates the computer in the network (Internet) where you have an account.

You also need some software: Two types of software are needed. The first one is communication software. It is used to dial up the ISP's computer using telephone connection. Some popular names are: PROCOMM, "Dial-UP Networking" etc. Generally, this comes with the Operating System or freely supplied by Modem Vendor or the ISP. The second one is variously called the Web browser, web client or simply the browser. Netscape and Internet Explorer are the most popular ones in this category. They are used mainly for browsing the contents of Internet web Pages. They also have a component for receiving, reading and sending emails. Hence our interest in browsers. Most browser software is free. In order to benefit from pictures, music, video clippings etc that may come along with email messages, you also need software to open and read or play these special multi-media files. For example music files need MP3 player software. Along with Email messages, pictures, music clippings, recorded speech, video clips etc (in short multi media items discussed in earlier unit) can be "attached".

16.2.2 How much does it cost ?

Normally an ISP charges a fixed sum for a certain number of hours of Internet Connectivity. Email comes as a free (default) service from most ISPs. Email charges work out to less than Rupees ten per message and this includes charges for the local phone call needed to get connected to the ISP's computer. Most of the times it is possible to send out an email in less than three minutes thus paying just the same cost as that for a local phone call. Any other person who has Internet Email can be reached easily by typing in the address of that person in To: field of the message.

16.2.3 Advantages

Email is fast, cheap and reliable. Most messages can be sent in about half an hour's time across the globe. They are cheap as already seen. As the message is held in the computer as soft copy, it can be modified, edited and used in databases or other programs. Messages can be forwarded to anyone. Same message can be sent to hundreds of people at no additional efforts. Messages can be replied by noting relevant points in sender's message text itself. It can be safely archived for future reference. Messages can be transferred from person to person in a safe or confidential way after encrypting. Messages reach the destination tamper proof. One can get confirmation of delivery of message, or whether the recipient has read the message.

16.2.4 Disadvantages

However Electronic Mail does have some disadvantages. One needs to have a computer or at least some access to a computer. If your ISPs server is down there could be disruption in mail transfer. Hackers could get hold of your password and create problems. Viruses may travel along with messages received by you and such viruses may corrupt your computer system. Some messages may arrive in a format that you can not "read".

16.2.5 Comparison with Other Communication Methods

Anyone can be reached via postal system - but email requires recipient to have email. Ordinary postal charges are becoming increasingly costly. Fax is instantaneous. In fax you need to prepare the original and scan it for sending. Scanning may be imperfect resulting in poor copy. Fax is costly when you consider International Fax: here it almost equal or more than ISD rates. While Telex is also instantaneous, it is cheap but slow. Telex terminals are noisy and error prone. Noise in transmission is heavy. Telex is going out of fashion. In the case of postal system and courier, already prepared text or material can be transferred without additional processing. After the passage of Information Technology Act last May 2000, Messages via Email are legal and binding just like paper written or printed communication.

16.2.6 What can you do in an Email System?

You can receive a message. Read them. Reply them. Or forward them to some one else. You can delete a message or store it safely in some folders. At last you can reply them too! When you are sending a message you can mention if it is urgent. Whether you need confirmation of receipt or delivery or reading etc. You can attach file along with your message. The file can be a picture program or a greeting card with music! You can add signature to your messages automatically. One can also specify 'when' it should be delivered. When you get a lot of useless mail, you can prevent messages from reaching you. This is called Spam control.

16.2.7 Some Tips for better use of Email

Though your email software may allow you to send graphics or color use plain simple text. This travels faster and problems are least. As bulky attachments will chock the traffic, avoid big files being sent as attachments. When you are on long vacation, please do arrange to send interim automatic reply using "Vacation Program". This is being courteous and you will be appreciated. All email messages are expected to be replied immediately. Please reply soon. Use proper signatures identifying who you are. Be aware of virus problem: do not click on attachments that are program files. Virus may corrupt your system.

16.2.8 Email Etiquette

People using Email follow certain unwritten rules of etiquette and manners. It is better to be aware of these rules so that the user may not feel out of place or unwanted for lacking in manners. Some of these "rules" are mentioned below:

1. Email messages are always short and crisp. They do not require formal salutations like Dear Sir, yours faithfully etc

2. Email messages should be replied fast and almost always at least an interim reply is expected.

3. Writing everything in Capitals, when not warranted, indicates that you are angry.

4. When you are contributing to a discussion list, you need to know the scope, topic, purpose and specific interests of members. You should not send any message that does not fit into the scope of the List. If you do you will be admonished and booted out.

5. Those who can not use graphics while composing messages can use 'emoticons' (small icons or images indicating emotions) to signify the emotion you are in while writing the same. For example one can use the famous smiley symbol ☺ :) - This tells the recipient that you are joking and are not serious.

16.3 WEB - BASED ELECTRONIC MAIL

A number of Internet Companies offers a facility called web-based electronic mail. In this case one need not own a PC or internet connection: he can utilize the facility available in any cyber café or Internet kiosks to get connected to Internet for using Email. There are more than 400 Internet cafes in Hyderabad alone. It is just like using the phone in STD booths.

Companies like Hotmail, Yahoo, Rediff, Satyam Online, Dishnet and others offer web based email. Most of these are free services. The advantage of having an Email Id from such companies is that they offer you some anonymity. It is similar to Box Number Advertisement in matrimonial columns. Moreover, this web based ID could be permanent irrespective of where you work. For instance if you are working in say Satyam the email Id given by Satyam is valid only as long as you are in Satyam. But the Id from HotMail is permanent.

However, web based email Ids have their own disadvantages too. Here the vendor decides how much of space you could have, what size of files are allowed etc. Facilities at his site, tools provided and privacy allowed are all variable. For instance, Rediff is fast and the space given is enough (5Mb) and allows you send messages in many languages. However there is no guaranty that messages will be delivered in time. You can not complain, as the service is free. Some vendors provide "In-box" filtering tools whereby you can automate your organization of folders. In Rediff you can send voice mail too: that is you can record your speech and send it over. The recipient can listen to the speech over his speeches attached to his multi media PC.

16.4 MAILING LISTS

A Mailing List is a facility offered by some organizations/Agencies to help individuals of a group to communicate among themselves through email on topics of their mutual interest. A ListServ software at a central computer acts as the hub. If a group of librarians are interested in say Library Security, they cam become members of a "Mailing List on Library Security". When any member sends a mail message of interest to other members, it first goes to the Server Machine and the gets broadcast (re-mailed or forwarded) to ALL the members of the List. By this way, all members can exchange views, ideas, experience, problems and solutions of topics of their interest in a non-interactive (not inst: ntaneous) way.

While using Mailing Lists, one needs to note two different email addresses: one address called the ListServ address or the server address. This is used to become a member of a certain list. This activity is called subscribing. When you no longer want to get messages, you can unsubscribe from a List also. The procedure varies from server to server, list to list. But it generally consists in sending just an email giving List Name and your name in the Subject Field or in the Body of the Message Text. Another address is the List address. This second Email address is used to send messages that are to be widely re-distributed.

16.4.1 Sources for finding Mailing Lists

There are hundreds of Mailing Lists and Discussion Lists in Internet. Following Table provides some important sources like directory of Lists, List of Lists etc.

SN	URL of the Source	Description
1	http://www.listz.com	Directory of 10000 mailing lists searchable by subject.
2	http://www.netspace.org/cgi-bin/lwgate	Mailing List Gateway of NetSpace
4	http://edwed.gsn.org	USA's K-12 Education related discussion lists and E-journals
5	http://www.dejanews.com/	Web based news groups, discussion lists, mailing lists; searchable. You can participate in news groups without having a news reader.
6	http://www.reference.com	Unique place to start searching for mailing lists

There are a very large number of mailing lists - more than about 90,000 in fact, covering all subjects on the earth. There are many of interest to librarians. A recent list of Lists of Interest to Librarians is given in the Appendix.

16.4.2 Some Examples of Indian Mailing Lists

There are a few from India as well. There is a mailing list maintained by National Center for Science Information housed in Indian Institute of Science Bangalore. It is called Lis-Forum and the ListServ Address is: listserv@ncsi.iisc.ernet.in The second address to which messages may be sent is: lis-forum@ncsi.iisc.ernet.in Lis-Forum is very active with more than 200 members.

IASLIC, Indian Association of Special Libraries and Information Centers, has a list whose details are available at: www.indiax.com/iaslic If you wish to join the List you may send a request "JOIN IASLIC-LIST" as text of the message to the address: server@listserv.indiax.com

Some persons also maintain the mailing lists. For example, corporatelibrns@yahoogroups.com. More Information on this is available at the web site: http://www.yahoogroups.com. To subscribe send a blank message to: corporatelibrns-subscribe@yahoogroups.com This is a mailing list taking care of needs of single one man libraries and their peculiar problems.

16.5 LIBRARY USES OF ELECTRONIC MAIL

Libraries everywhere are using Information Technology, Internet and Email in particular to a great extent nowadays. But most of them use it only to send messages. A typical list of topics or tasks for which Email may be used is given below:

1. Reminders for Return of Books
2. Intimation of arrival of new books to requestors
3. Intimation of arrival of Reserved books
4. Monthly List of additions
5. New Services Introduced
6. Holiday Notices
7. Inter Library Loan Requests
8. Recall Notices for books needed urgently by others
9. Placing orders for supply of books with Vendors
10. Sending Inquiries for book supplies
11. Results of Literature Searches
12. SDI Notifications

In the case of libraries using fully integrated software for library management, most of the above listed tasks can be sent using Email as a part of the software package.

In addition to the routine task of messaging, Email can be put to most effective use in a number of innovative ways. Advantage of Email for Librarians is highlighted in this section.

1) Mailing List subscription for others

The librarian can identify mailing lists of interest to his patrons. Thereafter help them become subscribers in their own right. Or, the library can subscribe for a list. When the messages arrive they may be automatically forwarded to relevant members. "In-box filtering and forwarding" can achieve this based upon certain criteria or conditions. Mail clients such as OUTLOOK EXPRESS and Lotus Notes allow this facility. Most other clients also provide for automatic re-routing of messages.

2) Auto-responders

A library may be having a number of publications in soft copy to be distributed to patrons. Examples are: Rules and Regulations, Video List, Patents List, List of Holidays etc. When a member sends a request for routine literature like this, one can use "auto-responders" to pick up relevant documents automatically and dispatch them to the member without human intervention.

3) News, Newsletters etc for patrons.

For instance one can subscribe to a daily email based newsletter service and get a soul-stirring story every day from the web site Chicken Soup for the Soul. The stories are taken from the series of well known books called The Chicken Soup for the Soul...".

This story can be sent by mail daily to every one of the library readers who might be interested. The advantage is that Readers are spared of subscribing and un-subscribing. In an environment where a large number of patrons say students in a University LAN, an arrangement as mentioned here would cut down mail traffic greatly. This is so because the mail server receives only one email message instead of several dozens at a time.

4) Dictionary via Email

Using Email it is possible to a query to a database and get replies. For example if you want to know the meaning of a word, instead of looking up the dictionary ypu may send a email request to: wsmith@wordsmith.org In the subject field just type: Define <word>

Immediately in a few seconds your mail box will have the dictionary entry copied to you!

5) DELNET Search

If you are member of Delhi Library Network, you can send email based queries to search any of the bibliographic databases hosted on DELNET severs in Delhi. Search results will be available to you via email.

Internet is replete with a large number of useful opportunities for making the librarian's life easy and more purposeful. Above are just a few stray examples.

16.6 LET US SUM UP

In this unit we have learnt about Electronic Mail in detail. Basic concepts of Email have been explained. What is needed for having email facility has been discussed. Advantages and disadvantages have been debated. It has been explained how web based email facility can be used even by persons not possessing a computer. Typical uses of Email in a library situation have been illustrated. Detailed explanation of Mailing lists and their usefulness for Libraries have been given. Sources for locating suitable Mailing Lists have been enumerated.

16.7 GLOSSARY

Account **:**	Every User of a Computer System or Network is given an Account Number and password with which he can access a computer.
Client **:**	A software used to read an email message or send messages. Netscape and Internet Explorer are popular Internet web Browsers software which include Email Client by default.
Domain Name **:**	Second part of the email address after the @ sign. Signifies the Email host computer and its location.
Email-ID **:**	Email Address of a person. Example: vyasa@manage.gov.in
ISP **:**	Internet Service Provider. Vendor who helps you get connected to Internet and Email as well.
Modem **:**	Modulator-Demodulator. A piece of hardware that is needed to have Email in addition to PC and Phone Line.
SMTP **:**	Simple Mail Transfer Protocol. Sending Mail requires a software based on SMTP or similar protocol.
POP **:**	Post Office Protocol. Software based on POP or similar ones are needed for receiving email.
Pine ,Eudora	Names of some popular Email Clients.
Elm, Outlook **:**	

16.8 RECOMMENDED BOOKS

JEEVAN, VKJ: "ListServers for Information Professionals". In Ashok Babu, T: *Vision of Future Library and Information systems*. Delhi: Viva Books, 2000. pp 118-127

PC Quest Plus. August 2000. Supplement: Your Handy ISP Lookup

PRIDE, Simon: *Email for the Library and Information Service Professional*. London: ASLIB, 1996.

TITTEL, EE and Robins, Margaret: *E-Mail Essentials: Everything you wanted to know*. New Delhi: AP Professional, 1994. 298 pp.

16.9 MODEL EXAMINATION QUESTIONS

I. ESSAY QUESTIONS

1. Explain the term Electronic Mail. Discuss its advantages and disadvantages compared to other modes of communication.
2. What are Mailing Lists? Give some examples of Lists useful for the Librarian.
3. Among the Internet Services, Email is the most important. Discuss with reasons.

II. SHORT QUESTIONS

a) Email Address

b) ListServ

c) Satyam Online

d) Auto-responder

e) Requirements for Email.

APPENDIX 1: LIST of Mailing Lists of Interest to Librarian

e-mail address	Topic
ACRL@UICVM.UIC.EDU	Association of College and Research Libraries Files
ALCTS@UICVM.UIC.EDU	Association for Library Collections and Technical Services
ALUMNI@ILS.UNC.EDU	School of Information and Library Science, University of North Carolina, Chapel Hill Alumni
ARCHIVES@MIAMIU.MUOHIO.EDU	Archives and Archivists
ASIS-L@VMD.CSU.UIUC.EDU	American Society for Information Science
AUTOCAT@UBVMCC.BUFFALO.EDU	Library Cataloguing and Authorities
CDROM-L@UCCVMA.UCOPEDIJ	CD-ROMs
CHMINF-L@IUBVM.UCS.INDIANA.EDU	Chemical Info Sources
CNI-COPYRIGHT@CNI.ORG	CNI's Copyright and Intellectual Property Forum
COLLDV-L@VM.USC.EDU	Library Collection Development
COLLIB-L@WILLAMETTE.EDU	ACRL College Libraries Section
COLLIBS @IS.SU.EDU.AU	Collection Development in Australian Academic and Research Libraries
CONSALD@MCFEELEY.CC.UTEXAS.EDU	Committee on South Asian Libraries and Documentation
COOPCAT@IUBVM.UCS.INDIANA.EDU	Cooperative Cataloguing
DIGLIB-L@INFOSERV.NLC-BNC.CA	Digital Libraries
ECOLL@UNLLIB.UNL.EDU	Collection Development of Electronic Resources
EMEDIA-REQUEST@VAX1.ELON.EDU	EMEDIA (Electronic Media Issues in Libraries)
GOVDOC-L@PSUVM.PSU.EDU	Government Documents
ILL-L@UVMVM.UVM.EDU	Interlibrary Loan
INDEX-L@BINGVMB	Indexer's Discussion Group
LAW-LIB@UCDAVIS.EDU	Law Librarians
LIBADMIN@UMAB.UMD.EDU	Library Administration and Management
LIBREF-L@KENTVM.KENT.EDU	Discussion of Library Reference Issues
LIBJOB@FIREFLY.PRAIRIENET.ORG	Information Professions Employment Opportunities List

APPENDIX: Some Library & Information Related E-mail Lists

(Continued)

e-mail address	Topic
ALCTS @UICVM.UIC.EDU	Library and Information Science Students
LITA-L@UICVM.UIC.EDU	Library and Information Technology Association
MAILBASE@MAILBASE.AC.UK	LIS-LINK (Computer-Based Info and Reference Services in Libraries)
MAISER@ZB.UB.UNI-DORTMUND.DE	CDLAN (Integrating CD-ROMs in LANs in Libraries)
MEDLIB-L@UBVM.CCBUFFALOEDU	Medical and Health Sciences Libraries
NISO-L@NERVM.NERDC.UFL.EDU	US (National) Information Standards Organization
OCLC-JOURNALS @OCLC.ORG	OCLC Electronic Journal Publishing
PACS-L@UHUPVMI .UH.EDU	Public-Access Computer Systems
PUB LIB @NYSERNET.ORG	Public Libraries
PUBYAC@NYSERNET.ORG	Library Services to Children and Young Adults in Public Libraries
SERIALST@UVMVM.UVM.EDU	Serials in Libraries
SLAITE-L@BABSON.EDU	Special Libraries Association Information Technology Division
SLA-PAM@LISTSERVER.LIBMUOHIO.EDU	Special Libraries Association—Physics, Astronomy, and Mathematics
SPIN-L@SILVERPLATTER.COM	Silverplatter Information Network
TQMLIB @CMS.CC.WAYNE.EDU	Total Quality Management for Librarians
USMARC@LOC.GOV	USMARC Advisory Group
VPIFJ-L@VTVMI.CC.VT.EDU	Publishing E-Journals: Publishing, Archiving, and Access
WEB4LIBRARYBERKELEY.EDU	Library-Based World-Wide Web Systems
Z39501W@NER VM.NERDC. YFL.EDU	Z39.50 Implements Workshop