

PAPER – 6A : INFORMATION TECHNOLOGY

QUESTIONS

1. Define the following terms briefly:

(i) GUI	(ii) System Software	(iii) Workstation
(iv) ISDN	(v) Spooling Software	(vi) Sort Utilities
(vii) Transaction Server	(viii) Bluetooth	(ix) Decision Table
(x) EBCDIC Code	(xi) The Boot Record	(xii) FAT
(xiii) Motherboard	(xiv) ALU	(xv) MMX
2. Convert the following from one number system to another number system along with the working notes:

(i) $(1\ 0\ 1\ 1\ 0\ 1\ 1\ 1)_2$	=	() ₁₀
(ii) $(921)_{10}$	=	() ₂
(iii) $(1128)_{10}$	=	() ₂
(iv) $(101.011)_2$	=	() ₁₀
(v) $(165.484)_{10}$	=	() ₂
3. Give one or two uses of each of the following:

(i) Bubble Memory	(ii) Flash Memory	(iii) Video RAM
(iv) DVD	(v) Word Processor	(vi) Index Fields
(vii) IDS Components	(viii) Virtual Private Network	(ix) DBMS
4. Distinguish between the following:

(i) Mainframe computers and Mini computers
(ii) Random-Access-Memory and Read-Only-Memory
(iii) EPROM and EEPROM
(iv) CD-R and CD-RW
(v) Shareware and Firmware
(vi) Assemblers and Interpreters
(vii) Bytes and Word
(viii) Impact and Non-Impact Printers
(ix) Primary Key and Secondary Key

- (x) Integer Fields and Text Fields
- (xi) Transaction Log and Mirror Log
- (xii) Proxy server and Caching Server
- (xiii) Operational Database and End-User Database
- (xiv) Online Backup and Live Backup

BUS AND ITS PARTS

- 5. (a) What do you understand by bus and what role does it play?
- (b) Discuss various types of a bus.

CHARACTERISTICS AND TYPES OF STORAGE

- 6. (a) What are storage devices and discuss their characteristics.
- (b) Discuss various types of storage.

MAGNETIC DISC

- 7. (a) Discuss in detail the functioning of magnetic disc.
- (b) Discuss the advantages and disadvantages of magnetic disc.

INPUT/OUTPUT DEVICES

- 8. (a) Discuss input devices MICR and OCR and their advantages and disadvantages.
- (b) Discuss voice recognition and graph plotter output devices.

DECISION SUPPORT SYSTEM

- 9. What is a DSS? Discuss its various components.

EXPERT SYSTEM

- 10. Discuss in detail Expert system.

DATABASE

- 11. (a) What is a database. Explain its uses
- (b) Discuss database architecture.
- (c) Discuss various types of database models.

DATA WAREHOUSE

- 12. (a) What do you understand by "Data Warehouse"?
- (b) Discuss its various components.

FLOWCHARTS

- 13. What are flowcharts and their use? Discuss various categories of flowcharts.

INTERNET RISK AND SECURITY CONSIDERATIONS

14. What are the major risks and security concerns while using Internet for E-commerce and what are the tools available in the market against them?

ELECTRONIC PAYMENTS

15. What are the different types of electronic payments?

CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

16. (a) What do you mean by the term "CRM" and what purpose does it serve?
(b) Discuss the architecture of CRM.

SUPPLY CHAIN MANAGEMENT

17. (a) What is SCM and in which areas is it applicable?
(b) Which are the problem areas in SCM? Discuss briefly.
(c) Discuss Bullwhip Effect.

TRANSMISSION PROTOCOLS

18. (a) What do you understand by the term "Protocols"?
(b) Discuss OSI and TCP/IP in detail.

NETWORK STRUCTURE/TOPOLOGY

19. (a) Define the term Network Topology.
(b) Discuss some of the basic network structures and their advantages and disadvantages.

E-COMMERCE AND ITS APPLICATIONS

20. (a) Define E-commerce, its benefits and applications.
(b) What are the three types of E-Commerce?

FLOWCHART

21. A bicycle shop in Delhi hires bicycles by the day at different rates as shown in following table :-

Season	Charges per day
Spring (March - May)	Rs. 8.00
Summer (June - August)	Rs. 9.50
Autumn (Sept - Nov.)	Rs. 5.00
Winter (Dec. - Feb.)	Rs. 6.00

To attract his customers, the proprietor also gives a discount on the number of days a bicycle is hired for. If the hire period is more than 10 days, a reduction of 15% is made.

For every bicycle hired, a deposit of Rs. 20 must be paid. Develop a flowchart to print out the details for each customer such as name of customer, number of days a bicycle is hired for, hire-charges and total charges including the deposit.

It is also assumed that there are 25 customers and complete details for each customer such as name of customer, season and number of days the bicycle is required for is inputted through console.

DECISION TABLE

22. A shop owner allows credit facility to his customers if they satisfy any one of the following conditions:
1. Holding the present job for more than 3 years and residing in the same place for more than 5 years.
 2. Monthly Salary exceeds Rs. 1500 and holding the present job for more than 3 years.
 3. Residing in the same place for more than 5 years and monthly salary exceeds Rs. 1500.

The facility is rejected for all other customers. Draw its decision table.

IMAGE PROCESSING

23. What is image processing? Discuss its advantages.

BUSINESS CONTINUITY PLANNING

24. What do you mean by Business Continuity Planning? Discuss its components in detail.

COMPUTER PROGRAMMING PROCESS

25. What is the concept of computer programming process? Discuss its phases.

SUGGESTED ANSWERS / HINTS

1. (i) GUI: GUI or Graphical User Interface takes the user away from command-driven interfaces to an user-friendly graphics oriented environment, which provide an alternative to cryptic text commands. With the GUI, the user can interact with operating system and other software packages by selecting options from menus that are temporarily super-imposed over whatever is currently on the screen by using mouse to position the graphics cursors over the appropriate icon thus eliminating the need for users to memorize and enter cumbersome commands.
(ii) System Software: System Software comprises of Programming Languages, Operating systems, Subroutines, Utility Programs, Diagnostic Routines and Language translators that control and support the computer system and its data processing applications. In other words, system software includes operating systems and any program that supports application software.

- (iii) **Workstation:** A workstation looks like a personal computer and is typically used by one person. Workstations are more powerful than the average personal computer and are based on different architecture of CPU called Reduced Instruction Set Computing (RISC), which results in faster processing of instructions.
- (iv) **ISDN:** ISDN or Integrated Services Digital Network (ISDN) is a system of digital phone connections to allow simultaneous transmission of voice and data across the world. ISDN allows multiple digital channels to be operated simultaneously through the same regular phone cable meant for analog signals.
- (v) **Spooling Software:** The purpose of spooling software is to compensate for the speed differences between the computer and its peripheral devices. Spooling utilities can also be used on the input side, so that programs and data to be processed are temporarily stored in an input spooling area on disk.
- (vi) **Sort Utilities:** Sort utilities are often found in mainframe and minicomputer environments and are those that sort data. For example, sort routines are commonly found in spreadsheet and database management software.
- (vii) **Transaction Server:** Transaction Server is an integral part of Windows NT, and is installed by default as part of the operating system in NT5. It is a service that is all about managing the way applications use components, and not just about managing transactions.
- (viii) **Bluetooth:** Bluetooth is a telecommunications industry specification that describes how mobile phones, computers, and personal digital assistants (PDAs) can be easily interconnected using a short-range wireless connection. Using this technology, users of cellular phones, pagers, and personal digital assistants can buy a three-in-one phone that can double as a portable phone at home or in the office, get quickly synchronized with information in a desktop or notebook computer, initiate the sending or receiving of a fax, initiate a print-out, and, in general, have all mobile and fixed computer devices be totally coordinated..
- (ix) **Decision Table:** A decision table is a table which may accompany a flowchart, defining the possible contingencies that may be considered within the program and the appropriate course of action for each contingency. A decision table is divided into four parts - Condition Stub, Action Stub, Condition entries and Action entries.
- (x) **EBCDIC Code:** EBCDIC stands for Extended BCD Interchange Code. It is an 8-bit standard character code without parity for large computers. A 9th bit can be used for parity. With 8 bits, up to 256 characters can be coded. In EBCDIC, the first 4 bits are known as Zone Bits and the remaining 4 bits represent digit values.
- (xi) **The Boot Record:** It is a small program that runs when the computer is started and determines whether the disk has the basic components of DOS or Windows that are necessary to run the operating system successfully. If the required files are present and the disk has a valid format, it transfers control to one of the operating system programs that continues the process of starting up. This process is called Booting

because the boot program makes the computer pull itself up by its bootstraps. The boot record also describes other disk characteristics, such as the number of bytes per sector and the number of sectors per track.

- (xii) FAT: The FAT or File-Allocation table is a log that records the location of each file and the status of each sector. When a file is written to a disk, the operating system checks the FAT for an open area, stores the file, and then identifies the file and its location in the FAT.
- (xiii) Motherboard: The motherboard or the system board is the main circuit board on the computer. It acts as a direct channel for the various components to interact and communicate with each other. There are various types of motherboards available depending on the processors that are used.
- (xiv) ALU: ALU includes a group of registers – high-speed memory locations built directly into the CPU that are used to hold the data currently being processed. Arithmetic operations include addition, subtraction, multiplication, and division whereas Logical operations include comparisons, such as determining whether one number is equal to, greater than, or less than another number.
- (xv) MMX: MMX stands for Multimedia Extensions which is defined as a set of instructions built in to the CPU, specifically intended for improving the performance of multimedia or graphic applications – mainly games.

$$\begin{aligned}
 2. \quad (i) \quad (10110111)_2 &= (\quad \quad \quad)_{10} \\
 &= (1 \times 2^7) + (0 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) \\
 &= 128 + 0 + 32 + 16 + 0 + 4 + 2 + 1
 \end{aligned}$$

$$(10110111)_2 = (183)_{10}$$

$$(ii) \quad (921)_{10} = (\quad \quad \quad)_2$$

2	921	
2	460	1
2	230	0
2	115	0
2	57	1
2	28	1
2	14	0
2	7	0
2	3	1
	1	1



$$(921)_{10} = (1110011001)_2$$

$$(iii) (1128)_{10} = (\quad)_2$$

2	1128	
2	564	0
2	282	0
2	141	0
2	70	1
2	35	0
2	17	1
2	8	1
2	4	0
2	2	0
	1	0



$$(1128)_{10} = (10001101000)_2$$

$$(iv) (101.011)_2 = (\quad)_{10}$$

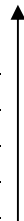
$$= (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) + (0 \times 2^{-1}) + (1 \times 2^{-2}) + (1 \times 2^{-3})$$

$$= 4 + 0 + 1 + 0 + 0.25 + 0.125$$

$$(101.011)_2 = (5.375)_{10}$$

$$(v) (165.625)_{10} = (\quad)_2$$

2	165	
2	82	1
2	41	0
2	20	1
2	10	0
2	5	0
2	2	1
	1	0



$$= (10100101)_2$$

$$(0.625)_{10}$$

0.625	
x 2	
1.25	1
0.25 x 2	
0.5	0
0.5 x 2	
1.0	1



$$= (0.101)_2$$

$$(165.625)_{10} = (10100101.101)_2$$

3. (i) **Bubble Memory:** Bubble memory is composed of small magnetic domains (bubbles) formed on a thin single-crystal film of synthetic garnet. These magnetic bubbles are magnetically charged cylinders which can move across the garnet film by electric charges. The presence or absence of a bubble can be used to indicate whether a bit is “on” or “off”. Bubble memory has high potential because of its low production costs and its direct access capabilities.
- (ii) **Flash memory:** Flash memory chips are one of the latest storage devices which is a form of static RAM (SRAM) chips, store data much like those used in the computer’s primary storage. Flash memory is non-volatile and very fast.
- (iii) **Video RAM:** Video RAM (VRAM) is used to accelerate the display of graphics on the screen. It does this by using two ports, one connected to the CPU and the other to the screen. Data flows in one port and out the other very smoothly.
- (iv) **DVD:** DVD or Digital Versatile Disc or Digital Video Disc is an optical disc storage media format that can be used for data storage, including movies with high video and sound quality. The advantages of DVDs are – a huge storage capacity that enables users to archive large amounts of data on a single, lightweight, removable, reliable, easily-transportable medium.
- (v) **Word Processor:** A word processor is a computer application used for the production including composition, editing, formatting, and possibly printing of any sort of printable material. Most are powerful systems using GUI and consisting of one or more programs that can produce any arbitrary combination of images, graphics and text. Microsoft Word is the most widely used computer word processing system.
- (vi) **Index Fields:** Index fields are used to store relevant information along with a document. The data input to an Index Field is used to find those documents when needed. The program provides up to twenty-five user-definable Index Fields in an Index Set. An index field can be one of three types: Drop-Down Look-Up List, Standard and Auto-Complete History List.
- (vii) **IDS Components:** The goal of intrusion detection is to monitor network assets to detect anomalous behavior and misuse. The primary IDS components are: Network Intrusion Detection (NID), Host-based Intrusion Detection (HID), Hybrid Intrusion Detection and Network-Node Intrusion Detection (NNID).
- (viii) **Virtual Private Network:** A VPN is a private network that uses a public network (usually the Internet) to connect remote sites or users together. Instead of using a dedicated, real world connection such as leased line, a VPN uses virtual connections routed through the Internet from the company’s private network to the remote site or employees. The two most common types of VPN are - Remote-access, also called a virtual private dial-up network (VPDN) and Site-to-Site VPN.
- (ix) **DBMS:** A DBMS is a set of software programs that controls the organization, storage, management, and retrieval of data in a database. A data base is a repository for related collection of data. For example, an address book can be a

data base where the names, address and telephone numbers of friends and business contacts are stored.

4. (i) **Mainframe Computers:** Mainframes are big general-purpose computers capable of handling all kinds of scientific and business applications. Mainframes can process at several million instructions per second and can support more than 1,000 remote terminals and have large on-line secondary storage capacity. A number of different types of peripheral devices like magnetic tape drive, hard disk drive, visual display units, plotters, printers and telecommunication terminals can be attached with main-frame computers. They have high-speed cache memory which enables them to process applications at a faster rate than mini or microcomputers. They also offer the facility of multiprogramming and time-sharing.

Mini Computers: This type of computer performs data processing activities in the same way as the mainframe but on a smaller scale. A minicomputer is small compared with a mainframe and may be called a scaled-down mainframe as the processor and the peripherals are physically smaller. Data is usually input by means of a keyboard. Minicomputers cost about Rs. 5 lacs to Rs. 50 lacs. These systems can serve as information processors in small-to-medium sized firms or as processors in computer networks for large firms. Primary storage capacity starts at about 640K and can go as high as few mega bytes (MB) A minicomputer system consists of a CPU, several disk drives, a high-speed printer, perhaps a few magnetic tape units, and number of terminals.

- (ii) **Random-Access-Memory:** The memory system constructed with metal-oxide semi conductor storage elements that can be changed is called a Random Access Memory (RAM). The purpose of RAM is to hold programs and data while they are in use. It is called random access memory since access time in RAM is independent of the address of the word, that is, each storage location (address) inside the memory is as easy to reach as any other location and takes the same amount of time.

RAMs can be further divided according to the way in which the data is stored, into dynamic RAMs and static RAMs. The computer designer's decision which to use where depends on what their function is to be, and on their speed and cost.

Read-Only-Memory: Read-only-memory (ROM) is used for micro programs wherein the storage cannot be altered by regular program instructions. The information is stored permanently in such memory during their manufacturing and can be read only but fresh information cannot be written into it. One set of instructions found in ROM is called the ROM-BIOS which stands for Read-only Memory Basic Input Output services. These programs perform the basic control and supervisory operations for the computer. Its various types are: PROM, EPROM and EEPROM and also handles the basic needs of the hardware involved, which include all I/O devices.

- (iii) **EPROM:** EPROM stands for Erasable Programmable Read Only Memory. EPROM chips can be electrically programmed. Unlike ROM and PROM chips, EPROM chips

can be erased and reprogrammed. Eraser is performed by exposing the chip to Ultra-violet light.

EEPROM: Electrically Erasable Programmable Read Only Memory is EEPROM. In this, the data can be erased by applying electrical charges.

- (iv) CD-R: It stands for compact disc, recordable in which a person can only write once on the CD, though it can be read as many times as wished. It can be played in CD players and CD-ROM drives. Modern recording devices can also read CDs as well. CD-Rs can be created in any CD-R or CD-RW drive.

CD-RW: The rewriteable compact disc is called a CD-RW which allows for repeated recordings on a disc. It is relatively more expensive than the CD-R. The CD-RW uses a material that can change to and fro from a crystalline form when exposed to a particular light. The technology of this process has a special name called phase changing.

- (v) Shareware: It is a software developed by individual and small companies that cannot afford to market their software world wide or by a company that wants to release a demonstration version of their commercial product. Shareware software often is disabled in some way and has a notice attached to explain the legal requirements for using the product

Firmware: Firmware or micro programs refer to a series of special program instructions. The most basic operations such as addition, multiplication etc. in a computer are carried out by hardwired circuits which are then combined in the form of micro programs called as Firmware to produce higher level operations. Firmware are held in the CPU in a special control storage device.

- (vi) Assemblers: Assemblers are used exclusively with assembly languages. They work similarly to compilers, translating an assembly language program into object code. Because assembly language programs are usually more machine efficient than those written in high-level languages, a two-step translation process may take place. First, the high-level language is translated to assembly language; then, using an assembler, it is converted to machine language.

Interpreters: Interpreters translate programs a line at a time as they are being run. For instance, if a user has a program in which a single statement is executed a thousand times during the course of the program's run, the interpreter would translate that statement a thousand different times into machine language. With an interpreter, each statement is translated into machine language just before it is executed. No object module or storable load module is ever produced.

- (vii) Byte: A byte is a basic grouping of bits (binary digits) that the computer operates on as a single unit. It consists of 8 bits and is used to represent a character by the ASCII and EBCDIC coding systems.

Word: A word is a grouping of bits (usually larger than a byte) that is transferred as a unit between primary storage and the registers of the ALU and control unit.

- (viii) Impact printers: Impact printers can be described as printers which utilize some form of striking device to transfer ink from an inked ribbon onto the paper being printed to form images or characters. Impact printers fall into two basic categories - Serial or line printing.

Non-impact printers: A non-impact printer forms characters by chemical or electronic means. The non-impact printers are, however, not commonly used as they require more expensive paper and only one copy can be printed at a time. Three types of non-impact printers are - Thermal printers, Ink-jet printers and Laser printers.

- (ix) Primary Key: The primary key of any table is any candidate key of that table which the database designer arbitrarily designates as primary. The primary key may be selected for convenience, comprehension, performance, or any other reasons. It is entirely proper to change the selection of primary key to another candidate key.

Secondary Key: Secondary keys can be defined for each table to optimize the data access that can refer to any column combination and they help to prevent sequential scans over the table. A candidate key which is not selected as a primary key is known as Secondary Key.

- (x) Integer Fields – The integer field accepts data as a whole number.

Text Fields – The text field accepts data as an alpha-numeric text string.

- (xi) Transaction Log: A transaction log is a file that records database modifications like inserts, updates, deletes, commits, rollbacks, and database schema changes.

Mirror Log: A mirror log is an optional file and has a file extension of .mlg. It is a copy of a transaction log and provides additional protection against the loss of data in the event the transaction log becomes unusable.

- (xii) Proxy Server: A proxy server is designed to restrict access to information on the Internet. A proxy server operates on a list of rules given to it by a System Administrator. Some proxy software uses list of specific forbidden sites, while other proxy software examines the content of a page before it is served to the requester. If certain keywords are found in the requested page, access to it is denied by the proxy server.

Caching Server: A caching server is employed when one wants to restrict his number of accesses to the Internet. A caching server sits between the client computer and the server that would normally fulfill a client's request. Once the client's request is sent, it is intercepted by the caching server. The caching server maintains a library of files that have been requested in the recent past by users on the network. If the caching server has the requested information in its cache, the server returns the information without going out to the Internet.

- (xiii) Operational databases: These databases store detailed data needed to support the operations of the entire organization and are also called Subject Area Databases (SADB), transaction databases, and production databases. Examples

are a customer database, personnel database, inventory database, and other databases containing data generated by business operations.

End User Databases: These databases consist of a variety of data files developed by end users at their workstations. For example, users may have their own electronic copies of documents they generated with word processing packages or received by electronic mail.

- (xiv) Online Backup: An online database backup is performed by executing the command-line or from the Backup Database utility. When an online backup process begins, the database engine externalizes all cached data pages kept in memory to the database file(s) on disk. This process is called a checkpoint.

Live Backup: A live backup is carried out by using the BACKUP utility with the command-line option and provides a redundant copy of the transaction log for restart of the system on a secondary machine in the event the primary database server machine becomes unusable.

- 5 (a) The Bus: The very maze of golden electric circuits etched on the both sides of the system motherboard, forms the bus of the PC. A bus acts as the system's expressway - it transmits data between the various components on the motherboard. Theoretically, a bus is a collection of wires through which data is transmitted between the various components of a PC. A bus connects the various components of the PC with the CPU and the main memory (RAM).
- (b) Logically, a bus is of two types - A Data bus and an Address bus.

The Data Bus: The Data Bus is an electrical path that connects the CPU, memory, and the other hardware devices on the motherboard. The number of wires in the bus affects the speed at which data can travel between hardware components, as each wire can transfer one bit at a time, an eight-wire bus can move eight bits at a time, which is a full byte. A 16-bit bus can transfer two bytes, and a 32-bit bus can transfer four bytes at a time.

PC buses are designed to match the capabilities of the devices attached to them. A microprocessor chip can now send and receive more data at once, and improved bus designs create wider paths through which the data can flow.

The Address Bus: The address bus is a set of wires similar to the data bus that connects the CPU and RAM and carries the memory addresses. It is important as the number of wires in it determines the maximum number of memory addresses. For example, one byte of data is enough to represent 256 different values. If the address bus could carry only eight bits at a time, the CPU could address only 256 bytes of RAM.

- 6. (a) Storage Devices and their characteristics

The CPU contains the basic instructions needed to operate the computer, but it does not have the capability to store programs or large sets of data permanently. Computers need blocks of space that it can address from time to time to help in

processing arithmetical and logical operations and also hold programs and data being manipulated. This area is called memory or storage.

Characteristics of storage: The division to primary, secondary, tertiary and off-line storage is based on memory hierarchy, or distance from the central processing unit. There are also other ways to characterize various types of storage.

- (i) Volatility of information.
- (ii) Ability to access non-contiguous information.
- (iii) Ability to change information.
- (iv) Addressability of information.
- (v) Capacity and performance

(b) Types of Storage: As shown in Fig 6.1, there are majorly three types of storage.

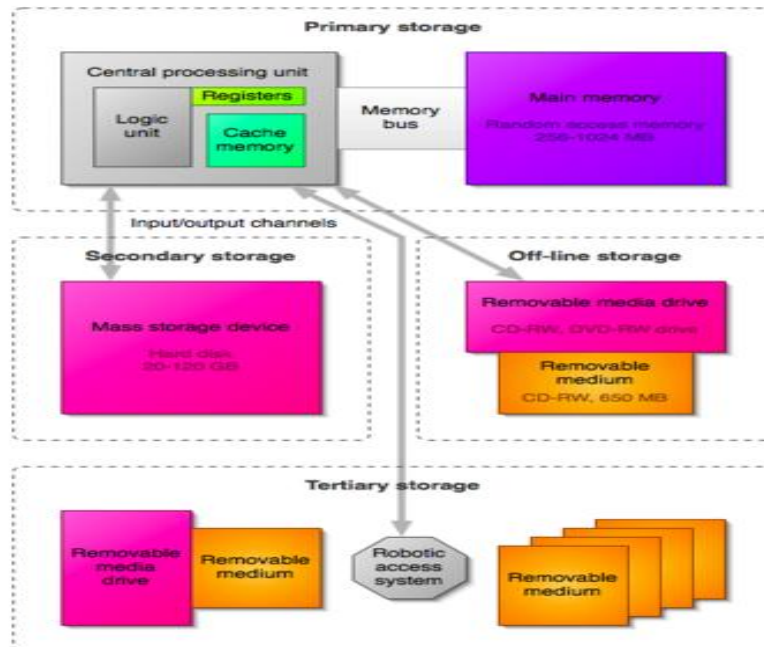


Fig. 6.1 Types of Storage

- (i) Primary Storage: Primary storage is directly connected to the central processing unit of the computer. As shown in the Fig. 6.1, primary storage typically consists of three kinds of storage: Processor registers, Main memory and Cache memory.
- (ii) Secondary, Tertiary and Off-line Storage.
- (iii) Network Storage includes - Network-attached storage and Network computers.

7. (a) **Magnetic Disk:** Magnetic disks also called as hard disks are the most popular direct access medium wherein a record can be accessed without having to plod through the preceding records. The hard disk is still the most common storage device for all computers wherein data is stored in tracks that are further divided into sectors.

Functioning of Magnetic Disk

- (i) Magnetic disk hold more data as they often include several platters stacked one on top of another.
- (ii) With hard disks, the number of R/W heads specifies the number of sides that the disk uses.

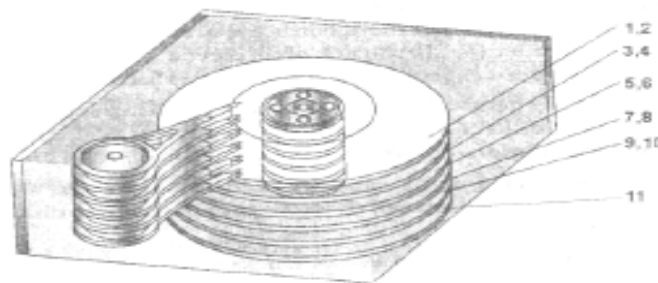


Fig. 7.1 Hard Disk Drive

- (iii) Read/write heads move in and out simultaneously, thus all the tracks vertically above and below each other should be read or written before any further movement of the heads take place. This eliminates first component of the seek time i.e., horizontal movement of the read/write heads as shown in Fig. 7.1.
- (iv) The tracks vertically above and below each other constitute more or less a hollow cylinder as shown in Fig. 7.2. The simultaneous movement of the read/write heads, enable reading or writing cylinder wise.

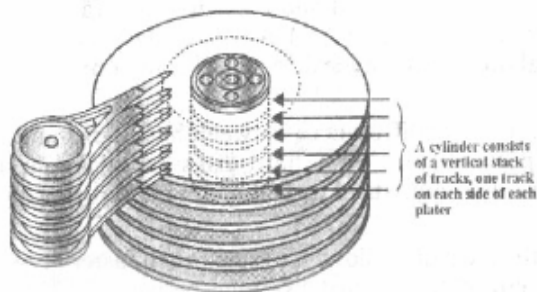


Fig. 7.2 HDD with cylinders and tracks

- (v) Only one magnetic pack is connected to the CPU and serves both as the input and output unit. A record picked up from a sector and updated in the CPU is deposited back in the same place in that sector. This mode of storing updated data is known as overlaying i.e., original data is automatically erased when the new updated record is being deposited in its place, thus requiring fewer discs.
 - (vi) The time required in accessing a record has generally three components: Seek Time, Rotational time and Data transfer time.
- (b) Advantages of magnetic disk include -
- (i) Magnetic rigid disk is a direct access storage medium; therefore, individual records can be retrieved without searching through the entire file.
 - (ii) The costs of disks are steadily declining.
 - (iii) Records can be readily updated by writing the new information over the area where the old information was stored.
 - (iv) With removable disk packs, a single disk drive can store large quantities of data although all but one of the disks is offline at any given point in time.
 - (v) Interrelated files stored on magnetic disk can allow a single transaction to be processed against all of these files simultaneously.

Disadvantages of magnetic disk include -

- (i) Updating a master file stored on disk destroys the old information.
- (ii) It is required that the read/write head must be extremely close to the surface of the disk. In fact, the heads of hard disks fly so close to the surface of the disk that if a dust particle, a human hair, or even a fingerprint were placed on the disk it would bridge the gap between the head and the disk, causing the heads to crash. A head crash, in which the head touches the disk, destroys the data stored in the area of the crash and can destroy a read/write head, as well.

8. (a) MICR (Magnetic Ink Character Recognition)

MICR employs a system of printed characters which are easily decipherable by human beings as well as a machine reader. A special printing font is used to represent characters in which each character is basically composed of vertical bars (See "2" of Fig. 8.1) The characters are printed in special ink, which contains a magnetizable material as shown in Fig. 8.2. In "2" of Fig. 8.1, there are four small gaps and two big gaps.



Fig. 8.1 A character

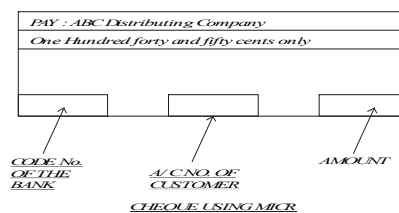


Fig. 8.2 Cheque with MICR code

When a character is subsequently read it is passed beneath a reading head and big and small gaps send in different types of impulses represented by 1 bit and 0 bit respectively. This method is primarily used in banking industry, and most cheques are now processed under the MICR approach as depicted in Fig. 8.1. The data printed across the bottom of a blank cheque are recorded in MICR form; the characters represent the bank on which the cheque is drawn, the customer's account number and the amount of the cheque. When they are originally printed by a printing press, the MICR about the bank identification number, as well as the data about the customer's bank account number are printed simultaneously. The cheques then are turned over to the proper bank customer for use.

Advantages of MICR

MICR possesses a very high reading accuracy. Cheques may be smeared, stamped, roughly handled yet they are accurately read and can be handled directly without transcribing them on floppy disk, magnetic tape etc. Cheques can be read both by human beings and machines.

Disadvantages of MICR

MICR has not found much favor from business. Damaged documents, cheques not encoded with amount etc. need to be processed clerically.

OCR (Optical Character Reading)

OCR also employs a set of printing characters with standard font that can be read by both human and machine readers. OCR has the potential of reading even handwritten documents straightway. OCRs can read upper and lower case letters, numeric and certain special characters from handwritten, typed and printed paper documents.

The optical character readers have slightly irregular type face. They can read the characters printed by computer printers, cash registers, adding machines and typewriters, and some of them can also read hand-written documents.

Large volume billing applications (e.g. the bills of utility companies, credit-card organizations, and magazine subscription outfits) increasingly are being adapted to OCR methods. The customer paying the bill returns the bill, which has OCR data (e.g. customer number and amount of the bill) recorded on it, along-with payment. Thus, the billing organization's bill (or the part returned by the customer) becomes input for recording cash payments received from the customer. This procedure, sometimes referred to as the use of turn-around documents, has the advantage of minimizing or eliminating the keying process when cash receipts are received from customers.

Advantages of OCR

OCR eliminates the human effort of transcription. Paper work explosion can be handled because OCR is economical for a high rate of input. Since documents only need to be typed or handwritten, not very skilled staff (like the keypunch operators) is required. Furthermore, these input preparation devices (typewriters etc.) are much cheaper than the keypunch or the key-to-tape devices.

Disadvantages of OCR

There are usually specific and rather inflexible requirements for type font and size of characters to be used. Most optical readers are not economically feasible unless the daily volume of transactions is relatively high. OCR characters can be sent as input to the CPU. Also, printers can be used to generate OCR output. Optical character readers can read from both cut form and continuous sheets.

(b) Voice Recognition and Graph Plotter Systems

Voice Recognition: Translating voice to text is a capability known as voice recognition, with the help of which one can speak to the computer rather than having to type. The user can also control the computer with oral commands, such as "shut down" or "print status report".

Voice recognition software takes the smallest individual sounds in a language, called phonemes, and translates them into text or commands.

Graph Plotter: A graph plotter is a device capable of tracing out graphs, designs and maps into paper and even into plastic or metal plates. A high degree of accuracy can be achieved, even upto one thousandth of an inch. Plotters may be driven on-line or off-line. Computer systems dedicated to design work often operate plotter on-line but systems used for other applications as well as graphic applications operate them off-line. There are two types of plotters are Drum Plotter and Flat-bed Plotter.

9. DSS or Decision Support Systems are information processing systems used by accountants, managers, and auditors to assist them in the decision-making process. Advances in hardware technology, interactive computing design, graphics capabilities, and programming languages contributed to DSS because of which it is used in accounting and auditing today.

Characteristics of Decision Support Systems: Although DSS applications vary widely in their level of sophistication and specific purpose, they possess several characteristics in common.

- (i) Decision support system support management decision making.
- (ii) Decision support systems solve relatively unstructured problems.
- (iii) A "friendly" computer interface is also a characteristic of a decision support system.

Components of a Decision Support System: A decision support system has four basic components - the user, one or more databases, a planning language, and the model base.

- (i) The user: The user of a DSS is usually a manager with an unstructured or semi-structured problem to solve. The manager may be at any level of authority in the organization (e.g., either top management or operating management).
- (ii) Databases: Decision support systems include one or more databases which contain both routine and non-routine data from both internal and external sources. The data from external sources include data about the operating environment surrounding an organization.
- (iii) Planning languages: Two types of planning languages that are commonly used in decision support systems are: (1) general –purpose planning languages that allow users to perform many routine tasks and (2) special-purpose planning languages that are more limited in what they can do.
- (iv) Model base: The planning language in a decision support system allows the user to maintain a dialogue with the model base. The model base is the “brain” of the decision support system because it performs data manipulations and computations with the data provided to it by the user and the database

10. Expert Systems

An expert system (ES) is a computerized information system that allows non-experts to make decisions comparable to those of an expert. Expert systems are used for complex or ill-structured tasks that require experience and specialized knowledge in narrow, specific subject areas, as shown in Fig. 10.1, expert systems typically contain the following components:

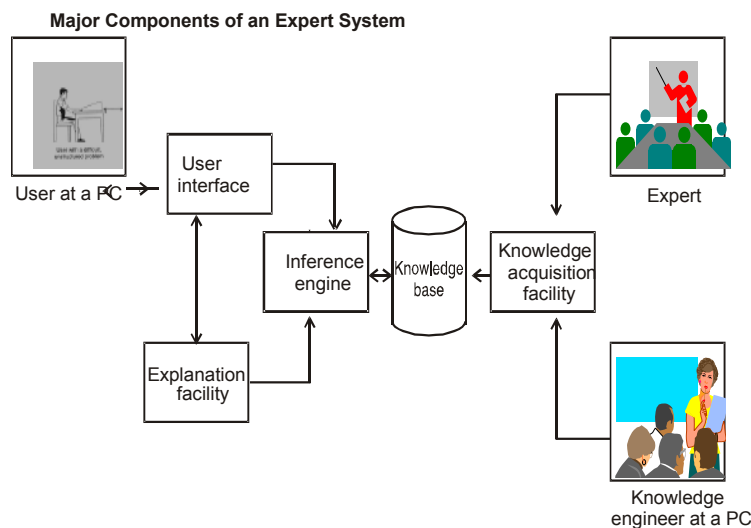


Fig. 10.1 Major Components of an Expert System

- (i) Knowledge base: This includes the data, knowledge, relationships, rules of thumb (heuristics), and decision rules used by experts to solve a particular type of problem. A knowledge base is the computer equivalent of all the knowledge and insight that an expert or a group of experts develop through years of experience in their field.
- (ii) Inference engine: This program contains the logic and reasoning mechanisms that simulate the expert logic process and deliver advice. It uses data obtained from both the knowledge base and the user to make associations and inferences, form its conclusions, and recommend a course of action.
- (iii) User interface: This program allows the user to design, create, update, use, and communicate with the expert system.
- (iv) Explanation facility: This facility provides the user with an explanation of the logic the ES used to arrive at its conclusion.
- (v) Knowledge acquisition facility: Building a knowledge base, referred to as knowledge engineering, involves both a human expert and a knowledge engineer. The knowledge engineer is responsible for extracting an individual's expertise and using the knowledge acquisition facility to enter it into the knowledge base.

Benefits of the Expert System

They provide a cost-effective alternative to human experts. They can outperform a single expert because their knowledge is representative of numerous experts. They are faster and more consistent and do not get distracted, overworked, or stressed out. They produce better-quality and more consistent decisions. Expert systems assist users in identifying potential decision making problems, which increase the probability that sound decisions will be made. They can increase productivity and preserve the expertise of an expert leaving the organization.

Limitations of the Expert System

Development can be costly and time-consuming. Some large systems required up to 15 years and millions of dollars to develop. It can be difficult to obtain knowledge from experts who have difficulty specifying exactly how they make decisions. Designers have not been able to program what humans consider common sense into current systems. Consequently, rule-based systems break down when presented with situations they are not programmed to handle. Until recently, developers encountered skepticism from businesses due to the poor quality of the early expert systems and the high expectations of users.

11. (a) Database : A precise definition of data base as given by "G.M.Scott" is- A data base is a computer file system that uses a particular file organization to facilitate rapid updating of individual records, simultaneous updating of related records, easy access to all records by all applications programs, and rapid

access to all stored data which must be brought together for a particular routine report or inquiry or a special purpose report or inquiry.

Each of the italicized phrases in the preceding definition has a special meaning that helps define a database.

- “File organization” indicates that the database has one of the three file structures that enable programs to establish associations between the records in the database.
- A database facilitates “rapid updating of individual records” and “simultaneously updating of related records” -that is a data base permits the entry of an individual transaction to update all records affected by that transaction simultaneously.
- “Easy access to all records by all applications programs” means that the standard data definitions and record formats permit. Without a database, each application program would be able to access data only from its own file.
- With respect to “rapid access” to all stored data needed of a “routine report or inquiry”, routine reports can be provided quickly after the end of the accounting period and often whenever requested during the period if the processing of transactions is kept up to date.
- Rapid access with respect to a “special purpose report or inquiry” means that records are kept continuously up to date for unanticipated inquiries into the files by managers and that the structure of the data base files facilitates the rapid development of special programs to prepare reports about unanticipated problems.

(b) Database Architecture

It follows a three level architecture –

- (i) External or user view in different ways to say, the chairman, or the operation manager or the data entry operator,
- (ii) Conceptual or global view,
- (iii) Physical or internal view.

External or user view encircles the following –

It is at the highest level of the database abstraction, including only those portion of database or application programs which is of concern to the users. It is described by means of a schema, called the external schema and is defined by the users or written by the programmers.

Global or conceptual view encompasses the following –

This includes database entities and relationships among them, indicating a single view representing the entire database, defined by the conceptual schema, describing all records, relationships and constraints or boundaries and data description to render it independent of the physical representation.

The physical or internal view contains the following –

It is at the lowest level of database abstraction, closest to the physical storage method, indicating how data will be stored and describing data structure and access methods and is expressed by internal schema. Database systems have several schemas, partitioned according to the levels of abstraction. At the lowest level is the physical schema, at the intermediate level is the logical schema and at the highest level is a subschema.

(c) Types of Database Models

- (i) **Distributed Database:** Sometimes an organization may require decentralizing its database by scattering it with computing resources to several locations so that running of application programs and data processing are performed at more than one site. This is known as Distributed Data Processing to facilitate savings in time and costs by concurrent running of application programs and data processing at various sites. When processing is distributed, the database needs to be distributed fully or partly, depending on the organizational requirements. There are two methodologies of distribution of a database - Replicated database and Partitioned database.
- (ii) **Object Oriented Database:** It is based on the concept that the world can be modeled in terms of objects and their interactions. Objects are entities conveying some meaning to users and possess certain attributes to characterize them and interacting with each other. For example - 'Engineer' is an object possessing attributes like 'date of birth', 'address', etc.
- (iii) **Client-server Database:** It is designed in a structure in which one system can connect to another system to ask it question or instruct it to perform job. The system that asks the questions and issues the instructions is the client and the system answering the queries and responding to the instructions is the server. The client machine contains the user interface logic, business logic and the database logic and the server machine contains the database. Both are coupled with a network of high bandwidth.
- (iv) **Knowledge Database:** A database system provides functions to define, create, modify, delete and read data in a system. The data maintained in a database system has been declarative data describing the static aspects of the

real world objects and their associations. A pay roll file and a personnel file can share data about pay rates for each and every employee, their positions, names, etc.

12. (a) Data Warehouse: A Data warehouse is a repository of an organization's electronically stored data and are designed to facilitate reporting and supporting data analysis. The data warehouses are able to bring in data from a range of different data sources, such as mainframe computers, minicomputers, as well as personal computers and office automation software such as spreadsheets and integrate this information in a single place. Data warehouses have several fundamental stages like - Offline Operational Databases, Offline Data Warehouse, Real Time Data Warehouse, Integrated Data Warehouse.
- (b) Components of a data warehouse: The primary components of the majority of data warehouses are shown in the Fig. 12.1.
 - (i) Data Source Layer: Data sources refer to any electronic repository of information that contains data of interest for management use or analytics. This definition covers mainframe databases, client-server databases, PC databases, spreadsheets and any other electronic store of data. Data needs to be passed from these systems to the data warehouse either on a transaction-by-transaction basis for real-time data warehouses or on a regular cycle for offline data warehouses.
 - (ii) Data Transformation Layer: The Data Transformation layer receives data from the data sources, cleans and standardizes it, and loads it into the data repository, also called staging data. Some of the activities that occur during data transformation are - Comparing data from different systems to improve data quality, standardizing data and codes, integrating data from different systems and performing other system housekeeping functions.
 - (iii) Data Warehouse Layer: The data warehouse is a relational database organized to hold information in a structure that best supports reporting and analysis.
 - (iv) Reporting Layer: The data in the data warehouse must be available to the organization's staff if the data warehouse is to be made useful. There are a very large number of software applications that perform this function, or reporting can be custom-developed. Examples of types of reporting tools include: Business intelligence tools, Executive information systems, Online Analytical Processing (OLAP) Tools and Data Mining.
 - (v) Metadata Layer: Metadata, or "data about data", is used to inform operators and users of the data warehouse about its status and the information held within the data warehouse. Examples of data warehouse metadata include the most recent data load date, the business meaning of a data item and the number of users that are logged in currently.

- (vi) Operations Layer: Data warehouse operations comprises of the processes of loading, manipulating and extracting data from the data warehouse. Operations also cover user management, security, capacity management and related functions.

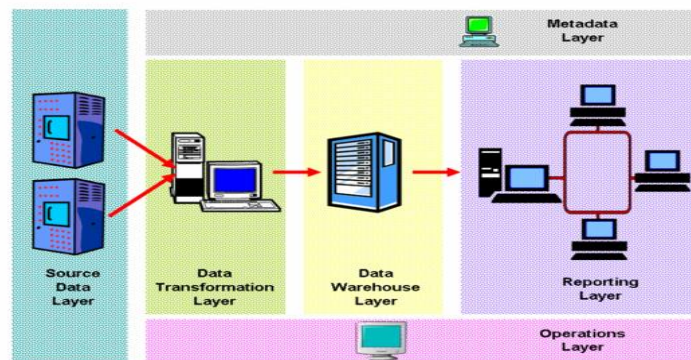


Fig. 12.1 Components of Data warehouse.

13. Flowcharts: A flowchart is defined as a diagram, prepared by the programmer, of the sequence of steps, involved in solving a problem. It is like a blueprint, in that it shows the general plan, architecture, and essential details of the proposed structure. It is an essential tool for programming and it illustrates the strategy and thread of logic followed in the program. It allows the programmer to compare different approaches and alternatives on paper and often shows interrelationships that are not immediately apparent. A flowchart helps the programmer avoid fuzzy thinking and accidental omissions of intermediate steps.

Flowcharts can be divided into 4 categories as below:

- (i) System outlines charts (Global map)
- (ii) System flowcharts (National map)
- (iii) Run flowcharts (State map)
- (iv) Program flowcharts (District Map)

System outline charts - These charts merely lists the inputs, files processed and outputs without regard to any sequence whatever.

System flowchart - It is designed to present an overview of the data flow through all parts of a data processing system and represents the flow of documents, the operations or activities performed and the persons or work-stations and also reflects the relationship between inputs, processing and outputs. An example of a system flowchart is Payroll process of any organization.

Run Flowcharts - These are prepared from the system flowcharts and show the reference of computer operations to be performed. The chart expands the detail of each

compute box on the system flow chart showing input files and outputs relevant to each run and the frequency of each run.

Program flowcharts - The program flowcharts are the most detailed and are concerned with the logical/arithmetic operations on data within the CPU and the flow of data between the CPU on the one hand and the input/output peripherals on the other.

14. The Internet's use by businesses for electronic commerce is expanding, thus requiring the focus for these businesses to develop methods of ensuring its safe and effective use. Now with the continued availability of Internet services, inherent risks are getting associated with using the Internet as a primary means of conducting business transactions, and those risks must be addressed and corrected. Because computers are more accessible and their hackers more numerous, the computer security problem is of utmost importance.

A number of additional concerns about initiating electronic commerce on the Internet must be addressed before these businesses are ready to take the "electronic plunge":

Reliability, Scalability, Ease of use, Payment methods are some of the major concerns in the use of Internet. Vulnerability of the Internet including the risks inherent in electronic mail transactions, the threat of computer viruses, and the existence of unprofessional employees etc. Financial information such as credit card numbers may be stolen and used by unauthorized parties to make illegal purchases resulting in damage to customers and businesses alike.

(I) General Management Concerns

- Loss of paper audit trail
- Business continuity
- Exposure of data to third parties
- Potential legal liability
- Record retention and retrievability.
- Segregation of duties

(II) Legal issues: Electronic transactions are often used by businesses to issue instructions to and make commitments with external organizations, and many of these transactions are used to form legally binding contracts. Electronic contracts raise some important legal issues like:

- Are electronic transactions enforceable in court?
- What terms and conditions are included within those transactions?
- Can they be proven in court?
- To what extent is a VAN liable if it loses an acceptance message and thereby prevents a contract from being formed?

- (III) Tools against Threats: Several tools are now available to protect information and systems against compromise, intrusion, or misuse:
 - (i) Firewalls are systems that control the flow of traffic between the Internet and the firm's internal LANs and systems. They are usually packaged as turnkey hardware/software packages, and are set up to enforce the specific security policies that are desired. A firewall is a proven, effective means of protecting the firm's internal resources from unwanted intrusion.
 - (ii) Encryption allows information to transit the Internet while being protected from interception by eavesdroppers. There are two basic approaches to encryption: Hardware encryption and Software encryption.
 - (iii) Message authentication makes sure that a message is really from whom it purports to be and that it has not been tampered with. Regardless of a company's individual needs, clearly defined Internet security policies and procedures should always be part of any corporate Internet security strategy.
 - (iv) Site Blocking is a software-based approach that prohibits access to certain Web sites that are deemed inappropriate by management.
- 15. Types of Electronic Payments: The methods that have been developed for making payments on the Internet are essentially electronic versions of the traditional payment systems we use everyday like - cash, checks, and credit cards. Many of the payment systems that are currently implemented now use personal computers, PDAs or laptops.
 - (i) Credit Cards: In a credit card transaction, the consumer presents preliminary proof of his ability to pay by presenting his credit card number to the merchant. The merchant can verify this with the bank, and create a purchase slip for the consumer to endorse. The merchant then uses this purchase slip to collect funds from the bank, and, on the next billing cycle, the consumer receives a statement from the bank with a record of the transaction.

To provide for secure transactions and authentication of both buyer and seller, these systems provide level of security for transactions, and the software on both the customer and business sides of the transaction. Credit cards can be handled on line in two different ways:
 - (a) Sending unencrypted credit card numbers over the Internet.
 - (b) Encrypting credit card details before any transactions are transmitted.
 - (ii) Transaction Using Third Party Verification: The market for handling credit card purchases on the Internet has to converge on a single way of doing things, or a single standard that allows the software from different vendors to work together. This lack of interoperability slows down both consumer and business acceptance of using credit cards for making purchases on the Internet.
 - (iii) Secured Electronic Transaction (SET): Secured Electronic Transaction protocol (SET) developed by a consortium led by MasterCard and Visa is actually a

combination of a protocol designed for use by other applications and a standard for handling credit card transactions over the Internet. Designed for cardholders, merchants, banks, and other card processors, SET uses digital certificates to ensure the identities of all parties involved in a purchase. SET also encrypts credit card and purchase information before transmission on the Internet.

- (iv) Joint Electronic Transaction: Joint Electronic Payments Initiative is an attempt to standardize payment negotiations. On the buyer's side, it serves as an interface that enables a Web browser, and wallets, to use a variety of payment protocols. On the merchant's side, it acts between the network and transport layers to pass off the incoming transactions to the proper transport.
 - (v) Electronic Cheques: Credit card payments will undoubtedly be popular for commerce on the Internet. However, following two systems have been developed to let consumers use electronic cheques to pay Web merchants directly.
 - (vi) Smart Cards: Smart cards have an embedded microchip instead of magnetic strip. The chip contains all the information a magnetic strip contains but offers the possibility of manipulating the data and executing applications on the card. Three types of smart cards are: Contact Cards, Contactless Cards and Combi Cards.
 - (vii) Electronic Purses : Electronic purse is another way to make payments over the net which is very similar to a pre paid card and can be used as a ATM card as well as a credit card. While making purchases, customers pass their cards through a vendor's point of sale terminal and validation is done through a Personal Identification Number (PIN Number). No credit check or signature is needed.
16. (a) Customer Relationship Management (CRM) includes the methodologies, technology and capabilities that help an enterprise manage customer relationships. The general purpose of CRM is to enable organizations to manage their customers in a better way through the introduction of reliable systems, processes and procedures.

A good CRM program needs to - identify customer success factors, create a customer-based culture, adopt customer-based measures, develop an end-to-end process to serve customers, recommend what questions to ask to help a customer solve a problem, recommend what to tell a customer with a complaint about a purchase and track all aspects of selling to customers and prospects as well as customer support.

Purposes of Customer Relationship Management – A good CRM program allows a business to acquire customers, service the customer, increase the value of the customer to the company, retain good customers, and determine which customers can be retained or given a higher level of service. A good CRM program can improve customer service by facilitating communication in several ways –

- (i) Provide product information, product use information, and technical assistance on web sites that are accessible round the clock.

- (ii) Identify how each individual customer defines quality, and then design a service strategy for each customer based on these individual requirements and expectations.
 - (iii) Provide a fast mechanism for managing and scheduling follow-up sales calls to assess post-purchase cognitive dissonance, repurchase probabilities, repurchase times, and repurchase frequencies.
 - (iv) Provide a mechanism to track all points of contact between a customer and the company, and do it in an integrated way so that all sources and types of contact are included, and all users of the system see the same view of the customer (reduces confusion)
 - (v) Help to identify potential problems quickly, before they occur.
 - (vi) Provide a user-friendly mechanism for registering customer complaints (complaints that are not registered with the company cannot be resolved, and are a major source of customer dissatisfaction)
 - (vii) Provide a fast mechanism for handling problems and complaints (complaints that are resolved quickly can increase customer satisfaction)
 - (viii) Provide a fast mechanism for correcting service deficiencies (correct the problem before other customers experience the same dissatisfaction)
 - (ix) Use internet cookies to track customer interests and personalize product offerings accordingly.
 - (x) Use the Internet to engage in collaborative customization or real-time customization.
 - (xi) Provide a fast mechanism for managing and scheduling maintenance, repair, and on-going support (improve efficiency and effectiveness)
 - (xii) The CRM can be integrated into other cross-functional systems and thereby provide accounting and production information to customers when they want it.
- (b) Architecture of CRM: There are three parts of application architecture of CRM –
- (i) Operational - Operational CRM means supporting the front office business processes, which provides the following benefits – delivers personalized and efficient marketing, sales, and service through multi-channel collaboration, enables a reverse view of the customer while the organization is interacting with them and give an access to sales people and service engineers the complete history of all customer interaction with the company. The operational part of CRM typically involves three general areas of business – Sales Force Automation (SFA), Customer Service and Support (CSS) and Enterprise Marketing Automation (EMA).
 - (ii) Analytical - In analytical CRM, data gathered within operational CRM and/or other sources are analyzed to segment customers or to identify potential to

enhance client relationship. Customer analysis typically can lead to targeted campaigns to increase share of customer's wallet. Examples of Campaigns directed towards customers are: Acquisition, Retention, Information and Modification.

- (iii) Collaborative - Collaborative CRM facilitates interactions with customers through all channels like personal, letter, fax, phone, web, email and supports co-ordination of employee teams and channels. It is a solution that brings people, processes and data together so companies can better serve and retain their customers. The data/activities can be structured, unstructured, conversational, and/or transactional in nature and provides the following benefits – enables efficient productive customer interactions across all communications channels, enables web collaboration to reduce customer service costs, integrates call centers enabling multi-channel personal customer interaction and integrates view of the customer while interaction at the transaction level.

- 17. (a) Supply Chain Management (SCM) is defined as the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. It spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.

Opportunities enabled by Supply Chain Management – The following strategic and competitive areas can be used to their full advantage if a SCM system is properly implemented.

- Fulfillment: Ensuring the right quantity of parts for production or products for sale arrive at the right time enabled through efficient communication, ensuring that orders are placed with the appropriate amount of time available to be filled.
- Logistics: Keeping the cost of transporting materials as low as possible consistent with safe and reliable delivery.
- Production: Production can run smoothly as a result of fulfillment and logistics being implemented correctly. If the correct quantity is not ordered and delivered at the requested time, production will be halted, but having an effective supply chain management system in place will ensure that production can always run smoothly without delays due to ordering and transportation.
- Revenue & profit: Managing the supply chain improves a company's flexibility to respond to unforeseen changes in demand and supply. Because of this, a company has the ability to produce goods at lower prices and distribute them to consumers quicker than companies without supply chain management thus increasing the overall profit.

- Costs: Keeping the cost of purchased parts and products at acceptable levels. SCM reduces costs by increasing inventory turnover on the shop floor thus reducing internal and external failure costs and working with suppliers to produce the most cost efficient means of manufacturing a product.
 - Cooperation: Collaborative planning, forecasting and replenishment (CPFR) is a longer-term commitment, joint work on quality, and support by the buyer of the supplier's managerial, technological, and capacity development.
- (b) Supply Chain Management problems: SCM must address the following problems–
- (i) Distribution Network Configuration: Number and location of suppliers, production facilities, distribution centers, warehouses and customers.
 - (ii) Distribution Strategy: Centralized versus decentralized, direct shipment, cross docking, pull or push strategies, third party logistics.
 - (iii) Information: Integrate systems and processes through the supply chain to share valuable information, including demand signals, forecasts, inventory and transportation.
 - (iv) Inventory Management: Quantity and location of inventory including raw materials, work-in-process and finished goods.
- (c) The Bullwhip Effect: The Bullwhip Effect or Whiplash Effect is phenomenon in forecast-driven distribution channels. Because customer demand is rarely perfectly stable, businesses must forecast demand in order to properly position inventory and other resources. Forecasts are based on statistics which are rarely perfectly accurate. Because forecast errors are given, companies often carry an inventory buffer called safety stock. Moving up the supply chain from end-consumer to raw materials supplier, each supply chain participant observes variation in demand and thus greater need for safety stock. In periods of rising demand, down-stream participants will increase their orders. In periods of falling demand, orders will fall or stop in order to reduce inventory. The effect is that variations are amplified the farther one gets from the end-consumer. Bullwhip Effect is a problem in forecast-driven supply chains.
- Factors contributing to the Bullwhip Effect are - Forecast Errors, Lead Time Variability, Batch Ordering, Price Fluctuations, Product Promotions, Inflated Orders, Methods intended to reduce uncertainty, variability and lead time, Vendor Managed Inventory (VMI), Just In Time replenishment (JIT) and Strategic partnership (SP).
18. (a) Protocols are a set of rules for inter-computer communication that have been agreed upon and implemented by many vendors, users and standards bodies. Ideally, a protocols standard allows heterogeneous computers to talk to each other.

Network protocols which are essentially software are sets of rules for –

- Communicating timings, sequencing, formatting, and error checking for data transmission.
- Providing standards for data communication.

A transmission protocols is a set of conventions or rules that must be adhered to by both the communicating parties to ensure that the information being exchanged between the two parties is received and interpreted correctly. These rules are embedded or built into the software which reside either in Computer's memory or memory of transmission device.

A protocol defines the following three aspects of digital communication:

- (i) Syntax: The format of data being exchanged, character set used, type of error correction used, type of encoding scheme (e.g., signal levels) being used.
- (ii) Semantics: Type and order of messages used to ensure reliable and error free information transfer.
- (iii) Timing: Defines data rate selection and correct timing for various events during data transfer.

Open system Interconnection Model (OSI Model) has been outlined by International Organization for Standardization (ISO) to facilitate communication of heterogeneous hardware or software platforms with each other with the help of seven layers of functions with their associated controls:

Layer 1 or Physical Layer is a hardware layer which specifies mechanical features as well as electromagnetic features of the connection between the devices and the transmission. Network topology is a part of this layer.

Layer 2 or Data Link Layer is also a hardware layer which specifies channel access control method and ensures reliable transfer of data through the transmission medium.

Layer 3 or Network Layer makes a choice of the physical route of transmission of say, a message packet, creates a virtual circuit for upper layers to make them independent of data transmission and switching, establishes, maintains, terminates connections between the nodes, ensure proper routing of data.

Layer 4 or Transport Layer ensures reliable and transparent transfer of data between user processes, assembles and disassembles message packets, provides error recovery and flow control. Multiplexing and encryption are undertaken at this layer level.

Layer 5 or Session Layer establishes, maintains and terminates sessions (dialogues) between user processes. Identification and authentication are undertaken at this layer level.

Layer 6 or Presentation Layer controls on screen display of data, transforms data to a standard application interface. Encryption, data compression can also be undertaken at this layer level.

Layer 7 or Application Layer provides user services by file transfer, file sharing, etc. Database concurrency and deadlock situation controls are undertaken at this layer level.

Different protocols cannot talk to each other hence standard protocols have been structure to resolve the problem. The entire operation of data transmission over a network is broken down into discrete systematic steps. Each step has its own rules or protocol. Steps must be carried out in consistent order for every computer in the network, either receiving or sending data.

Transmission Control Protocol/ Internet Protocol

The protocols used on the Internet is called TCP/IP which has two parts–

- (i) TCP deals with exchange of sequential data.
- (ii) IP handles packet forwarding and is used on the Internet.

TCP/IP has four layers–

- (i) The Application Layer provides services directly the users such as e-mail.
- (ii) The Transport Layer provides end-to-end communication between applications and verifies correct packet arrival.
- (iii) The Internet Layer provides packet routing for error checking and addressing and integrity.
- (iv) The Network Interface Layer provides an interface to the network hardware and device drivers and can also be called the Data Link Layer.

TCP/IP creates a packet-switching network. When a message, whether it is a file or just e-mail, is ready to be sent over the Internet, the TCP protocol breaks it up into small packets. Each packet is then given a header, which contains the destination address and are then sent individually over the Internet. The IP protocol guides the packets so that they arrive at the proper destination. Once there, the TCP protocol resembles the packets into the original message.

19. (a) Network Structure or Topology

The geometrical arrangement of computer resources, remote devices, and communication facilities is known as network structure or network topology. A computer network is comprised of nodes and links. A node is the end point of any branch in a computer, a terminal device, workstation or an interconnecting equipment facility and a link is a communication path between two nodes.

(b) Four basic network structures are:

- (i) Star Network: The most common structure or topology known as star network is characterized by communication channels emanating from centralized computer system as shown in Fig. 19.1. That is, processing nodes in a star network interconnect directly with a central system. Each terminal, small computer, or large main frame can communicate only with the central site and not with other nodes in the network. If it is desired to transmit information from one node to another, it can be done only by sending the details to the central node, which in turn sends them to the destination.

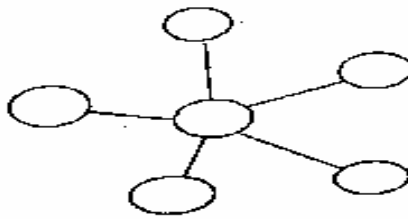


Fig. 19.1 Star Network

Advantages:

- It is easy to add new and remove nodes.
- A node failure does not bring down the entire network
- It is easier to diagnose network problems through a central hub.

Disadvantages:

- If the central hub fails, the whole network ceases to function.
- It costs more to cable a star configuration than other topologies (more cable is required than for a bus or ring configuration)

- (ii) Bus network: This structure is very popular for local area networks. In this structure or topology, a single network cable runs in the building or campus and all nodes are linked along with this communication line with two endpoints called the bus or backbone. Two ends of the cable are terminated with terminators as shown in Fig. 19.2.

Advantages:

- Reliable in very small networks as well as easy to use and understand.
- Requires the least amount of cable to connect the computers together and therefore is less expensive than other cabling arrangements.
- Is easy to extend. Two cables can be easily joined with a connector, making a longer cable for more computers to join the network.

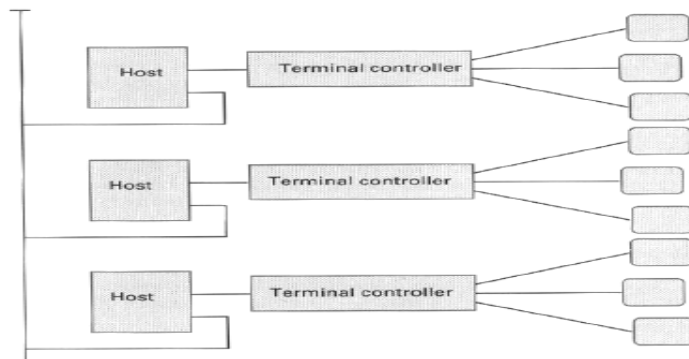


Fig. 19.2 Bus Network

Disadvantages:

- Heavy network traffic can slow a bus considerably as any computer can transmit at any time. But networks do not coordinate when information is sent. Computers interrupting each other can use a lot of bandwidth.
 - Each connection between two cables weakens the electrical signal.
 - The bus configuration can be difficult to trouble shoot. A cable break or malfunctioning computer can be difficult to find and can cause the whole network to stop functioning.
- (iii) Ring network: In this, the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is a direct point-to-point link between two neighboring nodes which are unidirectional and ensures that transmission by a node traverses the whole ring and comes back to the node as shown in Fig. 19.3.

Advantages:

- Ring networks offer high performance for a small number of workstations or for larger networks where each station has a similar workload.
- Ring networks can span longer distances than other types of networks.
- Ring networks are easily extendable.

Disadvantages:

- Relatively expensive and difficult to install.
- Failure of one computer on the network can affect the whole network.
- It is difficult to trouble shoot a ring network.
- Adding or removing computers can disrupt the network.

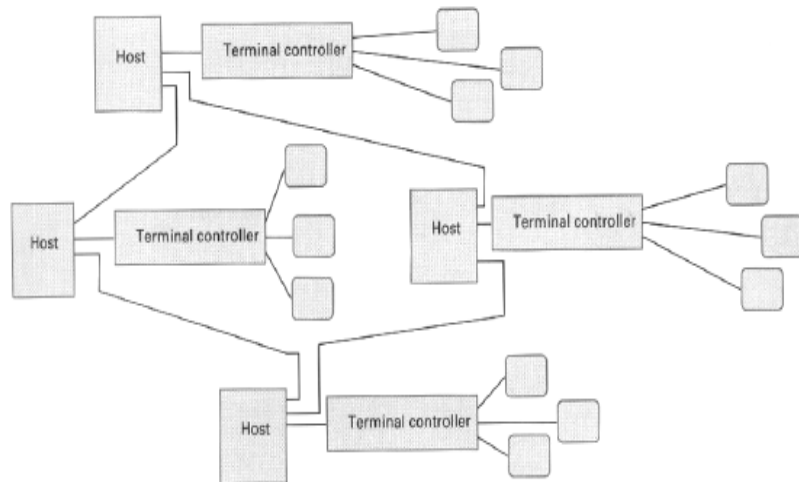


Fig 19.3 Ring Network.

- (iv) Mesh network: In this structure, there is random connection of nodes using communication links as shown in Fig. 19.4. A mesh network may be fully connected or connected with only partial links. In fully interconnected topology, each node is connected by a dedicated point to point link to every node. In partially connected mesh topology, computer nodes are widely scattered.

Advantages:

- (i) Yields the greatest amount of redundancy in the event that one of the nodes fails where network traffic can be redirected to another node.
- (ii) Network problems are easier to diagnose.

Disadvantages:

- The cost of installation and maintenance is high (more cable is required than any other configuration).

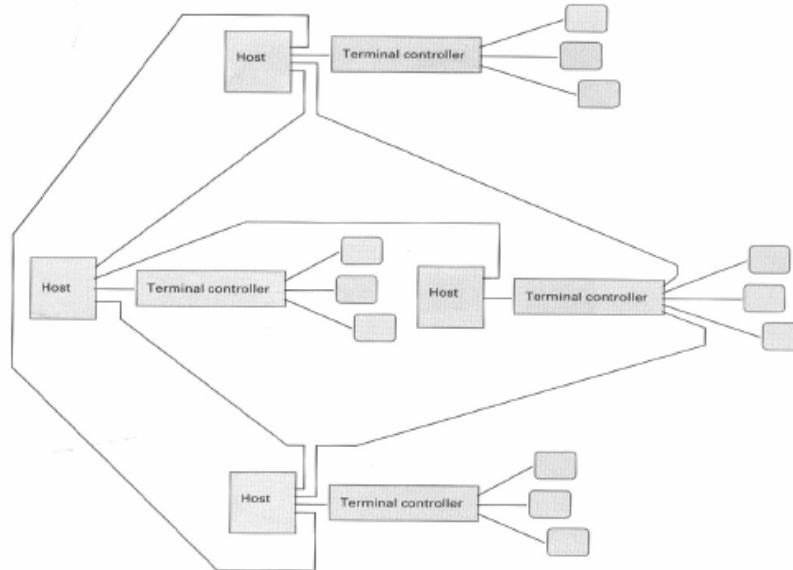


Fig. 19.4 Mesh Network

20. (a) Electronic Commerce : A limited examination of EC-related literature revealed the following definitions of EC:

- Electronic Commerce is a composite of technologies, processes and business strategies that foster the instant exchange of information within and between organizations. EC strengthens relationships with buyers, makes it easier to attract new customers, improves customer responsiveness, and opens new markets on a global scale. (Greg Martin, Interchange Software Group of Sterling Commerce).
- Electronic Commerce is the application of various communications technologies to provide the automated exchange of business information with internal and external customers, suppliers and financial institutions. Examples of these technologies include Electronic Data Interchange (EDI), bar coding, scanning, E-mail and fax, to name a few. The bottom line is that Electronic Commerce requires a paradigm shift in the way corporations do business today. (Electronic Commerce Forum).
- Electronic Commerce, simply put, is the automation of the business process between buyers and sellers. (IBM Corporation).
- Electronic business transactions, without paper documents, using computer and telecommunication networks. These networks can be either private or public, or a combination of the two.

Application Areas of E-Commerce

Electronic Commerce impacts a broad number of business activities such as: marketing, sales and sales promotion, pre-sales, subcontracts, supply, financing and insurance, commercial transactions like ordering, delivery and payment, product service and maintenance, co-operative product development, distributed co-operative working, use of public and private services, business-to-administrations (concessions, permissions, tax, customs, etc), transport and logistics, public procurement, automatic trading of digital goods and accounting.

Benefits of Electronic Commerce Applications: EC presents many benefits to individual organizations, consumers, and society as a whole.

- Reduced costs to buyers from increased competition in procurement as more suppliers are able to compete in an electronically open marketplace.
- Reduced errors, time, and overhead costs in information processing by eliminating requirements for re-entering data.
- Reduced costs to suppliers by electronically accessing on-line databases of bid opportunities, on-line abilities to submit bids, and on-line review of rewards.
- Reduced time to complete business transactions.
- Creation of new markets through the ability to easily and cheaply reach potential customers.
- Easier entry into new markets, especially geographically remote markets, for companies of all sizes and locations.
- Better quality of goods as specifications are standardized and competition is increased and improved variety of goods through expanded markets and the ability to produce customized goods.
- Faster time to market as business processes are linked, enabling seamless processing and eliminating time delays.
- Optimization of resource selection as businesses form cooperative teams to increase the chances of economic successes, and to provide the customer products and capabilities more exactly meeting his or her requirements.
- Reduced overhead costs through uniformity, automation, and large-scale integration of management processes.
- Reduced use of ecologically damaging materials through electronic coordination of activities and the movement of information rather than physical objects)
- Reduced advertising costs, delivery cost, design and manufacturing cost.
- Improved market intelligence and strategic planning.
- More opportunity for niche marketing.
- Equal access to markets.

Clearly, the benefits of corporate-wide implementation of EC are many, and this list is by no means complete. With the benefits, however, also come the risks. An organization should be cautious not to leap blindly into EC, but rather first develop an EC strategy, and then organize a corporate-wide team to implement that strategy. Key users throughout the organization should be represented on this implementation team.

(b) Types of E-commerce: There are three general classes of E-commerce applications:

- (i) Business-to-Business (B2B)
- (ii) Business-to-Consumer (B2C)
- (iii) Consumer-to-Consumer (C2C)

Business-to-Business (B2B): It is a short form of Business-to-Business, the exchange of services, information and/or products from one business to another, as opposed to between a business and a consumer. Business-to-Business electronic commerce (B2B) typically takes the form of automated processes between trading partners and is performed in much higher volumes than business-to-consumer (B2C) applications.

Business-to-Consumer (B2C): It is a short form of Business-to-Consumer, the exchange of services, information and/or products from a business to a consumer, as opposed to between one business and another. Business-to-Consumer electronic commerce (B2C) is a form of electronic commerce in which products or services are sold from a firm to a consumer. Two Classifications of B2C E-Commerce are – Direct Sellers and Online Intermediaries.

Advantages of B2C E-Commerce

- Shopping can be faster and more convenient.
- Offerings and prices can change instantaneously.
- Call centers can be integrated with the website.
- Broadband telecommunications will enhance the buying experience.

Consumer-to-Consumer (C2C): Consumer-to-Consumer electronic commerce is an internet-facilitated form of commerce that has existed for the span of history in the form of barter, flea markets, swap meets, yard sales and the like.

21. The required flowchart is shown in Fig. 21.1. In this example, N is a counter used for keeping a track of the number of customers for whom data is read and processed. In the beginning it is initialized so that its value is 0.

A transaction is then inputted through console and the value of the counter N is increased by 1. The season code is then checked. If the season is 'SPRING', the rate of hire charges is Rs. 8 per day and we go to check the No. of days for which a bicycle is hired. If the season is not 'SPRING', check whatever it is 'SUMMER' and so on.....

Once the rate for hire charges is decided, check whether the No. of days for which a bicycle is hired is greater than 10 days or not. If 'days' is greater than 10, the rate is increased by 15% otherwise not. Then hire charges are calculated by multiplying the rate by No. of days. The hire charges are then added to Rs. 20 and stored in a location TCHG to calculate the total of hire charges for a customer. Details of a customer namely his name, No. of days, hire charges, and total hire charges are then printed. Since there are in all 25 customers, then check counter N to see if details for all the customers have been read and processed or not. If not, then go back to read the next transaction. If yes, then stop.

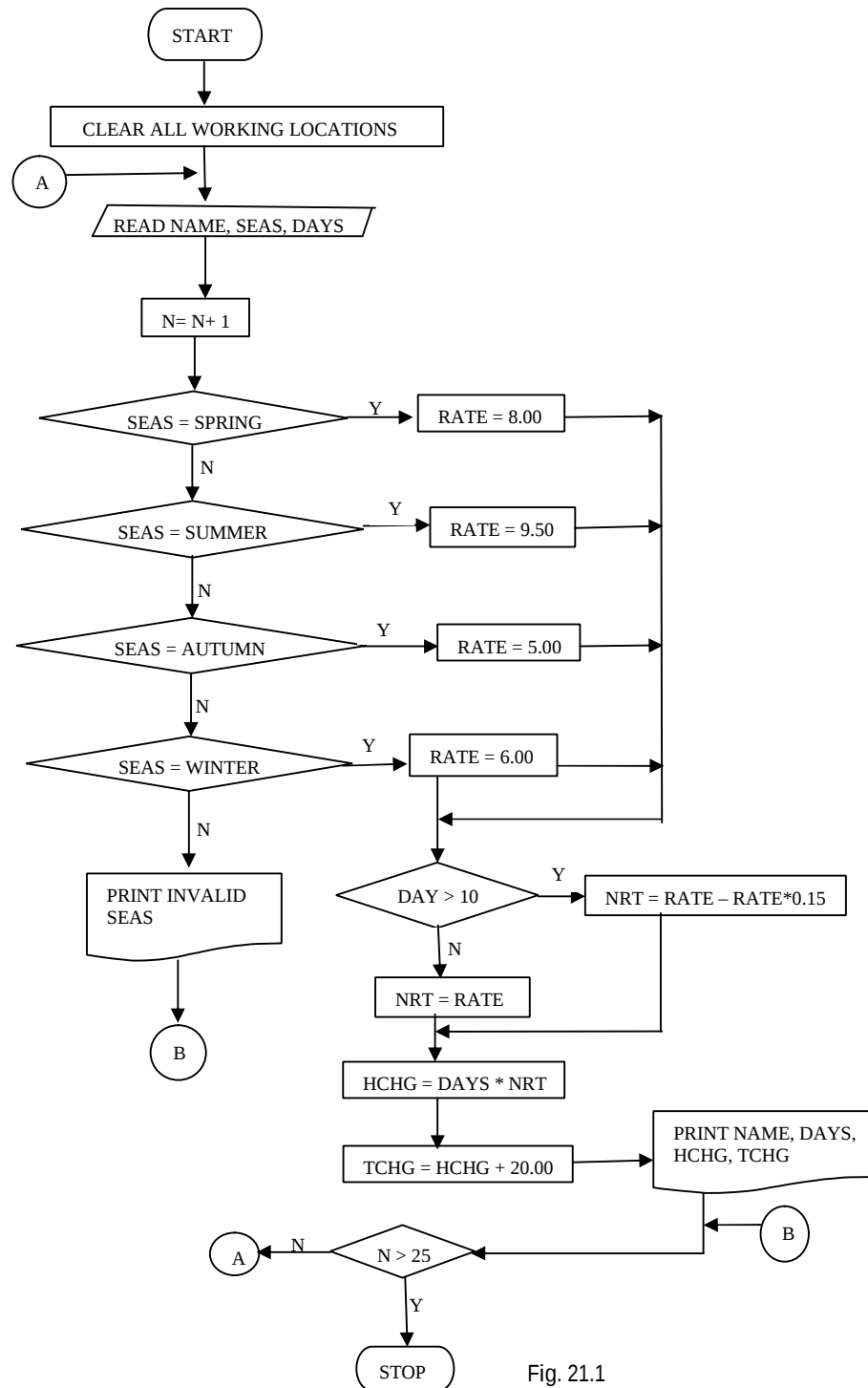


Fig. 21.1

22. Step 1 : Is to write down all of the conditions and actions:

Conditions involved in the problems are:

Holding the present job for more than 3 years, holding the present job for 3 years or less than 3 years, monthly salary exceeds Rs. 1500, monthly salary equals Rs. 1500 or less than Rs. 1500, residing in the same place for more than 5 years and residing in the same place for 5 years or less than 5 years.

Actions involved in the problem are: Allow credit facility and reject credit facility.

Step 2: Is to combine conditions which only describe the two possibilities of a single condition :

"Holding the present job for more than 3 years" and "Holding the present job for 3 years or less than 3 years" can be combined. A single condition "holding the present job for more than 3 years" can represent both because a "No" answer means holding the present job for more than 3 years or less than 3 years. The same reasoning allows the combination of 3 & 4 and also 5 & 6.

There are thus only three conditions : Holding the present job for more than 3 years, Monthly salary exceeds Rs. 1500 and residing in the same place for more than 5 years.

Step 3: Is to prepare the Yes and No responses using Y and N for all possible combinations of conditions and for each set of conditions, mark the actions to be taken with an X.

No. of rules = $2^{\text{no of conditions}}$

In the example, there are three conditions, so there will be 2^3 or 8 rules. The Y's and N's can be inserted in any order, but a systematic method will reduce the effort of filling in the table and reduce the chance of error. Start with the bottom row of the condition entries and fill in the row starting with Y and then alternating between N and Y. The row above this is filled in by writing two Y's, two N's, two Y's etc. The third row from the bottom uses sets of four Y's and four N's. This doubling of the sets of Y's and N's continues until the table is complete. Then analyze each rule and fill in the action entries. The table 22.1 shows the completed table at this stage.

	Allowing Credit Facility	R1	R2	R3	R4	R5	R6	R7	R8
C1	Holding the present job for more than 3 years	Y	Y	Y	Y	N	N	N	N
C2	Monthly salary exceeds Rs. 1500	Y	Y	N	N	Y	Y	N	N
C3	Residing in the same place for more than 5 years	Y	N	Y	N	Y	N	Y	N
A1	Allow credit facility	X	X	X		X			
A2	Reject credit facility				X		X	X	X

Table 22.1

Step 4: Is to combine rules where there are redundancies:

Two rules can be combined into a single rule if :

- all of the conditions except one have the same Y or N (or—) condition entries and
- the actions are the same for both.

Rule with impossible combination of condition entries can be combined with any other rule if all of the conditions except one have the same Y or N (or—) condition entries. Combine the two rules into one and replace the condition entry of Y and N with a dash (—), which means the condition does not affect the action to be taken. Using this procedure, rule R1 and R2 can be combined. In other words, if holding the present job for more than 3 years and monthly salary exceeds Rs. 1,500, then the credit facility is allowed without regard to the third condition viz. residing in the same place for more than 5 years. Rules R7 & R8 (or R4 & R8) can be combined. The resulting table, after redundancies removed, is shown in Table 22.2

	Allowing Credit Facility	R1	R2	R3	R4	R5	R6
C1	Holding the present job for more than 3 years	Y	Y	Y	N	N	N
C2	Monthly salary exceeds Rs. 1500	Y	N	N	Y	Y	N
C3	Residing in the same place for more than 5 year	—	Y	N	Y	N	—
A1	Allow credit facility	X	X		X		
A2	Reject credit facility			X		X	X

Table 22.2

Step 5 Is to check for completeness of the rules:

- Count number of dashes in the condition entries for each rule. The number of rules “represented” by each rule are 2^m where m is the number of dashes. Where there are no dashes, the number represented is 2^0 or 1. A single dash means 2 rules have been combined etc.
- Sum the number of rules represented by the different rules as computed above.
- Compare the number of rules represented by the reduced table with the number to be accounted for, which is 2^n (n no of conditions) If they are equal (and all other features are correct), the table is complete.

In the example, rules R1 & R6 have one dash and rules R2, R3, R4 and R5 have no dashes. The sum of the rules represented by the rules in the reduced table is $2+1+1+1+1+2$ which is equal to 2^3 or 8.

Therefore, the reduced table is complete.

23. Image Processing captures an electronic image of data so that it can be stored and shared. Imaging systems can capture almost anything, including keystrokes or handwritten documents (such as invoices or tax returns), flowcharts, drawings, and photographs. Many companies that use document imaging are making significant progress toward paperless offices. There are five distinct steps to document imaging:

- Step 1: Data capture. The most common means of converting paper documents into electronic images is to scan them. The scanning device converts the text and pictures into digitized electronic code. This scanner can range from a simple hand held device to a high-end, high-speed scanner capable of scanning more than 2,500 pages an hour.
- Step 2: Indexing. Document images must be stored in a manner that facilitates their retrieval. Therefore, important document information, such as purchase order numbers or vendor numbers, is stored in an index. Great care is needed in designing the indexing scheme, as it affects the ease of subsequent retrieval of information.
- Step 3: Storage. Because images require a large amount of storage space, they are usually stored on an optical disk. One 5.25-inch optical platter can store 1.4 gigabytes, or about 25,000 documents. A 12-inch removable optical disk stores up to 60,000 documents, and up to 100 optical disks can be stored in devices called jukeboxes.
- Step 4: Retrieval. Keying in any information stored in an index can retrieve documents. The index tells the system which optical disk to search and the requested information can be quickly retrieved.
- Step 5: Output. An exact replica of the original document is easily produced on the computer's monitor or on paper, or is transmitted electronically to another computer.

Advantages of Image Processing:

- Accessibility: Accessed and reviewed simultaneously by many people.
- Accuracy: Costly and error-prone manual data-entry eliminated, thus accurate.
- Availability: No lost or misfiled documents.
- Capacity: Vast amounts of data stored in little space thus reducing storage space.
- Cost: Voluminous data stored and processed, thus the cost per document is lowered.
- Customer satisfaction: Waiting time reduced, customers get information in no time.
- Security: Various levels of passwords (network, data base, files, etc.) and clearances can be assigned to restrict document access.
- Speed: Data can be retrieved at fantastic speeds. Stored documents can be indexed using any number of identifying labels, attributes, or keywords.
- Versatility: Handwritten or types text can be added to an image, as can voice messages. Documents can be added to word processing files; the data can be included in a spreadsheet or data base.

24. Business Continuity Planning (BCP):

A Business Continuity Plan (BCP) is a documented description of action, resources, and procedures to be followed before, during and after an event, functions vital to continue business operations are recovered, operational in an acceptable time frame.

BCP Components are –

- (i) Define requirements based on business needs,
- (ii) Statements of critical resources needed,
- (iii) Detailed planning on use of critical resources,
- (iv) Defined responsibilities of trained personnel,
- (v) Written documentations and procedures cover all operations,
- (vi) Commitment to maintain plan to keep up with changes.

The Phase-I of a BCP involves risk analysis in critical, vital, sensitive and non critical areas, determining critical time period, applications to recover in critical recovery time period and coverage of insurance.

The Phase-II of BCP involves determination of minimum resources necessary, review operations between current practices and backup procedures. The review should address a data file back up, software libraries, operations documentation, stationery requirement, backup communication paths, other operational adjustments like splitting system between dual processors, or tandems, disk mirroring, off site storage.

The Phase-III of BCP involves:

- Identification of most appropriate recovery solutions including information processing and telecommunication recovery,
- Hot sites which are fully configured and ready to operate within several hours, with compatible equipments and systems software so that primary installation can be backed up.
- Warm sites are partially configured with network connections and selected peripheral equipments but without the main computer.
- Cold sites are ready to receive equipment but do not offer any equipment at the site in advance of the need, thus by creating a basic environment to operate an information processing facilities.
- Duplicate information processing facilities.
- Reciprocal agreements
- Preparing a list of alternatives,
- Visits and reviews

The Phase-IV of BCP involves - Plan preparation, provision for requirement of manual process, document revised work flow, plan development, team building and developing general plan.

The Phase-V of BCP involves - Testing BCP in various phases like – Pretest, Test, Posttest, Paper test, Preparedness test, Review test, and Review test results

The Phase-VI of BCP involves - Maintenance by BCP Coordinator who has to arrange for scheduled and unscheduled tests, develop a scheduled training, maintain records of test, training and review, update notification directory.

25. Programming Process: The set of detailed instructions which outline the data processing activities to be performed by a computer is called a program. Computer programming is a process which results in the development of a computer program. Computer programming is not a simple job. It requires lot of planning and thinking. Thus, computer-programming process may be sub-divided into six separate phases.
- (i) Program Analysis - In this stage, the programmer ascertains for a particular application the outputs required, the inputs and the processing i.e., up-dating the physical balance, computing stock value for various items, determination of placement of the replenishment order etc..
 - (ii) Program Design - In this stage, the programmer develops the general organization of the program as it relates to the main functions to be performed. Out of several other tools available to him input, output and file layouts and flowcharts are quite useful at this stage.
 - (iii) Program Coding - The logic of the program outlined in the flowchart is converted into program statements or instructions at this stage. For each language, there are specific rules concerning format and syntax. Syntax means vocabulary, punctuation and grammatical rules available in the language manuals which the programmer has to follow strictly and pedantically.
 - (iv) Program debugging - The assembly compilation run can detect only few syntax errors. To debug the program, the programmers devise a set of test data transactions to test the various alternative branches in the program. Since the branches in a program tend to proliferate, a large number of transactions would have to be devised for a thorough test. Then, the file is up-dated by the transactions via the computer with the program to be debugged stored in it. The results got from the computer are compared with the ones derived manually prior to computer processing. If the results do not tally for the reasons mentioned above, the programmer then sits away from the computer and verifies his flowcharts and coding sheets in a hunt for the bugs.

- (v) Program Documentation - Each program should be documented to diagnose any subsequent program errors, modifying or reconstructing a lost program. Program documentation including the following may be assembled.
- The program specifications i.e., what the program is supposed to do.
 - The program descriptions i.e., input, output and file layout plans, flowcharts etc.
 - The test data employed in debugging the program. This could be highly useful later to the auditors.
 - The operation manual which details the operating instructions for the computer operator, viz., insert the data floppy when program has been read into the memory, or load the paper on the printer etc.
 - The maintenance documentation that is listings of any subsequent amendments to the program.
- (vi) Program Maintenance - The requirements of business data processing applications are subject to continual change. This calls for modification of the various programs. There are usually a separate category of programmers called maintenance programmers who are entrusted with this task. There is a difficult task of understanding and then revising the programs they did not write. This should bring out the necessity of writing programs in the first place that are simple to understand.